LMSA

LEDDY MAYTUM STACY ARCHITECTS

JACOBS HALL

1810 LEROY AVENUE, BERKELEY, CA 94709

BID #4 / 100% CONSTRUCTION DOCUMENTS / PERMIT SUBMISSION - 08.15.14

ABBREVIATIONS

&	AND
<	ANGLE
@	AT
A.B.	ANCHOR BOLT
AB./ABV.	ABOVE
A.C.	AIR CONDITIONING
ACOUS.	ACOUSTICAL
A.D.	AREA DRAIN
ADJ.	ADJUSTABLE
A.F.F.	ABOVE FINISH FLOOR
AGGR.	AGGREGATE
A.H.A.P.	AS HIGH AS POSSIBLE
A.H.U.	AIR HANDLING UNIT
ALUM.	ALUMINUM
ALT.	ALTERNATE
A.P.	ACOUSTICAL PANEL
APPROX.	APPROXIMATE
ARCH.	ARCHITECT
ARCH'L	ARCHITECTURAL
ASB.	ASBESTOS
ASPH.	ASPHALT
AXON.	AXONOMETRIC
B.	BATHROOM
B.B.	BULLETIN BOX
B.C.	BOTTOM OF CURB
BD.	BOARD
BITUM.	BITUMINOUS
BLDG.	BUILDING
BLK.	BLOCKING/BLOCK
BM.	BEAM
B.O.	BOTTOM OF
BOT.	BOTTOM
BR.	BEDROOM
B.U.	BUILT UP
CAB.	CABINET
CARP.	CARPET
C.B.	CATCH BASIN
CEM.	CEMENT
CER.	CERAMIC
CHAN.	CHANNEL
C.H.	CEILING HEIGHT
C.I.	CAST IRON
C.J.	CONTROL JOINT
C.L.	CENTER LINE
C.G.	CORNER GUARD
CLG.	CEILING
CLKG.	CAULKING
CLO./CLOS.	CLOSET
CLR.	CLEAR
COL.	COLUMN
COMP.	COMPOSITION
CONC.	CONCRETE
CONN.	CONNECTION
CONSTR.	CONSTRUCTION
CONT.	CONTINUOUS
CORR.	CORRIDOR
CPT.	CARPET
CMU.	CONCRETE MASONRY UNIT
CNTR.	COUNTER
CTR.	CENTER
CTSK.	COUNTERSUNK
C.W.	COLD WATER
(D)	DEMOLISH
DBL.	DOUBLE
DEPT.	DEPARTMENT
DET.	DETAIL
D.F.	DRINKING FOUNTAIN
DIA.	DIAMETER
DIM.	DIMENSION
DISP.	DISPENSER
DN.	DOWN
D.O.	DOOR OPENING
DR.	DOOR
DS.	DOWNSPOUT
D.S.P.	DRY STANDPIPE
DWG(S).	DRAWING(S)
DWR.	DRAWER
(E)	EXISTING
E.	EAST
EA.	EACH
E.C.C.	ELEVATOR CNTRL CLOSET
E.F.	EXHAUST FAN
E.J.	EXPANSION JOINT
EL.	ELEVATION
ELEC.	ELECTRICAL
ELEV.	ELEVATOR
EMER.	EMERGENCY
ENCL.	ENCLOSURE
ENG.	ENGINEER
E.O.S.	EDGE OF SLAB
E.P.	ELECTRICAL PANELBOARD
EQ.	EQUAL
EQPT.	EQUIPMENT
E.S.	EACH SIDE
E.W.H.	ELECTRICAL WATER HEATER
EXST.	EXISTING
EXP.	EXPANSION
EXPO.	EXPOSED
EXT.	EXTERIOR
EXTR.	EXTRUSION
F.A.	FIRE ALARM
F.A.U.	FORCED AIR UNIT
F.B.	FLAT BAR
F.D.	FLOOR DRAIN
F.D.C.	FIRE DEPARTMENT CONNECTION
F.E.	FIRE EXTINGUISHER (SURFACE)
F.E.C.	FIRE EXTINGUISHER CABINET
F.C.O.	FLOOR CLEAN OUT
F.F.	FINISH FLOOR
F.G.	FINISH GLASS
F.H.	FIRE HOSE
F.H.W.B.	FLAT HEAD MACHINE BOLT
F.H.M.S.	FLAT HEAD MACHINE SCREW
F.H.W.S.	FLAT HEAD WOOD SCREW
FIN.	FINISH
FIXT.	FIXTURE
FL./FLR.	FLOOR
FLASH.	FLASHING
FLOUR.	FLOURESCENT
FND.	FOUNDATION
F.O.	FACE OF
F.O.F.	FACE OF FINISH
F.O.S.	FACE OF STUDS
FPRF.	FIREPROOF
F.S.	FIRE SPRINKLER
F.S.D.	FIRE/SMOKE DAMPER
FT.	FOOT OR FEET
FTG.	FOOTING
F.R.	FIRE RATED
FURR.	FURRING
FUT.	FUTURE
GA.	GAUGE
GALV.	GALVANIZED
G.B.	GRAB BAR
G.F.R.C.	GLASS FIBER REINFORCED CONCRETE
GL.	GLASS
GND.	GROUND
GR.	GRADE
G.S.M.	GALVANIZED SHEET METAL
GYP.	GYPSUM
H.B.	HOSE BIBB
H.C.	HOLLOW CORE
HD.	HEAD
HDR.	HEADER
HDWD.	HARDWOOD
HDWE.	HARDWARE
HGT.	HEIGHT
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL
H.R.	HAND RAIL
HR.	HOUR
H.W.	HOT WATER
I.D.	INSIDE DIAMETER(DIM.)
INSUL.	INSULATION
INT.	INTERIOR
INV.	INVERT
JAN.	JANITOR
JT.	JOINT
KIT.	KITCHEN
LA.	LAYER
LAM.	LAMINATE
LAV.	LAVATORY
LBS.	POUNDS
LKR.	LOCKER
LOC.	LOCATION
LOW.LEV.	LOWER LEVEL
LR.	LIVING ROOM
LT.	LIGHT
MACH.	MACHINE
MAG.	MAGNETIC
MANUF.	MANUFACTURER
MANUF.LIT.	MANUFACTURER'S LITERATURE
MATL.	MATERIAL
MAX.	MAXIMUM
M.B.	MACHINE BOLT
MBL.	MARBLE
M.D.F.	MEDIUM DENSITY FIBERBOARD
M.D.O.	MEDIUM DENSITY OVERLAY(BOARD)
MECH.	MECHANICAL
MEMB.	MEMBRANE
MET.	METAL
MFR.	MANUFACTURER
MH.	MANHOLE
MIN.	MINIMUM
MIR.	MIRROR
MISC.	MISCELLANEOUS
M.O.	MASONRY OPENING
M.P.	MEASURING POINT
M.R.	MOISTURE RESISTANT
MTD.	MOUNTED
MTL.	METAL
MUL.	MULLION
(N)	NEW
N.	NORTH
N.A.	NOT ACCESSIBLE
N.I.C.	NOT IN CONTRACT
NO. OR #	NUMBER
NOM.	NOMINAL
N.T.S.	NOT TO SCALE
OA.	OVERALL
OB.	OBLIQUE
OBS.	OBSCURE
O.C.	ON CENTER
OCC.	OCCURE
O.D.	OUTSIDE DIAMETER (DIM.)
OFF.	OFFICE
O.F.I.	OWNER FURNISHED & INSTALLED
O.F.C.I.	OWNER FURNISHED, CONTRACTOR INSTALLED
OH.	OPPOSITE HAND
OPT.	OPTIONAL
OPER.	OPERABLE
OPNG.	OPENING
OPP.	OPPOSITE
O/.	OVER
P.	POLE
PAV.	PAVING
PERF.	PERFORATED
PERP.	PERPENDICULAR
PL.	PLATE
P.LAM.	PLASTIC LAMINATE
PLAS.	PLASTER
PLYWD.	PLYWOOD
P.O.B.	POINT OF BEGINNING
PR.	PAIR
PRCST.	PRECAST
PROP.	PROPERTY
PT.	PAINT
PTD.	PAINTED
P.T.D.	PAPER TOWEL DISPENSER
PTN.	PARTITION
P.T.R.	PAPER TOWEL RECEPTACLE
Q.T.	QUARRY TILE
QTY.	QUANTITY
R.	RISER
RAD.	RADIUS
R.A.G.	RETURN AIR GRILL
R.C.	RESILIENT CHANNEL/ REINFORCED CONCRETE
R.C.P.	REFLECTED CEILING PLAN
R.D.	ROOF DRAIN
REF.	REFERENCE
REFR.	REFRIGERATOR
RGTR.	REGISTER
REINF.	REINFORCED
REQ.	REQUIRED
RESIL.	RESILIENT
REV.	REVISION
RM.	ROOM
R.O.	ROUGH OPENING
RWD.	REDWOOD
R.W.L.	RAIN WATER LEADER
S.	SOUTH
S.A.D.	SEE ARCHITECTURAL DRAWINGS
S.A.S.M.	SELF ADHERED SHEET MEMBRANE
S.A.S.F.	SELF ADHERED SHEET FLASHING
S.C.	SOLID CORE
S.C.D.	SEE CIVIL DRAWINGS
SCHED.	SCHEDULE
S.E.D.	SEE ELECTRICAL DWGS.
S.D.	SOAP DISPENSER
SECT.	SECTION
S.F.	SUPPLY FAN
SI.D.	SEE INTERIOR DWGS.
S.H.	SOAP HOLDER
SHR.	SHOWER
SHT.	SHEET
SHT'G.	SHEATHING
SIM.	SIMILAR
S.J.	SEISMIC JOINT
SL.	SLIDING
S.L.D.	SEE LANDSCAPE DWGS.
S.M.D.	SEE MECHANICAL DWGS.
S.M.S.	SHEET METAL SCREW
S.N.D.	SANITARY NAPKIN DISPENSER
S.N.R.	SANITARY NAPKIN RECEPTACLE
S.P.D.	SEE PLUMBING DWGS.
S.P.F.D.	SEE PERFORMANCE DWGS.
SPEC.	SPECIFICATION
SQ.	SQUARE
S.S.D.	SEE STRUCTURAL DWGS.
S.SK.	SERVICE SINK
S.ST/S.S.	STAINLESS STEEL
STA.	STATION
STL.	STEEL
STD.	STANDARD
STOR.	STORAGE
STRL.	STRUCTURAL
SUSP.	SUSPENDED
T.	TILE, TREAD OR TOP
T.B.	TOWEL BAR
T.C.	TOP OF CURB
TEL.	TELEPHONE
TEMP.	TEMPERED
TER.	TERRAZZO
T.&G.	TONGUE AND GROOVE
THK.	THICK
THRU.	THROUGH
TN.	TOENAIL
T.O.	TOP OF
T.P.	TOP OF PAVEMENT
T.P.D.	TOILET PAPER DISPENSER
T.P.S.	TRANSLUCENT PANEL SYSTEM
T.V.	TELEVISION
T.W./T.O.W.	TOP OF WALL
TYP.	TYPICAL
UNF.	UNFINISHED
U.O.N.	UNLESS OTHERWISE NOTED
UP.LEV.	UPPER LEVEL
UR.	URINAL
UTIL.	UTILITY
V.B.	VERTICAL BLIND
V.C.T.	VINYL COMPOSITION TILE
VER.	VERIFY
VERT.	VERTICAL
VEST.	VESTIBULE
V.G.D.F.	VERTICAL GRAIN DOUGLAS FIR
V.I.F.	VERIFY IN FIELD
VS.	VINYL SHEET
W.	WEST
W/.	WITH
W.B.	WHITE BOARD
W.C.	WATER CLOSET
WD.	WOOD
W/D.	WASHER/DRYER
WDW.	WINDOW
W.G.	WIRE GLASS
W.H.	WATER HEATER
WIC.	WALK IN CLOSET
W.M.	WALL MOUNT
W.O.	WHERE OCCURS
W/O.	WITHOUT
WP.	WATERPROOF
W.S.P.	WET STAND PIPE
WSCT.	WAINSCOT
WT.	WEIGHT
W.W.F.	WIRE WELDED FABRIC
W.W.M.	WOVEN WIRE MESH

GENERAL NOTES

1. ALL WORK TO BE IN CONFORMANCE WITH SPECIFICATIONS AS PART OF THESE CONSTRUCTION DOCUMENTS.

2. SUBMIT ONE COPY OF ALL BUILDING PERMITS TO ARCHITECT.

3. CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS AND CONDITIONS AT THE SITE, CONFIRM THAT THE WORK IS BUILDABLE AS SHOWN, AND NOTIFY ARCHITECT IN WRITING OF ANY DISCREPANCIES PRIOR TO PROCEEDING WITH THE WORK IN QUESTION. THE CONTRACTOR IS RESPONSIBLE TO COORDINATE THE WORK OF ALL TRADES AND SUB-TRADES TO ENSURE THAT THE FINISHED PRODUCT IS FULLY COMPLIANT WITH THE DESIGN INTENT OF THESE DOCUMENTS INCLUDING, BUT NOT LIMITED TO, DIMENSIONS, ALIGNMENTS, REVEALS, CEILING HEIGHTS, PLACEMENT OF FIXTURES AND EQUIPMENT, AND PROPER, INTEGRATED OPERATION OF BUILDING SYSTEMS.

4. ALL DIMENSIONS ARE TO FINISH FACE OF MASONRY, FACE OF CONCRETE, CENTERLINE OF STEEL, FACE OF STUD OR CASEWORK UNLESS OTHERWISE NOTED. DIMENSIONS NOTED AS "CLR" MUST BE PRECISELY MAINTAINED. DIMENSIONS ARE NOT ADJUSTABLE WITHOUT ARCHITECT'S APPROVAL UNLESS NOTED AS "+/-". VERIFY DIMENSIONS MARKED "V.I.F." PRIOR TO COMMENCEMENT OF CONSTRUCTION, AND NOTIFY ARCHITECT OF ANY INCONSISTENCIES. "ALIGN" SHALL MEAN TO ACCURATELY LOCATE FINISH FACES IN THE SAME PLANE. FLOOR ELEVATIONS ARE TO TOP OF CONCRETE SLAB OR TOPPING UNLESS OTHERWISE NOTED AS FINISH FLOOR.

5. ALL DIMENSIONS, NOTES AND DETAILS SHOWN ON ONE PORTION OF A DRAWING SHALL APPLY TYPICALLY TO ALL OPPOSITE HAND AND/OR CONDITIONS UNLESS OTHERWISE NOTED.

6. ALL CONSTRUCTION DOCUMENTS ARE COMPLEMENTARY, AND WHAT IS CALLED FOR BY ANY WILL BE AS BINDING AS IF CALLED FOR BY ALL. ANY WORK SHOWN OR REFERRED TO ON ANY CONSTRUCTION DOCUMENTS SHALL BE AS THOUGH ON ALL RELATED DOCUMENTS.

7. DO NOT SCALE DRAWINGS. DIMENSIONS SHALL GOVERN. DRAWINGS AT A LARGE SCALE SHALL TAKE PRECEDENCE OVER DRAWINGS OF A SMALL SCALE. DETAILS SHALL GOVERN OVER PLANS AND ELEVATIONS. IN CASE OF CONFLICT BETWEEN THE ARCHITECT'S AND THE CONSULTANTS' DRAWINGS IN LOCATING MATERIALS AND EQUIPMENT, THE ARCHITECTURAL DRAWINGS SHALL GOVERN AND THE CONTRACTOR SHALL NOTIFY THE ARCHITECT IMMEDIATELY OF SUCH CONFLICT.

8. CONTRACTOR TO VERIFY LAYOUT OF PARTITIONS, DOORS, ELECTRICAL OUTLETS, DATA AND TELEPHONE OUTLETS, LIGHT FIXTURES,SWITCHES AND SPRINKLER HEADS WITH ARCHITECT PRIOR TO PROCEEDING WITH CONSTRUCTION. CONTRACTOR TO VERIFY THAT NO CONFLICTS EXIST IN LOCATIONS OF ANY MECHANICAL, TELEPHONE, DATA, ELECTRICAL, LIGHTING, PLUMBING, AND SPRINKLER EQUIPMENT (INCLUDING ALL PIPING, DUCTWORK AND CONDUIT) AND THAT ALL REQUIRED CLEARANCES FOR INSTALLATION AND MAINTENANCE ARE PROVIDED.

9. ALL WORK LISTED, SHOWN, OR IMPLIED ON ANY CONSTRUCTION DOCUMENTS SHALL BE SUPPLIED AND INSTALLED BY THE GENERAL CONTRACTOR, EXCEPT WHERE NOTED OTHERWISE.

10. CONTRACTOR SHALL NOTIFY ARCHITECT IMMEDIATELY OF ALL UTILITIES DETERMINED IN THE COURSE OF CONSTRUCTION AS BEING NECESSARY TO BE REMOVED WHICH HAVE NOT OTHERWISE BEEN NOTED FOR REMOVAL IN THE CONSTRUCTION DOCUMENTS. CONTRACTOR SHALL REMOVE SUCH UTILITIES ONLY AFTER CONSULTATION WITH THE ARCHITECT AND OWNER.

11. ALL WORK NOTED "BY OTHERS" OR "N.I.C." SHALL BE PROVIDED BY OWNER OR TENANT UNDER SEPARATE CONTRACT. SUBMIT SCHEDULE REQUIREMENTS TO THE ARCHITECT AND OWNER FOR THIS "OTHER" WORK IN THE CONSTRUCTION PROGRESS SCHEDULE AND COORDINATE AS REQUIRED TO ASSURE ORDERLY SEQUENCE OF INSTALLATION.

12. EXAMINATION OF THE SITE AND PORTIONS THEREOF WHICH WILL AFFECT THIS WORK SHALL BE MADE IMMEDIATELY BY THE GENERAL CONTRACTOR, WHO SHALL COMPARE EXISTING CONDITIONS WITH THE DRAWINGS AND SATISFY HIM/HERSELF AS TO THE CONDITIONS UNDER WHICH WORK IS TO BE PERFORMED. CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY CONDITIONS REQUIRING MODIFICATION BEFOR PROCEEDING WITH THE WORK. CONTRACTOR SHALL AT SUCH TIME ASCERTAIN AND CHECK LOCATIONS OF EXISTING STRUCTURES. CONTRACTOR'S BID SHALL BE BASED UPON THIS EXAMINATION.

13. REPETITIVE FEATURES NOT SHOWN ON DRAWINGS SHALL BE COMPLETELY PROVIDED AS IF DRAWN IN FULL.

14. DESIGN/BUILD CONTRACTORS SHALL BE RESPONSIBLE FOR THE DESIGN, PERMIT AND CONSTRUCTION DOCUMENTATION, CALCULATIONS AND INSTALLATION OF SYSTEMS MEETING THE REQUIREMENTS OF THE PERFORMANCE SPECIFICATIONS AND THE PREVAILING CODES. CONTRACTORS SHALL SUBMIT DRAWINGS TO THE ARCHITECT FOR REVIEW PRIOR TO SUBMITTING FOR PERMIT OR COMMENCEMENT OF INSTALLATION. THE ARCHITECT RESERVES RIGHT TO REJECT AND REQUIRE REVISIONS TO SUBMITTAL IF DESIGN INTENT IS NOT MET.

15. IN CASE OF CONFLICT BETWEEN THE ARCHITECT'S AND ENGINEER'S DRAWINGS IN LOCATING MATERIALS AND EQUIPMENT, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT IMMEDIATELY OF SUCH CONFLICT PRIOR TO PERFORMING WORK.

16. ALL MANUFACTURED ARTICLES, MATERIALS, AND EQUIPMENT SHALL BE INSTALLED, CONNECTED, ERECTED, CLEANED, AND CONDITIONED PER THE MANUFACTURER'S INSTRUCTIONS. IN CASE OF DIFFERENCES BETWEEN MANUFACTURER'S INSTRUCTIONS AND THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT BEFORE PROCEEDING WITH THE WORK IN QUESTION.

17. RESOLUTION OF ALL QUESTIONS OR VARIANCES FROM THESE CONTRACT DOCUMENTS MUST BE MADE THROUGH THE ARCHITECT AND CONFIRMED IN WRITTEN FORM.

18. DURING ALL PHASES OF CONSTRUCTION, DO NOT INTERFERE WITH THE USE OF ADJACENT BUILDINGS. MAINTAIN SAFE PASSAGE TO AND FROM ADJACENT BUILDINGS AND SPACES.

19. THE GENERAL CONTRACTOR SHALL REMOVE ALL RUBBISH AND WASTE MATERIALS OF ALL SUBCONTRACTORS AND TRADES ON A DAILY BASIS AND SHALL EXERCISE STRICT CONTROL OVER JOB CLEANING TO PREVENT ANY DIRT, DEBRIS, OR DUST FROM AFFECTING ANY FINISHED AREAS IN OR OUTSIDE THE JOB SITE. BURNING OF DEBRIS ON SITE SHALL NOT BE PERMITTED. GENERAL CONTRACTOR TO COMPLY WITH APPROVED "CONSTRUCTION WASTE MANAGEMENT PLAN".

20. GENERAL CONTRACTOR TO PROVIDE SHORING AND BRACING AS REQUIRED. GENERAL CONTRACTOR TO RETAIN STRUCTURAL ENGINEER TO EVALUATE TEMPORARY CONSTRUCTION LOADING CAPACITY OVER AND ADJACENT TO EXISTING ETCHEVERRY BASEMENT

21. STORE, HANDLE, AND DISPOSE OF CONSTRUCTION MATERIALS AND WASTES PROPERLY, SO AS TO PREVENT THEIR CONTACT WITH STORMWATER.

22. CONTROL AND PREVENT THE DISCHARGE OF ALL POTENTIAL POLLUTANTS, INCLUDING PAVEMENT CUTTING WASTES, PAINTS, CONCRETE, PETROLEUM PRODUCTS, CHEMICALS, WASHWATER OR SEDIMENTS, AND NON-STORMWATER DISCHARGES TO STORM DRAINS AND WATERCOURSES.

23. USE SEDIMENT CONTROLS OR FILTRATION TO REMOVE SEDIMENT WHEN DEWATERING SITE AND OBTAIN ALL NECESSARY PERMITS.

24. AVOID CLEANING, FUELING, OR MAINTAINING VEHICLES ON-SITE, EXCEPT IN A DESIGNATED AREA WHERE WASHWATER IS CONTAINED AND TREATED.

25. DELINEATE WITH FIELD MARKERS CLEARING LIMITS, EASEMENTS, SETBACKS, SENSITIVE OR CRITICAL AREAS, BUFFER ZONES, TREES, AND DRAINAGE COURSES.

26. PROTECT ADJACENT PROPERTIES AND UNDISTURBED AREAS FROM CONSTRUCTION IMPACTS USING VEGETATIVE BUFFER STRIPS, SEDIMENT BARRIERS OR FILTERS, DIKES, MULCHING, OR OTHER MEASURES AS APPROPRIATE.

27. PERFORM CLEARING AND EARTH MOVING ACTIVITIES ONLY DURING DRY WEATHER.

28. AVOID TRACKING DIRT OR OTHER MATERIALS OFFSITE; CLEAN OFF-SITE PAVED AREAS AND SIDEWALKS USING DRY SWEEPING METHODS.

29. THE CONTRACTOR SHALL TRAIN AND PROVIDE INSTRUCTION TO ALL EMPLOYEES AND SUBCONTRACTORS REGARDING THE CONSTRUCTION BMPS.

30. ALL ITEMS ARE NEW UNLESS OTHERWISE NOTED.

31. ANCHORAGE OF ALL FIXED EQUIPMENT IS TO BE INSTALLED IN ACCORDANCE WITH CBC, TITLE 24, CCR, ALL APPLICABLE PARTS.

SYMBOLS

ROOM INFORMATION		ROOM NUMBER / FINISHES / AREA
BUILDING ELEVATION	1 / A101	DRAWING NUMBER / SHEET NUMBER
BUILDING SECTION	1 / A101	DRAWING NUMBER / SHEET NUMBER
INTERIOR ELEVATION	1 / A101	DRAWING NUMBER / SHEET NUMBER
COLUMN LINE	0	GRID NUMBER
DETAIL	1 / A101	DRAWING NUMBER / SHEET NUMBER
DOOR MARK	101	
PARTITION TYPE	A1	
DATUM ELEVATION		
CENTERLINE	℄	
MATCHLINE		
WINDOW	1t	
CEILING HEIGHT	+X'-X 1/X"	
REVISION TAG	1	

PROJECT DIRECTORY

OWNER:	UNIVERSITY OF CALIFORNIA BERKELEY, CAPITAL PROJECTS 1936 UNIVERSITY AVE., 2ND FLR. BERKELEY. CA, 94704	SALLY MCGARRAHAN T: (510) 643 - 5560 SMCGARRAHAN @ BERKELEY.EDU
PROJECT MANAGEMENT CONSULTANT:	KSD GROUP 1200 CONCORD AVE., NO. 170 CONCORD, CA 94520	KEN DEFIEBRE M: (925) 487 - 4752 KEN@KSDGROUP.COM
GENERAL CONTRACTOR:	HATHAWAY DINWIDDIE 275 BATTERY STREET, SUITE 300 SAN FRANCISCO, CA 94111	JOEL BENNETT (408) 988-4200 BENNETTJ@HDCCO.COM
ARCHITECT:	LEDDY MAYTUM STACY ARCHITECTS 677 HARRISON STREET SAN FRANCISCO, CA 94107	RYAN JANG T: (415) 495 - 1700 X 342 RJANG@LMSARCH.COM
STRUCTURAL ENGINEER:	FORELL / ELSESSER ENGINEERS 160 PINE ST., SUITE 600 SAN FRANCISCO, CA 94111	CHRIS PETTEYS T: (415) 837 - 0700 C.PETTEYS@FORRELL.COM
LANDSCAPE ARCHITECT:	CLIFF LOWE ASSOCIATES 1175 FOLSOM STREET SAN FRANCISCO, CA 94103	CLIFF LOWE T: (415) 431 - 0394 CLIFF@CLASCAPE.COM
MECHANICAL/ PLUMBING DESIGN-BUILD ENGINEER:	PAN-PACIFIC MECHANICAL 1205 CHRYSLER DR. MENLO PARK, CA 94025	MIKE CARTER T: (650) 815-6915 MCARTER@PPMECHANICAL.COM
ELECTRICAL + LIGHTING DESIGN-BUILD ENGINEER:	THE ENGINEERING ENTERPRISE 1305 MARINA VILLAGE PKWY. ALAMEDA, CA 94501	KRISTINA MARTIN T: (510) 769-7600 TINA@ENGENT.COM
FIRE PROTECTION DESIGN-BUILD:	COSCO FIRE PROTECTION 230 S. VASCO RD. LIVERMORE, CA 94551	WES MCCLAIN T: (925) 455-2751 WMCCLAIN@COSCOFIRE.COM
MEP PEER REVIEW ENGINEER:	INTEGRAL GROUP ENGINEERS 427 13TH ST. OAKLAND, CA 94612	TYLER BRADSHAW T: (510) 663-2070 TBRADSHAW@INTEGRALGROUP.COM
CIVIL ENGINEER:	BKF 4670 WILLOW RD., SUITE 250 PLEASANTON, CA 94588	JOHN LAMON T: (925) 396 - 7700 JLAMON@BKF.COM
ACOUSTICAL:	CHARLES SALTER ASSOCIATE, INC. 130 SUTTER STREET, SUITE 500 SAN FRANCISCO, CA 94104	JEREMY DECKER T: (415) 397 - 0442 JEREMY.DECKER@CMSALTER.COM
WATERPROOFING:	SIMPSON GUMPERTZ HAGER 100 PINE STREET, SUITE 1600 SAN FRANCISCO, CA 94111	JIM MENDYGRAL T: (415) 495 - 3700 JEMENDYGRAL@SGH.COM
GEOTECHNICAL CONSULTANT:	A3GEO, INC. 1331 SEVENTH STREET, UNIT E BERKELEY, CA 94710	DONA MANN T: (415) 425 - 0247 DONA@A3GEO.COM
SURVEYOR:	BKF 4670 WILLOW RD., SUITE 250 PLEASANTON, CA 94588	WALTER STEMBERGA T: (925) 396 - 7730 WSTEMBERGA@BKF.COM
ARBORIST:	HORTSCIENCE, INC. 325 RAY STREET PLEASANTON, CA 94566	JIM CLARK T: (925) 981 - 9430 X 25 JIM@HORTSCIENCE.COM

PROJECT DATA

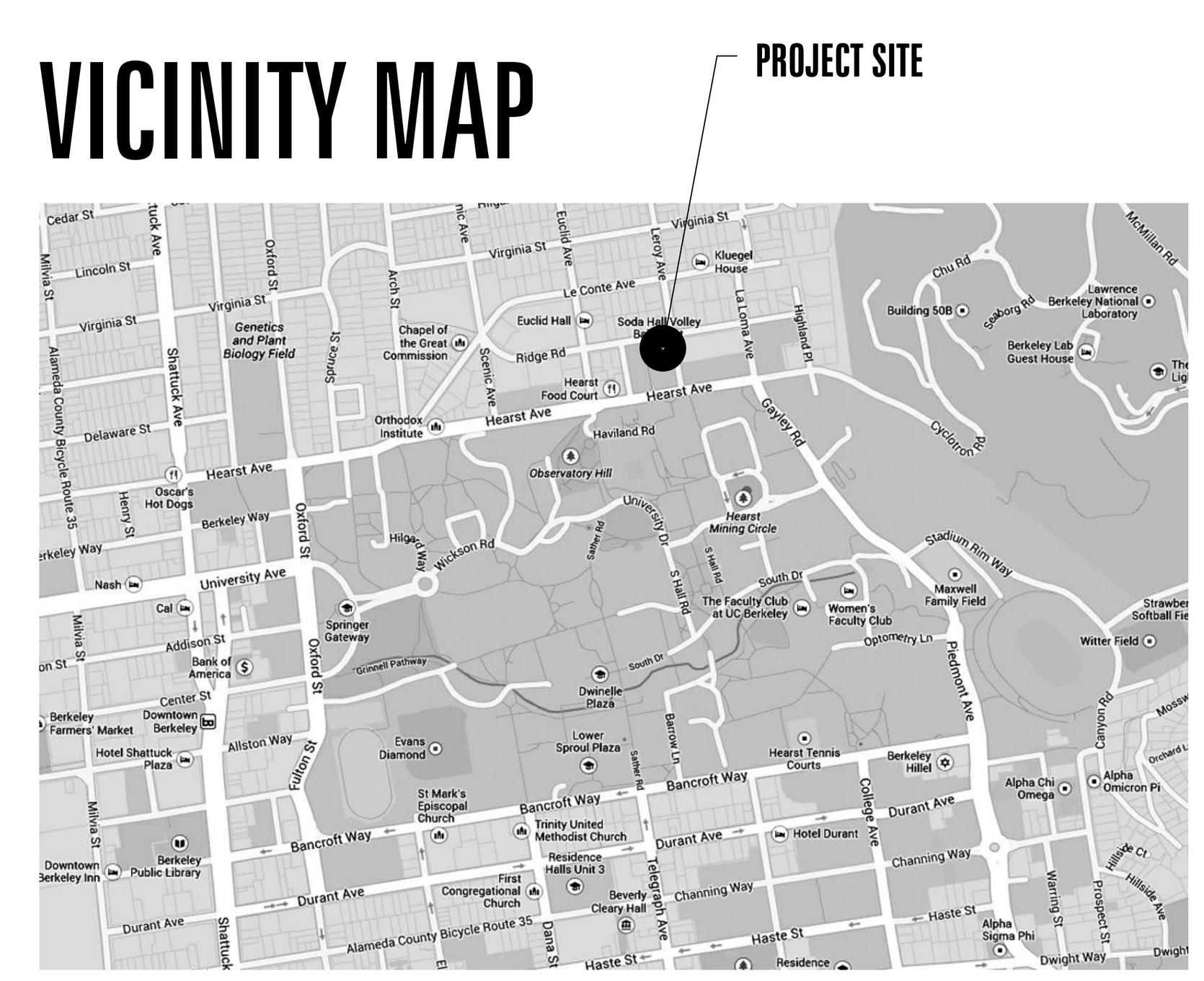
PROJECT ADDRESS:	1810 LEROY AVE., AT RIDGE ROAD BERKELEY, CA 94709
PROJECT DESCRIPTION:	DESIGN INSTITUTE HOUSING INTERDISCIPLINARY UNDERGRADUATE STUDIOS FOCUSED ON ENGINEERING DESIGN AND MANUFACTURED INNOVATIONS
OCCUPANCY CLASSIFICATION:	A-3 ASSEMBLY
CONSTRUCTION TYPE:	TYPE IIB
FIRE PROTECTION:	FULLY SPRINKLERED
FLOOR AREA:	24035 SF
NO. OF STORIES:	3 + BASEMENT

DEFERRED SUBMITTALS:

THE FOLLOWING IS A LIST OF DELAYED REVIEW / DEFERRED APPROVAL ITEMS FOR SUBMITTAL AND REVIEW BY THE LOCAL AUTHORITY HAVING JURISDICTION. THESE DEFERRED SUBMITTALS SHALL FIRST BE SUBMITTED TO THE ARCHITECT / ENGINEER FOR REVIEW AND COORDINATION; FOLLOWING THE COMPLETION OF THE ARCHITECT / ENGINEER'S REVIEW AND APPROVAL, A SUBMITTAL TO THE LOCAL AUTHORITY SHALL BE MADE WHICH SHALL INCLUDE A LETTER STATING "THIS REVIEW AND COORDINATION HAS BEEN PERFORMED AND COMPLETED, PLANS AND CALCULATIONS FOR THE DEFERRED ITEMS ARE FOUND TO BE ACCEPTABLE (E.G. WITH REGARD TO GEOMETRY, LOAD CONDITIONS, ETC.) WITH NO EXCEPTIONS".

1. ENGINEERING AND CALCULATIONS FOR ENCLOSED METAL STAIRS AS NOTED IN DOCUMENTS; AS ENGINEERED BY METAL STAIR CONTRACTOR.
2. FIRE PROTECTION: SHOP DRAWINGS AND CALCULATION COMPLYING WITH THE REQUIREMENTS OF NFPA, AND ALL APPLICABLE ORDINANCES AND CODES. FIRE SPRINKLER, FIRE PROTECTION, UNDERGROUND FIRE SERVICE, AND HOOD/DUCT FIRE PROTECTION SYSTEMS SHALL BE SUBMITTED TO THE AUTHORITY HAVING JURISDICTION FOR REVIEW PRIOR TO INSTALLATION.
3. PUBLIC RIGHT OF WAY ENCROACHMENT PERMITS PRIOR TO CONSTRUCTING ANY IMPROVEMENTS WITHIN THE PUBLIC RIGHT OF WAY AND FOR WORK ON CITY'S UTILITIES INCLUDING WATER, SEWER, STORM DRAIN PIPING AND ELECTRICAL/TRAFFIC LIGHT WORK. THE CONTRACTOR SHALL OBTAIN AN ENCROACHMENT PERMIT FROM THE LOCAL JUSIDICTION.
4. TREE REMOVAL PERMITS PRIOR TO STARTING DEMOLITION OR ANY IMPROVEMENTS.
5. PILE SUBMITTAL AND DRAWINGS AND CALCULATORS BY PILE SUBCONTRACTOR.
6. LAGGING, SHORING AND TEMPORARY CONSTRUCTION SCOPE OF WORK.
7. EXTERIOR SKIN DESIGN BUILD SCOPE OF WORK INCLUDING WINDOWS, GLAZING, EXTERIOR GAGED FRAMING, AND EXTERIOR CLADDING
8. PHOVOLTAIC PANEL ARRAY AT HIGH ROOF; ELECTRICAL ENGINEERING AND STRUCTURAL ANCHORAGE AS ENGINEERED BY PV CONTRACTOR

VICINITY MAP



DRAWING INDEX

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GENERAL INFORMATION DRAWINGS													
G0.0	COVERSHEET CURRENT	○	○	●	○	○	○	○		○	○	○	○
G0.2	CODE ANALYSIS & AMMR	○	●	●	⁄	⁄		⁄		○		⁄	○
G0.3	EXITING DIAGRAMS	○	●	●		⁄		⁄		○		⁄	○
G0.4	ACCESSIBLE PATH & SIGNAGE DIAGRAMS	○	●	●				⁄		○		⁄	○
G0.5	EXISTING BUILDING PLANS			○				⁄		○			○
G0.6	DEDUCT BASEMENT ALTERNATE SCOPE			○									○
CIVIL DRAWINGS													
C1.00	EXISTING CONDITIONS	○	●	●	●			⁄		○	○		○
C2.00	UTILITY PLAN	○	●	●				○	●	○	○		●
C3.00	OFFSITE DEMOLITION PLAN		●	●	●					○	○		●
C3.10	OFFSITE PAVING PLAN		●	●	⁄					○	○		●
C3.20	STORMWATER TREATMENT EXHIBIT		○	●							○		
C3.20-	EXCAVATION PLAN				○		●			○	○		○
C4.00	CIVIL DETAILS	○	●	●	⁄			○	●	○	○		○
LANDSCAPE DRAWINGS													
L0.0	LANDSCAPE NOTES & LEGENDS	○	●	●						○	○		○
L0.1	LANDSCAPE KEY PLAN		○	●						○	○		○
L1.0	LANDSCAPE LAYOUT PLAN	○	●	●						○	○		○
L1.1	LANDSCAPE MATERIALS PLAN	○	●	●						○	○		○
L2.0	LANDSCAPE GRADING PLAN	○	●	●	⁄					○	○		○
L3.0	LANDSCAPE PLANTING PLAN	○	●	●						○	○		○
L4.1	IRRIGATION NOTES & LEGEND									●	○		○
L4.2	IRRIGATION PLAN									●	○		○
L4.3	IRRIGATION DETAILS									●	○		○
L5.0	LANDSCAPE ELEVATIONS	○	●	●									
L6.0	LANDSCAPE DETAILS - PAVING & SITE FURNITURE	○	●	●						○	○		○
L6.1	LANDSCAPE DETAILS - DRAINAGE	○	●	●						○	○		○
L6.2	LANDSCAPE DETAILS - WALLS	○	●	●						○	○		○
L6.3	LANDSCAPE DETAILS - PLANTING	○	●	●						○	○		○
L6.4	LANDSCAPE DETAILS - PLANTING												○
ARCHITECTURAL DRAWINGS													
A1.1	SITE DEMOLITION PLAN	○	●	●	●		●			○			●
A1.2	SITE PLAN	○	●	●	Ø			○		○		⁄	●
A2.0	BASEMENT PLAN			○		○		○		○		⁄	●
A2.1	1ST STORY FLOOR PLAN	○	●	●		○		○		○		⁄	●
A2.2	2ND STORY FLOOR PLAN	○	●	●		○		○		○		⁄	●
A2.3	3RD STORY FLOOR PLAN	○	●	●		○		○		○		⁄	●
A2.4	LOWER ROOF PLAN	○	●	●		○		○		○		⁄	●
A2.5	UPPER ROOF PLAN							○		○		⁄	○
A2.6	FURNITURE & EQUIPMENT PLANS			○				⁄		○			○
A2.7	FURNITURE & EQUIPMENT PLANS		●	●				⁄		○			○
A3.1	EXTERIOR ELEVATIONS	○	●	●		○		○		○			●
A3.2	EXTERIOR ELEVATIONS	○	●	●		○		○		○			●
A3.3	BUILDING SECTIONS	○	●	●				○		○		⁄	○
A3.4	WALL SECTIONS	○	●	●									
A4.1	ENLARGED FLOOR PLANS	○	●	●						○			○
A5.1	INTERIOR ELEVATIONS			○						○			○
A5.2	INTERIOR ELEVATIONS	○	●	●						○			○
A5.3	INTERIOR ELEVATIONS	○	●	●						○			○
A5.4	INTERIOR ELEVATIONS	○	●	●						○			○
A5.5	INTERIOR ELEVATIONS	○	●	●						○			○
A6.0	BASEMENT REFLECTED CEILING PLAN			○						○			○
A6.1	1ST STORY REFLECTED CEILING PLAN	○	●	●						○			○
A6.2	2ND STORY REFLECTED CEILING PLAN	○	●	●						○			○
A6.3	3RD STORY REFLECTED CEILING PLAN	○	●	●						○			○
A7.1	VERTICAL CIRCULATION	○	●	●						○			○
A7.2	VERTICAL CIRCULATION	○	●	●						○		●	●
A7.3	EXTERIOR CIRCULATION	○	●	●						○			○
A7.4	STAIR, ELEVATOR & BRIDGE DETAILS											○	●
A8.1	DOORS & WINDOWS - SCHEDULES & DETAILS	○	●	●		○				○			○
A8.2	EXT DETAILS - DESIGN BUILD	○				○		⁄		○			○
A8.3	EXT DETAILS - DESIGN BUILD					○		⁄		○			○
A8.4	EXT DETAILS - DESIGN BUILD					○		⁄		○			○
A8.5	EXT DETAILS WATER PROOFING							○		○			○
A8.6	ROOF DETAILS					○							○
A9.1	PARTITION SCHEDULE & DETAILS	○	●	●						○			○
A9.2	INTERIOR DETAILS												○
A9.3	INTERIOR DETAILS												○
A9.4	INTERIOR DETAILS												○
STRUCTURAL DRAWINGS													
S0.1	GENERAL NOTES	○		●		○		○		○			○
S0.2	GENERAL NOTES	○		●				○		○			○
S0.3	GENERAL NOTES, ABBREVIATIONS LEGEND & SHEET LIST	○		●				○		○			○
S0.4	3D ISOMETRIC - BUILDING VIEW NW CORNER	○		●				○		○			○
S0.5	3D ISOMETRIC - BUILDING VIEW SE CORNER	○		●				○		○			○
S2.0	BASEMENT FRAMING PLAN			○				○		○			●
S2.1	1ST STORY FRAMING PLAN	○		●				○		○			●
S2.2	2ND STORY FRAMING PLAN	○		●				○		○			●
S2.3	3RD STORY FRAMING PLAN	○		●				○		○			●
S2.4	LOW ROOF/HIGH ROOF FRAMING PLAN	○		●				○		○			●
S3.1	ELEVATIONS	○		●				○		○			●
S3.2	ELEVATIONS	○		●				○		○			●
S4.1	BUILDING AND WALL SECTIONS	○		●				○		○			○
S4.2	BUILDING AND WALL SECTIONS	○		●				○		○			○
S5.1	TYPICAL CONCRETE DETAILS	○		●				○		○			○
S5.2	TYPICAL CONCRETE DETAILS	○		●				○		○			○
S5.3	CONCRETE FOUNDATION DETAILS	○		●				○		○			○
S5.4	TYPICAL CONCRETE DETAILS	○		●				○		○			○
S5.5	TYPICAL CONCRETE DETAILS							○		○			●
S5.6	CONCRETE DETAILS							○		○			○
S6.1	TYPICAL STEEL DETAILS	○		●				○		○			●
S6.2	TYPICAL STEEL DETAILS	○		●				○		○			○
S6.3	TYPICAL STEEL DETAILS	○		●				○		○			●
S6.4	TYPICAL METAL DECK DETAILS	○		●				○		○			○
S6.5	TYPICAL METAL DECK DETAILS	○		●				○		○			○

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S6.6	BRACE FRAME DETAILS	○		●				○		○			●
S6.7	STEEL DETAILS			○				○		○			●
S6.8	STEEL DETAILS							○		○			●
MECHANICAL DRAWINGS													
M0.00	MECHANICAL LEAD SHEET		○	●						○			○
M0.01	MECHANICAL SCHEDULES		○	●						○			○
M2.00	BASEMENT FLOOR MECHANICAL PLAN			○						○			○
M2.00Z	BASEMENT FLOOR RADIANT ZONING PLAN			○									
M2.01	MECHANICAL FLOOR PLAN LEVEL 1		○	●						○			○
M2.01Z	MECHANICAL ZONING PLAN LEVEL 1		○	●									
M2.02	MECHANICAL FLOOR PLAN LEVEL 2		○	●						○			○
M2.02Z	MECHANICAL ZONING PLAN LEVEL 2		○	●									
M2.03	MECHANICAL FLOOR PLAN LEVEL 3		○	●						○			○
M2.03Z	MECHANICAL ZONING PLAN LEVEL 3		○	●									
M2.04	MECHANICAL LOW ROOF PLAN		○	●						○			○
M3.00	MECHANICAL PIPING PLAN BASEMENT LEVEL												○
M3.01	MECHANICAL PIPING PLAN LEVEL 1									●			○
M3.02	MECHANICAL PIPING PLAN LEVEL 2									●			○
M3.03	MECHANICAL PIPING PLAN LEVEL 3									●			○
M5.00	MECHANICAL DIAGRAMS									●			○
M5.01	MECHANICAL DETAILS									●			○
M5.02	MECHANICAL DETAILS									●			○
M6.00	TITLE 24												○
M6.01	TITLE 24												○
M6.02	TITLE 24												○
PLUMBING DRAWINGS													
P0.0	PLUMBING LEAD SHEET		○	●						○			○
P0.1	PLUMBING SCHEDULES		○	●						○			○
P2.0	PLUMBING PLAN BASEMENT LEVEL			○						○			○
P2.0_UG	PLUMBING PLAN FIRST FLOOR UNDERGROUND		○	●						○			
P2.1	PLUMBING PLAN LEVEL 1		○	●						○			○
P2.2	PLUMBING PLAN LEVEL 2		○	●						○			○
P2.3	PLUMBING PLAN LEVEL 3		○	●						○			○
P2.4	PLUMBING PLAN LOW ROOF LEVEL		○	●						○			○
P2.5	PLUMBING HIGH ROOF PLAN									●			○
P3.1	ENLARGED PLUMBING PLANS									●			○
P4.1	DOM WATER & COMP. AIR RISER DIAG.												○
P4.2	SAN. WASTE VENT & STORM DRAIN DIAG.												○
P5.1	PLUMBING DETAILS												○
ELECTRICAL DRAWINGS													
E0.01	ELECTRICAL SYMBOLS & SHEET INDEX		○	●						○			○
E0.02	NOTES AND SCHEDULES		○	●						○			○
E0.03	SCHEDULES - PANEL		○	●						○			○
E0.04	SCHEDULES - PANEL		○	●						○			○
E0.05	SCHEDULES - LIGHTING									○			○
E1.01	SITE PLAN - ELECTRICAL		○	●						○			○
E1.02	EXISTING BUILDING ROUTING PLAN		○	●						○			○
E2.00	BASEMENT FLOOR PLAN - POWER			○						○			○
E2.01	1ST FLOOR PLAN - POWER		○	●						○			○
E2.02	2ND FLOOR PLAN - POWER		○	●						○			○
E2.03	3RD FLOOR PLAN - POWER		○	●						○			○
E2.04	LOWER AND UPPER ROOF PLANS - POWER		○	●						○			○
E3.00	BASEMENT PLAN - LIGHTING			○						○			○
E3.01	1ST FLOOR PLAN - LIGHTING		○	●						○			○
E3.02	2ND FLOOR PLAN - LIGHTING		○	●						○			○
E3.03	3RD FLOOR PLAN - LIGHTING		○	●						○			○
E4.01	ENLARGED ELECTRICAL AND TELCOM ROOM PLANS		○	●						○			○
E5.01	POWER RISER DIAGRAM		○	●						○			○
E6.01	ELECTRICAL DETAILS		○	●						○			○
E6.02	ELECTRICAL DETAILS		○	●						○			○
E6.03	TELCOM DETAILS		○	●						○			○
E6.04	TELCOM DETAILS			○									
FIRE ALARM DRAWINGS													
FA0.00	COVER SHEET AND DRAWING INDEX			○									○
FA0.01	EQUIPMENT LIST			○									○
FA0.02	MISCELLANEOUS NOTES AND DETAILS			○									○
FA1.00	MAIN XLS FACP DETAILS AND CALCULATIONS			○									○
FA1.01	MAIN XLS FACP INNER & OUTER DOORS			○									○
FA1.02	REMOTE ANNUNCIATOR AND FIRE COMMUNICATOR			○									○
FA1.03	XLS FACP MOUNTING DETAILS			○									○
FA1.04	TYPICAL WIRING DETAIL OF FIELD DEVICES			○									○
FA2.00	PARTIAL FIRE ALARM RISER DIAGRAM			○									○
FA3.00	FIRE ALARM SITE PLAN			○									○
FA3.01	FIRE ALARM PLAN - BASEMENT			○									○
FA3.02	FIRE ALARM PLAN - 1ST STORY & 2ND STORY			○									○
FA3.03	FIRE ALARM PLAN - 3RD STORY & LOW ROOF			○									○
FA4.00	ETCHEVERRY HALL RISER, DETAILS AND CALCULATIONS			○									○
FIRE PROTECTION													
FP.1	FIRE PROTECTION COVER SHEET			○						○			○
FP.2	BASEMENT OVERHEAD PIPING									○			○
FP.3	1ST FLOOR PIPING			○						○			○
FP.4	2ND FLOOR PIPING									○			○
FP.5	3RD FLOOR PIPING									○			○
FP.6	EQB CALCULATIONS									○			○
FP.7	DETAILS & BLDG. SECTION									○			○
FP.8	UG FIRE SERVICE									○			○

DRAWING INDEX LEGEND:

(blank)	NOT ISSUED
●	ISSUED WITH REVISIONS
○	ISSUED
⁄	ISSUED FOR REFERENCE ONLY
Ø	ISSUED WITH REVISIONS, FOR REFERENCE ONLY

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REQUEST FOR ALTERNATE MEANS OF PROTECTION

Jacobs Hall
University of California, Berkeley
Berkeley, CA

Code Section: 2010 Edition of the California Building Code (CBC), Section 509.2, Horizontal Building Separation Allowance.

Code Requirement: The Code allows two buildings to be considered as separate and distinct buildings, provided the following conditions are met:

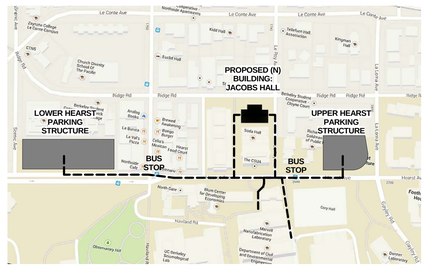
1. The buildings are separated with a minimum 3-hour fire resistance rated horizontal assembly.
2. The building below the horizontal assembly is no more than one story above grade plane.
3. Building below the horizontal assembly is of Type I-A construction.
4. Shaft, stairway, ramp, and escalator enclosures through horizontal assembly will have at least a 2-hour fire resistance rating. Building above permitted to have multiple Group A occupancy uses, each with an occupant load less than 300, or B, M, R, or S occupancies.
5. Building below is required to be protected by an automatic sprinkler system and is permitted to have multiple Group A occupancy uses, each with an occupant load less than 300, or B, M, R, or S-2 parking occupancies.
6. The maximum building height shall not exceed the limits set in Section 503.

the grade plane where the Code allows only one story above grade plane.

The building below (Etcheverry) is of Type I-B construction where the Code requires Type I-A construction. The intent of this requirement is to ensure that building below has been provided with a structural frame and bearing walls that have a minimum fire resistance rating of 3-hours, the same as the minimum requirement for the assembly. This ensures that the building does not collapse prior to the floor assembly reaching its limit. This is established for the common scenario of "podium" construction where the building above is supported by the building below, and a collapse of the below structure would cause catastrophic damage to the entire building system. The building above (Jacobs Hall) has a structure, including the foundation, which is self-supported independently of the existing basement. Therefore, even under the catastrophic event of the building below collapsing, the building above would remain.

There are no enclosures are provided between Jacobs Hall and Etcheverry Basement that would require a significant penetration to the 4-hour fire resistance rated assembly. Both Etcheverry (Group B) and Jacobs Hall (Group B/A-3) consist of permitted occupancies by Section 509.2. The code requires that the entire building below is fully sprinklered. The intent of this requirement is two part. First is to provide protection for the structural frame and bearing walls to avoid collapse of the building both above and below. The second is to control and limit the exposure of the 4-hour fire resistance rated assembly from a fire. The upper level of the Etcheverry basement (directly below the 4-hour fire resistance rated assembly) is partially sprinklered and the lower level of the Etcheverry Basement is not sprinklered. . As required by CBC 509.2 but not associated with this project, the College of Engineering is planning to install fire sprinklers on all floors of Etcheverry Hall as part of the approved 2012 Etcheverry Master Plan. This plan is a multi-phased project that will be implemented over a 5-year period once all donor funding has been generated. Our intention is to work with the Campus Fire Marshal's Office to prioritize which areas should receive sprinklers first. Any current violations that exist in the 2nd Floor sprinklered areas will be

SITE ACCESS MAP



Code Intent: The intent of this section is to essentially allow a 3-hour fire resistance rated assembly to create a separable building similar to the concept used for fire walls, as long as both buildings meet certain requirements.

Request: To allow a 4-hour fire resistance rated horizontal assembly to provide the separation for the 10-foot 1-inch overlap of the proposed Jacobs Hall Ground Floor and existing Etcheverry Hall Basement.

Justification: The proposed Jacobs Hall is a 3-story construction Type II-B building that is 44 feet tall and has a total area of 18,750 square feet. Jacobs Hall will be comprised mainly of studio classrooms with occupant loads of greater than 50 people (Group A-3) and offices (Group B). Jacobs Hall will be built on the corner of Leroy Avenue and Ridge Road in Berkeley, California, adjacent to Etcheverry Hall (west) and Soda Hall (south). Currently, Etcheverry Hall's two Basement Levels extend to the east under approximately 75-80% of Soda Hall. Etcheverry Hall is a Group B building constructed in the 1960's. It is concrete construction and could be considered to be equivalent to a construction Type I-B building. The Ground Floor of Jacobs Hall will overlap 10 feet, 1-inch over the existing Etcheverry Hall Basement for the length of the building (123 feet, 4 inches). The overlapping portion of Jacobs Hall's structure, including the foundation, is self-supported independently of the existing Basement with only a few minor non-structural elements from Level 3 resting on a topping slab above the Basement.

To consider these overlapping buildings both separate and distinct, in accordance with Section 509.2, the following has been provided. The building overlap area of 1,244 square feet, which is approximately 20% of the Jacobs Hall floor plan, is required to be separated from one another by a 3-hour fire resistance rated assembly. For this project, the minimum poured-in-place concrete slab thickness of Etcheverry, not including the topping slab, is 8 inches. Per CBC Table 721.2.2.1, this provided the equivalence of a 4-hour fire resistance rating. The section of the building below the fire resistance rated separation (Etcheverry) is not above

corrected by the College of Engineering prior to the completion of Jacob's Hall. Finally, the building does not exceed the maximum building heights set forth in Section 503.

Conclusion: Based upon the information provided, the 4-hour fire resistance rated assembly will provide the required protection intended by the Code to consider these as separate and distinct buildings. On this basis, the intent of the Code is met.

Prepared by:

ROLF JENSEN & ASSOCIATES, INC.

Jared F. Mattern — 12/19/13 Date

Reviewed by:

ROLF JENSEN & ASSOCIATES, INC.

Thomas M. Dusza, P.E. — 12/19/13 Date

Approved by:

UNIVERSITY OF CALIFORNIA, BERKELEY FIRE MARSHAL

Name Date

JFW/TMD:ga
S61590RQSAAT08

Attachment

BUILDING AREAS

STORY	GROSS FLOOR AREA
BASEMENT	4885 GSF
1	6300 GSF
2	6325 GSF
3	6525 GSF
TOTAL GSF:	**24035 GSF**

PROGRAM AREA	ASSIGNABLE FLOOR AREA
EXHIBIT / LOBBY	1110 ASF
STUDIO	10833 ASF
MEETING	873 ASF
OFFICE	784 ASF
LOUNGE	622 ASF
EQUIPMENT	1596 ASF
STORAGE	493 ASF
RESTROOMS	960 ASF
UTILITY	571 ASF
CIRCULATION	3197 ASF
TOTAL ASF:	**21039 ASF**

ALLOWABLE HEIGHT AND AREA

TABLE 503
ALLOWABLE BUILDING HEIGHTS AND AREAS: **TYPE IIB**

GROUP A-3	ALLOWED	ACTUAL
HEIGHT	55' + 20' = 75'*	**44'****
STORIES	2 + 1 = 3*	**3****
AREA PER STORY (sf)	11875	**6525 (3rd STORY)**
TOTAL AREA (sf) X2	23750	**19150****

*Automatic Sprinkler System Height Increase per 504.2 used.
*Automatic Sprinkler System Are Increase per 506.3 not used. Is = 0.
*Frontage increase assumed at P.L. along Hearst Avenue (Soda), Leroy Avenue, (Jacobs & Soda) & Ridge Road (Jacobs). Not assumed at Etcheverry plaza; no fire access per 506.2.2.
** Basement excluded in area calculations per Sect 506.5.
*** Basement excluded in height & story calculations per table 502.

AREA MODIFICATIONS

PER TABLE 503 ALLOWABLE AREA INCREASES	TYPE IIB (9500 SF BASE ALLOWABLE AREA)
506.1 General: Aa = {At + [At x If] + [At x Is]}	Aa = {9500 + [9500 X 0.25] + [9500 X 0]} = Aa = 9500 + 2375 + 0 = 11875
506.2 Frontage Increase: If = [F/P - 0.25] W/30 F = 198'-6", P = 379'-4", W = 30'	If = [198'-6" / 379'-4" - 0.25] 30/30 = 0.25 (distance to Etcheverry <40', but not a fire lane, so it doesn't count)
Perimeter Calculations:	129'-10" Jacobs @ Ridge Road 129'-10" Jacobs @ Soda Hall 59'-10" Jacobs @ Leroy Ave 59'-10" Jacobs @ Etcheverry Plaza
506.3: Automatic Sprinkler Increase:	Is = 0 (Not taken per exception 3. Used for fire resistance rating substitutions in accordance with Table 601)
Total Area Allowed Per Floor:	11875 SF
506.4 Area Determination:	Multiply by 2 (A Occupancy)
Total Area Allowed:	23750 SF
Act Area / Allowed:	19150 / 23750 SF = .81

AUTOMATIC FIRE SPRINKLER INCREASE

504.2 Where a building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the value specified in Table 503 for maximum building height is increased by 20 feet (6096 mm) and the maximum number of stories in increased by one. Increases are permitted in addition to the building area increase in accordance with Section 506.2. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, these increases are permitted in addition to the area increase in accordance with Section 506.3.

ALLOWABLE HEIGHT INCREASED FROM 2-3 STORIES & 55'-75'
(NOT USED FOR AREA INCREASE)

PLUMBING FIXTURE COUNT

CAPITAL PROJECTS APPENDIX V: MINIMUM TOILET FACILITIES.
MINIMUM STATIONS SERVED BY 1 FIXTURE.
FOOTNOTE 1: A STATION IS DEFINED BY A LECTURE HALL OR CLASSROOM SEAT, OFFICE DESK, LABORATORY BENCH SPACE, ETC., THAT WILL SERVE 1 STUDENTS OR FACULTY MEMBER WITHIN AN ASSIGNABLE AREA. DETERMINE TOTAL STATIONS TO BE SERVED BY ASSUMING 100% OCCUPANCY OF ALL ASSIGNABLE AREAS.

STORY/ SPACE:	STATIONS:	50%	WC (M) (CL- 1:75) (OF- 1:40)	URINAL (M) (CL- 1:75) (OF- 1:40)	LAV (M) (CL- 1:75) (OF- 1:40)	WC (W) (CL- 1:33) (OF- 1:17)	LAV (W) (CL- 1:66) (OF- 1:34)	DRINKING FOUNTAIN
0 / BASEMT	060							
1 / STUDIO	120							
2 / STUDIO	120							
3 / STUDIO	130							
SUBTOTAL:	430	215	3	3	3	7	4	
0 / BASEMT	2							
1 / OFFICE	7							
2 / OFFICE	7							
3 / OFFICE	0							
SUBTOTAL:	16	6	1	1	1	1	1	
TOTAL REQUIRED:			**4**	**4**	**4**	**8**	**5**	
1			2	1	2	3	2	1
2			1	2	2	3	2	1
3			1	2	2	3	2	1
TOTAL PROVIDED			**4**	**5**	**6**	**9**	**6**	**3**

CALIFORNIA PLUMBING CODE SECTION 412.1: FIXTURE COUNT.

412.2.1 IN MULTISTORY BUILDING,S ACCESSIBILITY TO REQUIRED FIXTURES SHALL NOT EXCEED 1 VERTICAL STORY.
412.3 SEPARATE TOILET FACILITIES SHALL BE PROVIDED FOR EACH SEX.

TABLE A: OCCUPANT LOAD FACTOR:

OCCUPANCY:		LOAD FACTOR:	STORY:	OCCUPIED AREA:	NO. OF OCCPTS:	50% M / F
EDUCATION FACILITIES OTHER THAN GROUP E (UNIVERSITIES)		50 SF / PERSON	BASEMENT FIRST SECOND THIRD	2696 SF 3825 SF 4051 SF 4219 SF	54 77 81 85	27 39 41 43
SUBTOTAL:				14791 SF	297	149

TABLE 4-1 MINIMUM PLUMBING FIXTURES:

	WC (M) 1 PER 40	URINAL 1 PER 35	LAV (M) 1 PER 40	WC (W) 1 PER 30	WC (W) 1 PER 40	DRINKING FOUNTAIN 1 PER 150
TOTAL REQUIRED:	**4**	**5**	**4**	**5**	**4**	**1**
TOTAL PROVIDED:	**4**	**5**	**6**	**6**	**9**	**3**

CODES AND REGULATIONS

All work to be in conformance with:

2010 California Building Code
2010 California Fire Code
2010 California Plumbing Code
2010 California Mechanical Code
2010 California Electrical Code
2010 California Green Building Standard Code
UC Berkeley Capital Projects Requirements
UC Berkeley Fire Prevention Division
UC Berkeley Physical Plant / Campus Services Standards
UC Berkeley Environmental Health and Safety Requirements
UC Berkeley Construction Inspector Services
UC Berkeley Information Service and Technology Standards
UC Berkeley Police Department Standards
Division of the State Architect Access Compliance
2013 California Building Code (Chapt 11, Applicable to Accessibility only)
2010 California Energy Code
Requirements of other agencies having jurisdiction

ADJACENT BUILDING INFO.

SODA HALL: Computer Science Building
UCB Project No.: 912542
Approved: 5/28/92, 1988 UBC
Construction Type: II-FR (I-B equivalent)
Occupancy Group: B w/ minor A3
Height: 5 stories w/ 2 story basement
Occupancy Load: 1114
Area: 105044 GSF
Automatic Sprinkler System: Yes
Office of the State Architect Application: 74205 92, Approved 5/21/92

ETCHEVERRY HALL
A&E No.: 30830
Drawn: 9/7/1961
Construction Type: II-N (I-B equivalent)
Occupancy Group: B
*Per FA Upgrade Dwg: Approved 7/13/07, A&E No:65775, Sheet FA0.00
Automatic Sprinkler System: Partial, including Level 2 below Jacobs
Office of the State Architect Application: N/A

OCCUPANCY

Assembly: Group A-3
Business: Group B

508.3.1 Occupancy Classification
Nonseparated occupancies shall be invidually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space except that the most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the building or portion thereof in which the nonseparated occupancies are located.

508.3.2 Allowable Building Area and Height
The allowable building area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1.

508.3.3 Separation. No separation is required between nonseparated occupancies.

CONSTRUCTION TYPE

Type II B
Automatic sprinkler throughout per 903.3.1 (NFPA 13)

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS (HOURS)

ELEMENT	
Primary Structural Frame	0
Bearing Walls (Interior and Exterior)[b]	0
Nonbearing Walls (Exterior)[b]	0
Nonbearing Walls (Interior)	0
Floor Construction and Secondary Members	0
Roof Construction and Secondary Members	0

EXTERIOR WALL FIRE RATING

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE (HOURS)

TYPE OF CONSTRUCTION	IIB
FIRE SEPARATION DISTANCE = X (FEET)	Group A. B
X<5	1
5≤X<10	1
10≤X<30	0
X≥30	0

TABLE 705.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON FIRE SEPARATION DISTANCE

FIRE SEPARATION DISTANCE (FEET)	UP	P
0 - <3	NP	NP
3 - <5	15%	15%
5 - <10	25%	25%
10 - <15	45%	45%
15 - <20	75%	75%
>20	NL	NL

705.8.1 Allowable area of openings, Exception 2:
Buildings whose exterior walls and exterior primary structural frame are not required to be fire resistance rated and shall be permitted to have unlimited unprotected openings.

TYPE II B CONSTRUCTION. DOES NOT REQUIRE PRIMARY STRUCTURAL FRAME TO BE FIRE RESISTANCE RATED. FIRE SEPARATION DISTANCE OF > 10' DOES NOT REQUIRE EXTERIOR WALLS TO BE FIRE RESISTANCE RATED. THEREFORE, UNLIMITED UNPROTECTED OPENINGS ARE PERMITTED

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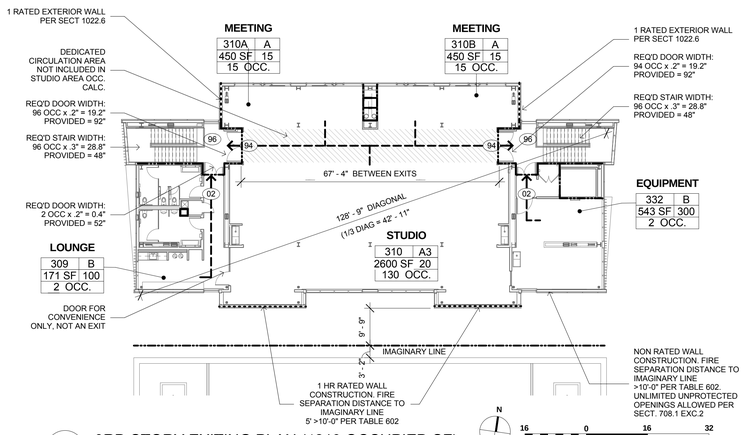
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 1 - Shoring / Excavation	05/30/14
	BID # 2 - Ext. Skin D/B	06/06/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
	BID # 3A - Elevator	08/01/14
	100% CDs / Permit Submission	08/15/14

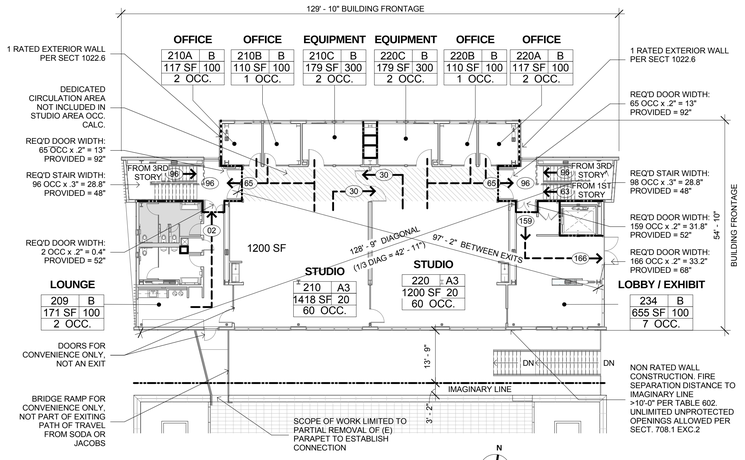
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/4" = 1'-0"

SHEET TITLE
CODE ANALYSIS & AMMR

SHEET No
G0.2



5 G0.3 3RD STORY EXITING PLAN (4219 OCCUPIED SF)
SCALE: 1/16" = 1'-0"



4 G0.3 2ND STORY EXITING PLAN (4051 OCCUPIED SF)
SCALE: 1/16" = 1'-0"

EXITING PLANS

NOTE: MAXIMUM TRAVEL DISTANCE TO AN EXIT DOES NOT EXCEED 250'-0" ON ANY FLOOR AS REQUIRED BY CBC SEC. 1016.1.

EXITING NOTES

1. INTERVENING SPACES: ALL SPACES ARE ACCESSORY TO ONE ANOTHER. PER 1014.2, EGRESS IS PERMITTED THROUGH ADJOINING ROOMS AND AREAS WHERE SUCHS ROOMS AND AREAS ARE ACCESSORY TO ONE ANOTHER.

2. INTERVENING SPACES: A DISCERNABLE PATH OF EGRESS TRAVEL MUST BE PROVIDED THROUGH ADJOINING ROOMS AND AREAS PER 1014.2. THE PATH OF EGRESS TRAVEL SHALL MEET REQUIREMENTS FOR AISLE PER 1017 AND MINIMUM WIDTH REQUIREMENTS FOR CORRIDORS OUTLINED IN SECTION 1018.

3. INTERVENING SPACES: PER 1014.2.4 AND 1014.2.5 EXITS SHALL NOT PASS THROUGH KITCHENS OR ANY ROOMS SUBJECT TO LOCKING.

4. COMMON PATH FO EGRESS TRAVEL: PER 1014.3 THE COMMON PATH OF EGRESS TRAVEL MUST NOT EXCEED 75'.

5. FIRE RATED GLAZED WALL ASSEMBLY: FIRE RESISTANT GLAZED WALL ASSEMBLIES (NOT WALL OPENINGS)SHALL COMPLY WITH ASTM E119 REQUIREMENTS FOR RADIANT HEAT BARRIERS.

6. SEE SITE PLAN A1.1 FOR SITE EXIT INFO.

7. BUILDING SHALL BE EQUIPPED WITH AN AUTOMATIC SPRINKLER SYSTEM IN ACCORDANCE WITH CBC SEC. 903.3.1.1.

8. EXIT ENCLOSURE: PENETRATIONS INTO AND OPENINGS THROUGH AN EXIT ENCLOSURE ARE PROHIBITED EXCEPT FOR REQUIRED EXIT DOORS, EQUIPMENT AND DUCTWORK NECESSARY FOR INDEPENDENT PRESSURIZATION, SPRINKLER PIPING, STANDPIPES, ELECTRICAL RACEWAY FOR FIRE DEPARTMENT COMMUNICATION SYSTEMS AND ELECTRICAL RACEWAY SERVING THE EXIT ENCLOSURE.

9. MULTIPLE EXITS: MULTIPLE MEANS OF EGRESS SHALL BE SIZED SUCH THAT THE LOSS OF ANY ONE MEANS OF EGRESS SHALL NOT REDUCE THE AVAILABLE CAPACITY TO LESS THAN 50% OF THE REQUIRED CAPACITY.

10. ILLUMINATION: THE MEANS OF EGRESS ILLUMINATION LEVEL SHALL NOT BE LESS THAT 1 FOOT-CANDLE AT THE WALKING LEVEL SURFACE.

11. EXIT SIGNAGE: THE PATH OF EXIT TRAVEL TO AND WITHIN EXITS SHALL BE IDENTIFIED BY EXIT SIGNS CONFORMING TO CBC SECTION 1003.2.8. EXIT SIGNS SHALL BE READILY VISIBLE FROM ANY DIRECTION OF APPROACH AND LOCATED AS NECESSARY TO CLEARLY INDICATE THE DIRECTION OF EGRESS TRAVEL. NO POINT SHALL BE MORE THAN 100' FROM THE NEAREST VISIBLE SIGN.

12. SEE A8.1 FOR EXIT DOOR REQUIREMENTS.

13. SHAFT RATINGS PER 708.4: SHAFT ENCLOSURES SHALL HAVE A FIRE-RESISTANCE RATING OF NOT LESS THAN 2 HOURS WHERE CONNECTING FOUR STORIES OR MORE, AND NOT LESS THAN 1 HOUR WHERE CONNECTING LESS THAN 4 STORIES.

LEGEND

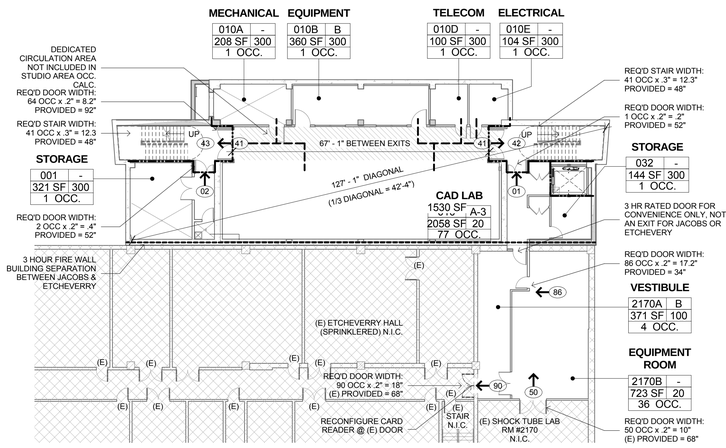
Room name	ROOM NAME
101 | A 150 SF | LF # OCC.	ROOM NUMBER | OCCUPANCY FLR. AREA | FLR. AREA ALLOW. PER OCC. OCCUPANT LOAD
# →	CUMULATIVE # OF OCCUPANTS EXITING SPACE
#	MAX. OCCUPANT LOAD AT EXIT STAIR
- - - -	EXITING PATH
	BOUNDARY OF NET OCCUPIED SPACE (WHEN UNENCLOSED)
-------	1 HR. RATED FIRE BARRIER
-·-·-·-	2 HR. RATED FIRE BARRIER
-··-··-	3 HR. RATED FIRE BARRIER

NOTE: FOR EXIT SIGNAGE LOCATIONS, SEE A2.6 & A2.7

MIN. EGRESS WIDTH (PER 1005.1), U.N.O.

OCCUPANTS	STAIR (x .30)	CORRIDOR (x .20)	DOOR (x .20)
<160	48"		
<180			48"
<240		48"	

3 G0.3 1ST STORY EXITING PLAN (3825 OCCUPIED SF)
SCALE: 1/16" = 1'-0"



6 G0.3 BASEMENT EXITING PLAN (2696 OCCUPIED SF)
SCALE: 1/16" = 1'-0"

2 G0.3 CODE ANALYSIS SODA HALL ELEVATION
SCALE: 1/16" = 1'-0"

EXTERIOR WALL FIRE RATING
SODA HALL LEVEL 3

FIRE RESIST RATING REQ'TS FOR EXT. WALLS BASED ON 0'-5' FIRE SEPARATION DISTANCE:
1HR (TABLE 602)

(E) WALL CONSTRUCTION (DETAIL 34/A8.5 OF SODA HALL CONSTRUCTION DRAWINGS): 5" PRECAST CONCRETE PANEL & TILE FINISH.

MIN EQUIV THICKNESS OF PRECAST CONCRETE WALLS, NON LOAD BEARING. SILICEOUS CONCRETE, 1 HR RATING: 3.5" (TABLE 721.2.)

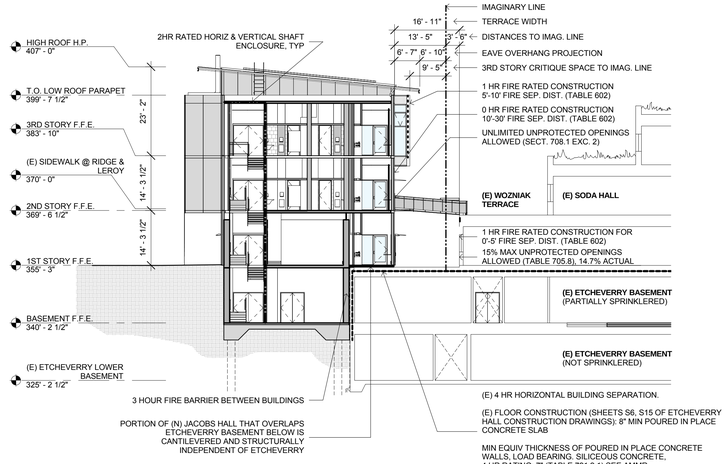
(E) 1 HR RATING FIRE RESISTANCE RATING TO REMAIN, NO CHANGES REQUIRED.

ALLOWABLE EXT WALL OPENINGS
SODA HALL LEVEL 3

(E) UNPROTECTED OPENINGS: 316 SF
(E) EXTERIOR WALL AREA: 2144 SF
316 SF / 2144 SF = 14.7%

MAX ALLOWABLE AREA OF EXT WALL OPENINGS BASED ON 3'-5' FIRE SEPARATION DISTANCE: 15% (TABLE 705.8)

(E) UNPROTECTED OPENINGS TO REMAIN, NO CHANGES REQUIRED.



1 G0.3 CODE ANALYSIS BUILDING CROSS SECTION
SCALE: 1/16" = 1'-0"

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PROJECT

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1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 2 - Ext. Skin D/B	06/06/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
	BID # 3A - Elevator	08/01/14
	100% CDs / Permit Submission	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/16" = 1'-0"

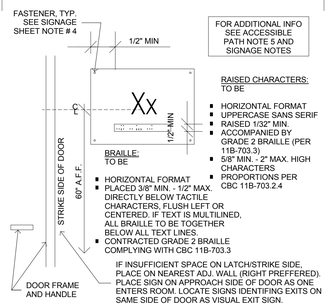
SHEET TITLE
EXITING DIAGRAMS

SHEET No
G0.3

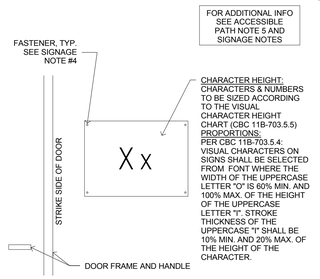
NOTES:
1. AN ASSISTIVE LISTENING SYSTEM SHALL BE PROVIDED IN ASSEMBLY AREAS, INCLUDING CONFERENCE AND MEETING ROOMS. THE MINIMUM NUMBER OF RECEIVERS TO BE PROVIDED SHALL BE EQUAL TO 4 PERCENT OF THE TOTAL NUMBER OF SEATS, BUT IN NO CASE LESS THAN TWO. 25% MINIMUM OF RECEIVERS PROVIDED, BUT NO FEWER THAN TWO, SHALL BE HEARING-AID COMPATIBLE IN ACCORDANCE WITH CBC 11B-706.3.
2. IF PORTABLE ASSISTIVE-LISTENING SYSTEMS ARE USED FOR CONFERENCE OR MEETING ROOMS, THE SYSTEM MAY SERVE MORE THAN ONE ROOM. AN ADEQUATE NUMBER OF ELECTRICAL OUTLETS OR OTHER SUPPLEMENTARY WIRING NECESSARY TO SUPPORT A PORTABLE ASSISTIVE-LISTENING SYSTEM SHALL BE PROVIDED.
3. ASSISTIVE LISTENING SYSTEMS SHALL BE CAPABLE OF PROVIDING A SOUND PRESSURE LEVEL OF 110dB MINIMUM AND 118 dB MAXIMUM WITH A DYNAMIC RANGE ON THE VOLUME CONTROL OF 50dB. THE SIGNAL-TO-NOISE RATIO FOR INTERNALLY GENERATED NOISE SHALL BE 18dB MINIMUM.
4. ASSISTIVE LISTENING SYSTEMS SHALL BE IDENTIFIED BY THE INTERNATIONAL SYMBOL OF ACCESS FOR HEARING LOSS COMPLYING WITH 11B-703.7.2.4.

INTERNATIONAL SYMBOL OF ACCESS FOR HEARING LOSS

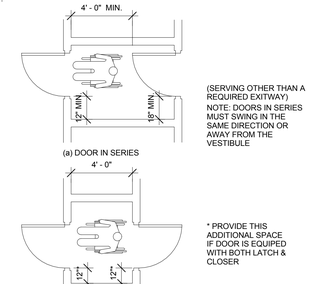
20 G0.4 ASSISTIVE LISTENING SYSTEMS
PER CBC 11B-219 & 11B-706 N.T.S



15 G0.4 ACCESSIBLE IDENTIFICATION SIGNAGE
N.T.S



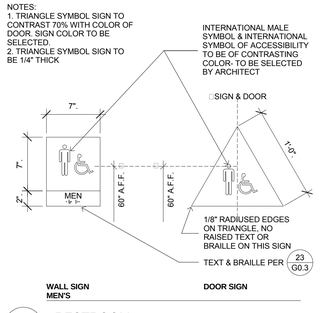
10 G0.4 ACCESSIBLE DIRECT'L & INFO. SIGNAGE
N.T.S



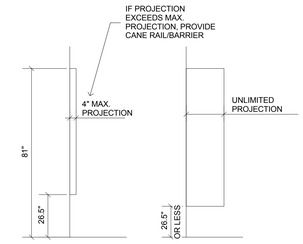
NOTE: SIGN TO BE REFLECTORIZED

19 G0.4 "UNAUTHORIZED VEHICLES" SIGN
PER CBC 11B-502.8 N.T.S.

NOTES:
1. TRIANGLE SYMBOL SIGN TO CONTRAST 70% WITH COLOR OF DOOR. SIGN COLOR TO BE SELECTED.
2. TRIANGLE SYMBOL SIGN TO BE 1/4" THICK

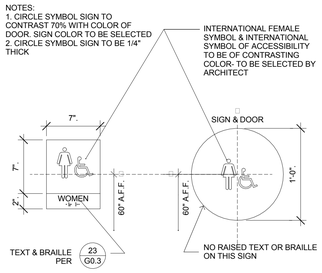


14 G0.4 RESTROOM
MEN'S N.T.S.

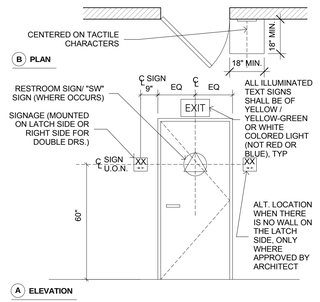


18 G0.4 PROTRUDING OBJECTS
N.T.S.

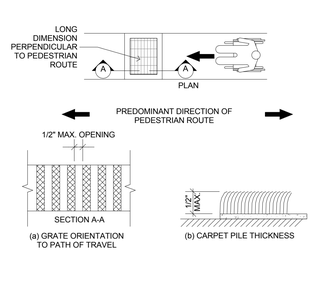
NOTES:
1. CIRCLE SYMBOL SIGN TO CONTRAST 70% WITH COLOR OF DOOR. SIGN COLOR TO BE SELECTED
2. CIRCLE SYMBOL SIGN TO BE 1/4" THICK



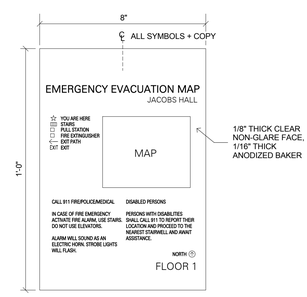
13 G0.4 RESTROOM
WOMEN'S N.T.S.



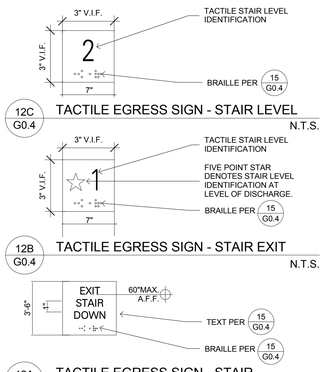
8 G0.4 TYPICAL MOUNTING + LOCATIONS
N.T.S.

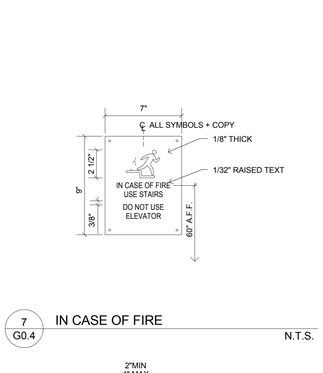


3 G0.4 PATH OF TRAVEL
SURFACE REQUIREMENTS N.T.S.

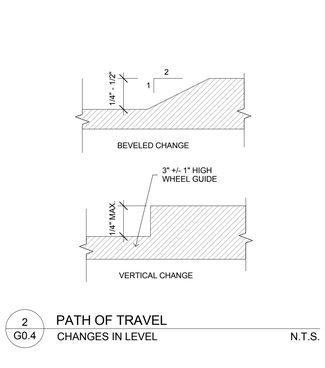


17 G0.4 EVACUATION MAP
N.T.S.

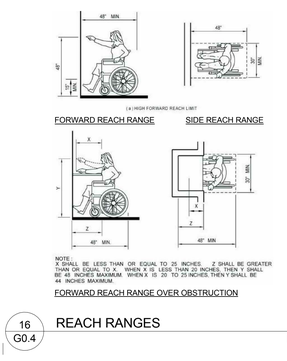




7 G0.4 IN CASE OF FIRE
N.T.S.

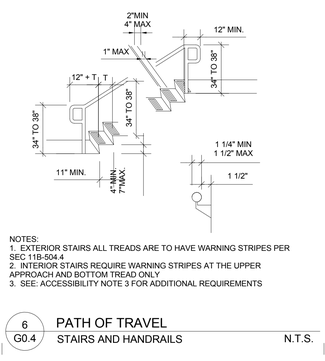


2 G0.4 PATH OF TRAVEL
CHANGES IN LEVEL N.T.S.

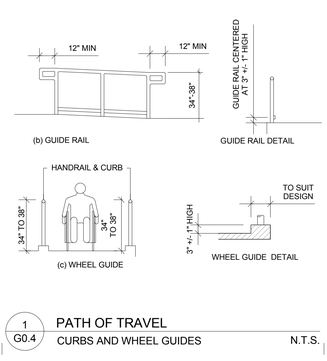


21 G0.4 ROOM SIGN
N.T.S.

16 G0.4 REACH RANGES
N.T.S



6 G0.4 PATH OF TRAVEL
STAIRS AND HANDRAILS N.T.S.



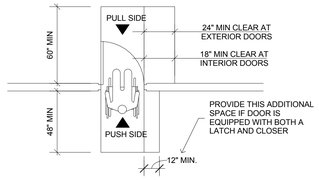
1 G0.4 PATH OF TRAVEL
CURBS AND WHEEL GUIDES N.T.S.

ACCESSIBLE PATH NOTES:

1. WALKS AND SIDEWALKS ON AN ACCESSIBLE ROUTE:
A. SHALL HAVE A CONTINUOUS COMMON SURFACE NOT INTERRUPTED BY STEPS OR BY ABRUPT CHANGES IN LEVEL EXCEEDING 1/2, SEE: 2/GO.4
B. SHALL BE A MINIMUM OF 48" WIDE, EXCEPT THAT WALKS SERVING AN INDIVIDUAL DWELLING UNIT MAY BE 36" WIDE.
C. SHALL NOT EXCEED A 1/4" PER FOOT SURFACE CROSS-SLOPE
D. WHEN THE SLOPE IN THE DIRECTION OF TRAVEL EXCEEDS A 5% SLOPE, THE WALK WILL COMPLY WITH THE REQUIREMENTS FOR RAMPS, SEE: 2/G0.4

2. EXTERIOR RAMPS AND LANDINGS ON ACCESSIBLE ROUTE:
A. HANDRAILS, CURBS, WHEEL GUIDES, AND APPURTENANCES SHALL NOT PROJECT INTO THE REQUIRED CLEAR WIDTH OF A RAMP.
B. OUTDOOR RAMPS AND LANDINGS SHALL BE BUILT SO THAT WATER WILL NOT ACCUMULATE ON THE WALKING SURFACE.
C. RAMPS MORE THAN 30" ABOVE THE ADJACENT FLOOR AND OPEN ON ONE OR BOTH SIDES SHALL BE PROVIDED WITH CONTINUOUS GUARDRAILS.
D. RAMPS EXCEEDING 10' IN LENGTH AND RAMP LANDINGS HAVING A VERTICAL DROP EXCEEDING 4" SHALL HAVE GUIDE CURBS OR WHEEL GUIDES AND RAILS, SEE: 1/GO.4.
E. HANDRAILS ARE REQUIRED AT RAMPS EXCEEDING A 1:20 SLOPE, SEE: 1/G0.4.

3. STAIRS
A. ALL TREAD SURFACES SHALL BE SLIP RESISTANT. TREADS SHALL HAVE SMOOTH, ROUNDED, OR CHAMFERED EXPOSED EDGES, AND NO ABRUPT EDGES AT THE NOSING. WEATHER-EXPOSED STAIRS AND THEIR APPROACHES SHALL BE DESIGNED SO THAT WATER WILL NOT ACCUMULATE ON THE WALKING SURFACES.
B. RISERS SHALL BE SOLID. OPEN RISERS ARE NOT PERMITTED.
C. STAIRWAYS SHALL HAVE HANDRAILS ON BOTH SIDES. HANDRAIL ENDS SHALL BE RETURNED OR TERMINATE IN NEWEL POSTS OR SAFETY TERMINALS.
D. THE HANDGRIP PORTION OF HANDRAILS SHALL HAVE A SMOOTH SURFACE WITH NO SHARP CORNERS. GRIPPING SURFACES SHALL BE UNINTERRUPTED BY NEWEL POSTS, OTHER CONSTRUCTION ELEMENTS, OR OBSTRUCTIONS.
E. AT NOTED PUBLIC USE STAIRWAYS, HANDRAILS SHALL BE RETURNED SMOOTHLY TO FLOOR, WALL, OR POST.
F. SEE: 6/GO.4 FOR ADDITIONAL STAIR AND HANDRAIL REQUIREMENTS.



4. DOORS
A. THE BOTTOM 10" OF ALL DOORS AND GATES SHALL HAVE A SMOOTH, UNINTERRUPTED SURFACE TO ALLOW THE DOOR OR GATE TO BE OPENED BY A WHEELCHAIR FOOTREST
B. MAXIMUM EFFORT TO OPERATE DOORS SHALL NOT EXCEED 81/2 POUNDS FOR UNIT EXTERIOR DOORS, 5 POUNDS FOR FIRE DOORS, AND 5 POUNDS FOR ALL OTHER DOORS.
C. ALL DOORS SHALL BE OPERABLE WITH A SINGLE EFFORT LEVER TYPE HARDWARE OR OTHER HARDWARE DESIGNED TO PROVIDE PASSAGE WITHOUT REQUIRING THE ABILITY TO GRASP THE OPENING HARDWARE.
D. THE FLOOR OR LANDING ON EACH SIDE OF A DOOR SHALL BE LEVEL. PRIMARY ENTRY DOORS, REQUIRED EXIT DOORS OR SECONDARY EXTERIOR DOORS WITH CHANGES IN HEIGHT BETWEEN THE INTERIOR SURFACE OR FLOOR LEVEL AND THE EXTERIOR SURFACE OR FLOOR LEVEL SHALL COMPLY WITH CBC 11B-303.
E. THRESHOLDS AT THE PRIMARY ENTRY AND REQUIRED EXIT DOORS SHALL BE NO HIGHER THAN 1/2". THRESHOLDS AT SECONDARY EXTERIOR DOORS, INCLUDING SLIDING GLASS DOOR TRACKS, SHALL BE NO HIGHER THAN 3/4". CHANGES IN HEIGHT AT INTERIOR DOOR THRESHOLDS SHALL NOT EXCEED 1/2". THRESHOLDS WITH A CHANGE IN HEIGHT OF NOT MORE THAN 1/4" MAY BE VERTICAL. THRESHOLDS WITH A CHANGE IN HEIGHT BETWEEN 1/4" AND 3/4" SHALL BE BEVELED WITH A SLOPE NO GREATER THAN 1:2.

5. SIGNAGE
A. PLANS, SPECIFICATIONS OR OTHER INFORMATION INDICATING COMPLIANCE WITH 11B-703 SHALL BE SUBMITTED TO THE ENFORCING AGENCY FOR REVIEW AND APPROVAL.
B. CONTRACTED GRADE 2 BRAILLE SHALL BE USED WHEREVER BRAILLE SYMBOLS ARE SPECIFICALLY REQUIRED IN OTHER PORTIONS OF THESE REGULATIONS. DOTS SHALL BE 1/10" ON CENTERS IN EACH CELL WITH 2/10" SPACE BETWEEN CELLS. DOTS SHALL BE RAISED A MINIMUM OF 1/40" ABOVE THE BACKGROUND. BRAILLE DOTS SHOULD BE DOMED OR ROUNDED.
C. ALL BUILDING ENTRANCES THAT ARE ACCESSIBLE TO AND USABLE BY PERSONS WITH DISABILITIES AND AT EVERY MAJOR JUNCTION ALONG OR LEADING TO AN ACCESSIBLE ROUTE OF TRAVEL SHALL BE IDENTIFIED WITH A SIGN DISPLAYING THE INTERNATIONAL SYMBOL OF ACCESSIBILITY AND WITH ADDITIONAL DIRECTIONAL SIGNS, AS REQUIRED, TO BE VISIBLE TO PERSONS ALONG APPROACHING PEDESTRIAN WAYS.
D. WHEN PERMANENT IDENTIFICATION IS PROVIDED FOR ROOMS AND SPACES, RAISED LETTERS SHALL BE PROVIDED AND SHALL BE ACCOMPANIED BY BRAILLE IN CONFORMANCE WITH SECTION 11B-703. SIGNS SHALL BE INSTALLED ON THE WALL ADJACENT TO THE LATCH OUTSIDE OF THE DOOR. WHERE THERE IS NO WALL SPACE ON THE LATCH SIDE, INCLUDING AT LEAF DOORS, SIGNS SHALL BE PLACED ON THE NEAREST ADJACENT WALL, PREFERABLY ON THE RIGHT. MOUNTING HEIGHT SHALL BE 60" ABOVE THE FINISH FLOOR TO THE CENTERLINE OF THE SIGN. MOUNTING LOCATION SHALL BE DETERMINED SO THAT THE PERSON MAY APPROACH WITHIN 3' OF THE SIGNAGE WITHOUT ENCOUNTERING PROTRUDING OBJECTS OR STANDING WITHIN THE SWING OF A DOOR. SEE 15/G0.4 FOR ADDITIONAL INFORMATION.
E. WHEN SIGNS IDENTIFY, DIRECT, OR GIVE INFORMATION ABOUT ACCESSIBLE ELEMENTS AND FEATURES OF A BUILDING OR SITE, THEY SHALL INCLUDE THE APPROPRIATE SYMBOL OF ACCESSIBILITY.
F. CHARACTERS, SYMBOLS AND THEIR BACKGROUND SHALL HAVE A NON GLARE FINISH. CHARACTERS AND SYMBOLS SHALL CONTRAST WITH THEIR BACKGROUND, EITHER LIGHT CHARACTERS ON A DARK BACKGROUND OR DARK CHARACTERS ON A LIGHT BACKGROUND.
G. PICTORIAL SYMBOL SIGNS (PICTOGRAMS) SHALL BE ACCOMPANIED BY THE EQUIVALENT VERBAL DESCRIPTION PLACED DIRECLY BELOW THE PICTOGRAM. THE BORDER DIMENSION OF THE PICTOGRAM SHALL BE A MINIMUM OF THE BORDER DIMENSION OF THE PICTOGRAM SHALL BE A MINIMUM OF 6" IN HEIGHT.
H. UNAUTHORIZED VEHICLES SIGN (SEE 19/G0.4) TO STATE, "UNAUTHORIZED VEHICLES PARKED IN DESIGNATED ACCESSIBLE SPACES NOT DISPLAYING DISTINGUISHED PLACARDS OR LICENSE PLATES ISSUED FOR PERSONS WITH DISABILITIES WILL BE TOWED AWAY AT OWNER'S EXPENSE. TOWED VEHICLES MAY BE RECLAIMED AT _____ OR BY TELEPHONING_____." SEE 11-B502 FOR ADDITIONAL INFORMATION.

6. ELEVATOR
A. A MINIMUM INSIDE CAB CLEAR DIMENSION SHALL BE 68"X 54" FOR SIDE-SLIDE OPENING DOORS AND 80"X54" FOR CENTER OPENING DOORS.
B. FLOOR BUTTONS AND CALL BUTTONS SHALL BE PROVIDED WITH VISUAL INDICATORS TO SHOW WHEN EACH CALL IS REGISTERED AND EXTINGUISHED WHEN ANSWERED.
C. THE EMERGENCY TELEPHONE HANDSET SHALL BE POSITIONED NO HIGHER THAN 48" ABOVE THE FLOOR, AND THE HANDSET CORD SHALL BE A MINIMUM OF 29" IN LENGTH. COMPARTMENT DOOR HARDWARE SHALL BE A LEVER TYPE CONFORMING TO THE PROVISIONS OF SECTION 11B-309.4.
D. HALL CALL BUTTONS SHALL BE 3/4"MIN. IN SIZE AND SHALL BE RAISED 1/8" ABOVE THE SURROUNDING SURFACE. THE BUTTONS SHALL BE INTERNALLY ILLUMINATED WITH A WHITE LIGHT OVER THE ENTIRE SURFACE.
E. THE MINIMUM ILLUMINATION AT THE CAR CONTROLS THRESHOLD AND THE LANDING WHEN THE CAR AND LANDING DOORS ARE OPEN SHALL NOT BE LESS THAN 5 FOOT-CANDLES.
F. A VISUAL AND AUDIBLE SIGNAL SHALL BE PROVIDED AT EACH HOISTWAY ENTRANCE INDICATING TO THE PROSPECTIVE PASSENGER THE CAR ANSWERING THE CALL AND ITS DIRECTION OF TRAVEL. THE VISUAL SIGNAL FOR EACH DIRECTION SHALL BE 2" X 2 1/2" AND VISIBLE FROM THE PROXIMITY OF THE HALL CALL BUTTON. THE AUDIBLE SIGNAL SHALL SOUND ONCE FOR THE "UP" DIRECTION AND TWICE FOR THE "DOWN" DIRECTION.
G. THE MINIMUM TIME FROM NOTIFICATION THAT A CAR IS ANSWERING A CALL UNTIL THE DOORS OF THE CAR START TO CLOSE SHALL BE NO LESS THAN 5 SECONDS AND SHALL COMPLY WITH 11B-407.3,4. DOORS SHALL REMAIN FULLY OPEN FOR 5 SECONDS. MIN.
H. FLOOR LANDING NUMBER DESIGNATION SHALL BE PROVIDED ON BOTH JAMBS AT ALL HOISTWAYS. CHARACTERS SHALL BE RAISED, 2" HIGH MIN., WITH THE CORRESPONDING BRAILLE SYMBOLS PLACED BELOW. THE RAISED CHARACTERS SHALL BE ON A CONTRASTING BACKGROUND. ON GRADE LEVEL A RAISED, 2" DIA. FIVE-POINT STAR SHALL BE PLACED TO THE LEFT OF THE CHARACTER.
I. THE AUTOMATIC DOORS REOPENING DEVICE SHALL BE CAPABLE OF SENSING AN OBJECT OR PERSON IN THE PATH OF A CLOSING DOOR WITHOUT REQUIRING CONTACT FOR ACTIVATION AT A NOMINAL 5" AND 29" ABOVE THE FLOOR. DOOR REOPENING DEVICES SHALL REMAIN EFFECTIVE FOR A PERIOD OF 20 SECONDS, MIN.
J. THE ELEVATOR SHALL BE AUTOMATIC AND SELF-LEVELING TO BRING THE CAR TO THE LANDING WITHIN A TOLERANCE OF 1/2". THE CLEARANCE BETWEEN CAR AND LANDING SHALL BE 11/4" MIN.

SIGNAGE NOTES :
1. ALL SYMBOLS + COPY TO BE CENTERED IN SIGN U.O.N.
2. ALL SIGNS TO BE SURFACE MOUNTED TO WALL OR GLAZING
3. FOR ALL SIGNS MOUNTED ON GLASS, CONCEAL ADHESIVE. INSTALL SIGNS BACK TO BACK ON GLAZING, IF SIGN IS PROVIDED ONLY ON ONE SIDE, PROVIDE A MATCHING BLANK PLATE ON OPPOSITE SIDE.
4. WALL SIGNS/ PLAQUES TO BE MOUNTED WITH FASTENERS AT ALL FOUR CORNERS, PROVIDE FASTENERS AT MIDPOINT OF SIDES OVER 18", U.O.N. EXCEPTION: WALL SIGNS MOUNTED ON GLAZING TO BE MOUNTED WITH ADHESIVE. U.O.N.
5. PERMANENT SIGNAGE ON A WALL ON THE APPROACH SIDE OF A DOOR AND MUST ALLOW A PERSON TO APPROACH WITHIN 3" WITHOUT ENCOUNTERING PROTRUDING OBJECTS OR STANDING WITHIN THE SWING PATH OF A DOOR.
6. CHARACTER PLACEMENT: CHARACTERS AND BRAILLE SHALL BE IN A HORIZONTAL FORMAT. BRAILLE SHALL BE PLACED A MINIMUM OF 3/8 INCH AND MAXIMUM OF 1/2 INCH DIRECTLY BELOW THE TACTILE CHARACTERS; FLUSH LEFT OR CENTERED. WHEN TACTILE SIGN IS MULTI-LINED, ALL BRAILLE SHALL BE PLACED TOGETHER BELOW ALL LINES OF TACTILE TEXT.
7. SIGNS RAISED CHARACTERS, BRAILLE, VISUAL CHARACTERS, PICTOGRAM FIELD, SYMBOLS OF ACCESSIBILITY, LOCATIONS + MOUNTING HEIGHTS TO COMPLY W/ CBC 11B DIVISION 7 (COMMUNICATION ELEMENTS & FEATURES)
9. ALL SIGNS TO CONFORM TO 2013 CBC CH.11, INCLUDING BUT NOT LIMITED TO SIZE, INFORMATION COLOR CONTRAST, BRAILLE, AND APPROPRIATE INSTALLATION HEIGHT.
10. ALL SIGNS TO HAVE 90 DEGREE CORNERS, U.O.N.
11. ALL WALL MOUNTED SIGNS TO BE 1/4" THICK, U.O.N.

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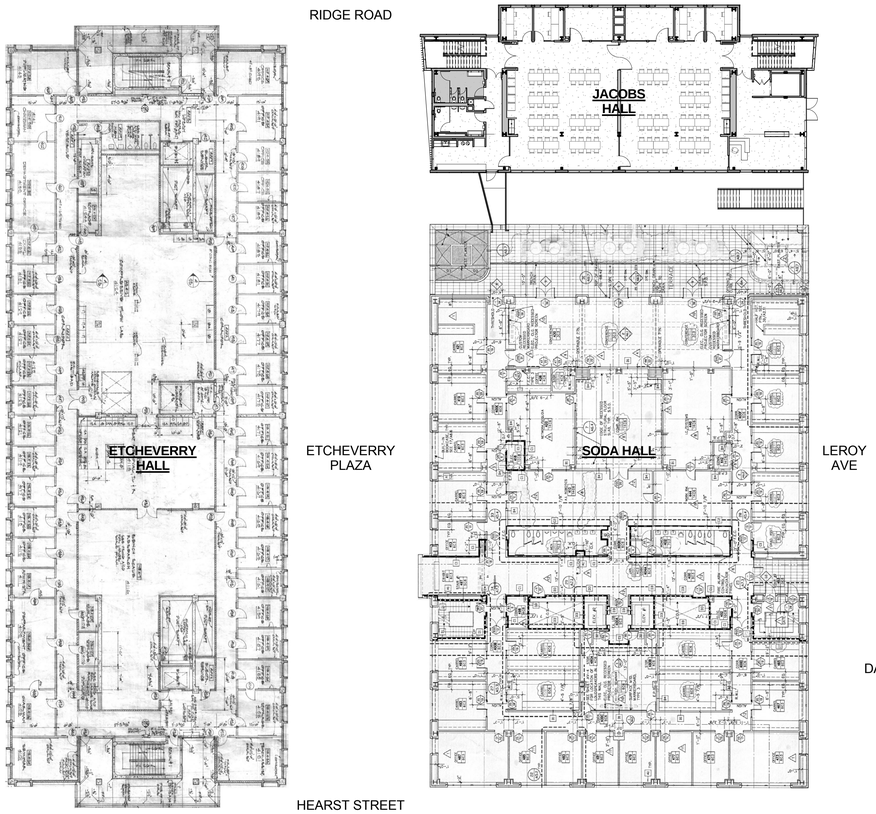
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 3 - Structure / Site Utilities / M.P.	07/09/14
	BID # 3A - Elevator	08/01/14
	100% CDs / Permit Submission	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: AS INDICATED

SHEET TITLE
ACCESSIBLE PATH & SIGNAGE DIAGRAMS

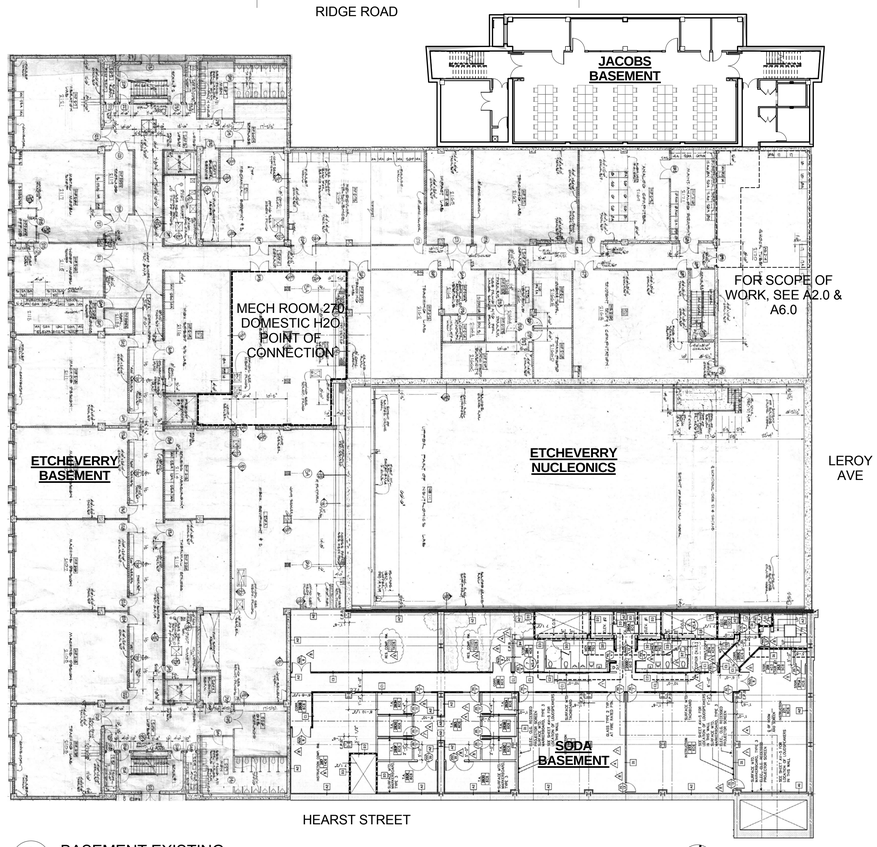
SHEET No
G0.4



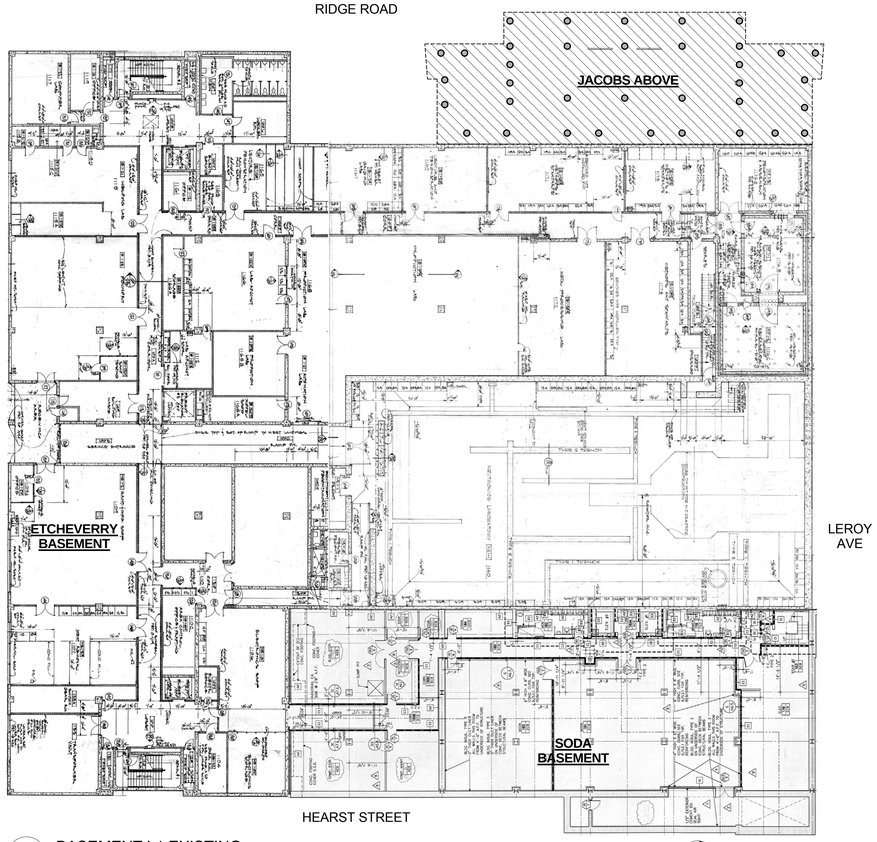
2 G0.5 2ND FLOOR PLAN (SODA HALL LEVEL 4)
SCALE: 1" = 20'-0"

1 G0.5 1ST FLOOR PLAN (SODA HALL LEVEL 3)
SCALE: 1" = 20'-0"

NOTE: ELECTRICAL & TEL/ DATA POINT OF CONNECTION @ SODA HALL LEVEL 1 & 2. S.E.D.



3 G0.5 BASEMENT EXISTING
SCALE: 1" = 20'-0"



4 G0.5 BASEMENT L1 EXISTING
SCALE: 1" = 20'-0"

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1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	CM / Contractor RFP	03/31/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
	100% CDs / Permit Submission	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1" = 20'-0"

SHEET TITLE
EXISTING BUILDING PLANS

SHEET No
G0.5

ABBREVIATIONS & LEGEND

CONC	=	CONCRETE
COL	=	COLUMN
FF	=	FINISH FLOOR
FL	=	FLOW LINE
HCR	=	HANDICAP RAMP
IRR	=	IRRIGATION
PL	=	PROPERTY LINE
PLNTR	=	PLANTER
R.O.W.	=	RIGHT OF WAY
RWD	=	REDWOOD
SDCB	=	STORM DRAIN CATCH BASIN
SDDI	=	STORM DRAIN DROP INLET
SDMH	=	STORM DRAIN MANHOLE
SSCO	=	SANITARY SEWER CLEAN OUT
SSMH	=	SANITARY SEWER MANHOLE
SW	=	SIDEWALK
TC	=	TOP OF CURB
TR	=	TREE
TW	=	TOP OF WALL
UB	=	UTILITY BOX
WD	=	WOOD
(symbol)	=	FIRE HYDRANT
(symbol)	=	GUY WIRE
(symbol)	=	JOINT POLE
(symbol)	=	SIGN
WV	=	WATER VALVE
—G—	=	GAS LINE
—IW—	=	IRRIGATION WATER LINE
—SS—	=	SANITARY SEWER LINE
—SD—	=	STORM DRAIN UTILITY LINE
—UN—	=	UNKNOWN UTILITY LINE
—W—	=	WATER LINE
— — —	=	PROPERTY LINE
(hatch)	=	UNDERGROUND STRUCTURE

NOTES

1. THIS MAP REPRESENTS TOPOGRAPHIC FIELD SURVEYS PERFORMED IN JULY AND NOVEMBER OF 2013.

2. HORIZONTAL AND VERTICAL SURVEY CONTROL IS BASED ON A SURVEY PERFORMED BY COOTS AND ASSOCIATES, SHOWN ON A MAP ENTITLED "UNIVERSITY OF CALIFORNIA – BERKELEY, CAMPUS SURVEY CONTROL POINTS, MARCH 1995".

3. UTILITY LINES SHOWN ARE BASED ON OBSERVATIONS BY GEOTECH UTILITY LOCATING COMPANY AND ARE APPROXIMATE ONLY.

4. ALPHANUMERIC DESIGNATIONS FOR ABOVE GROUND UTILITIES ("SSMH #4726") ARE ONLY RELEVANT TO INFORMATION SHOWN ON THIS SURVEY AND ARE NOT ASSOCIATED WITH U.C. BERKELEY'S NAMING CONVENTIONS FOR UTILITY STRUCTURES.

BENCH MARK

STANDARD CITY OF BERKELEY MONUMENT DISC LOCATED AT THE INTERSECTION OF LE ROY AVENUE & RIDGE ROAD AND SHOWN AS POINT NUMBER 66 ON THE MAP ENTITLED "UNIVERSITY OF CALIFORNIA – BERKELEY, CAMPUS SURVEY CONTROL POINTS, MARCH 1995" BY COOTS AND ASSOCIATES.

ELEVATION: 369.11'

CLIENT

U.C. BERKELEY CAPITAL PROJECTS
1936 UNIVERSITY AVENUE, 2ND FLOOR
BERKELEY, CA 94704–7027

SURVEYOR'S STATEMENT

THIS TOPOGRAPHIC SURVEY MAP WAS PREPARED BY ME OR UNDER MY DIRECTION.

DAVIS THRESH, P.L.S. NO. 6868 EXP. DATE 09/30/2014

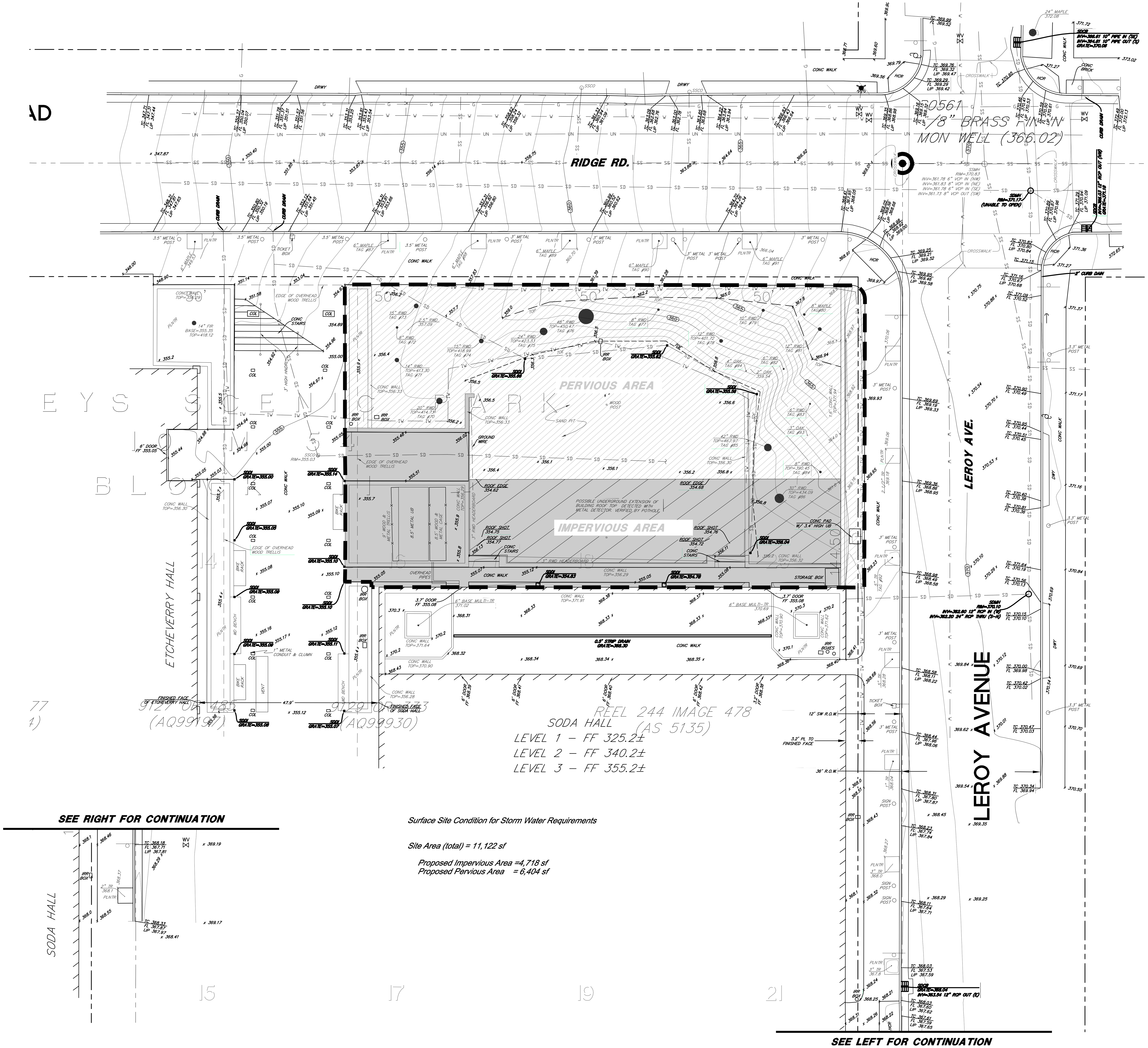
LICENSED LAND SURVEYOR
DAVIS THRESH
No. 6868
STATE OF CALIFORNIA

1"=10'

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.



Surface Site Condition for Storm Water Requirements

Site Area (total) = 11,122 sf

Proposed Impervious Area =4,718 sf
Proposed Pervious Area = 6,404 sf

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PROJECT

JACOBS HALL

UNIVERSITY OF CALIFORNIA, BERKELEY, CA

REGISTERED PROFESSIONAL ENGINEER
No. 36739
Exp. 6/30/16
CIVIL
STATE OF CALIFORNIA

No	REVISION	DATE
	100% SD Pricing	09/11/13
	Fire Marshal Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	Bid #1: Shoring / Excavation	05/30/14
	Bid #3: Structure / Utilities / W.P.	07/09/14
	ENCROACHEMNT PERMIT	07/23/14
	90% CD SET	08/01/14
	100% CD / PERMIT SUBMISSION	08/15/14

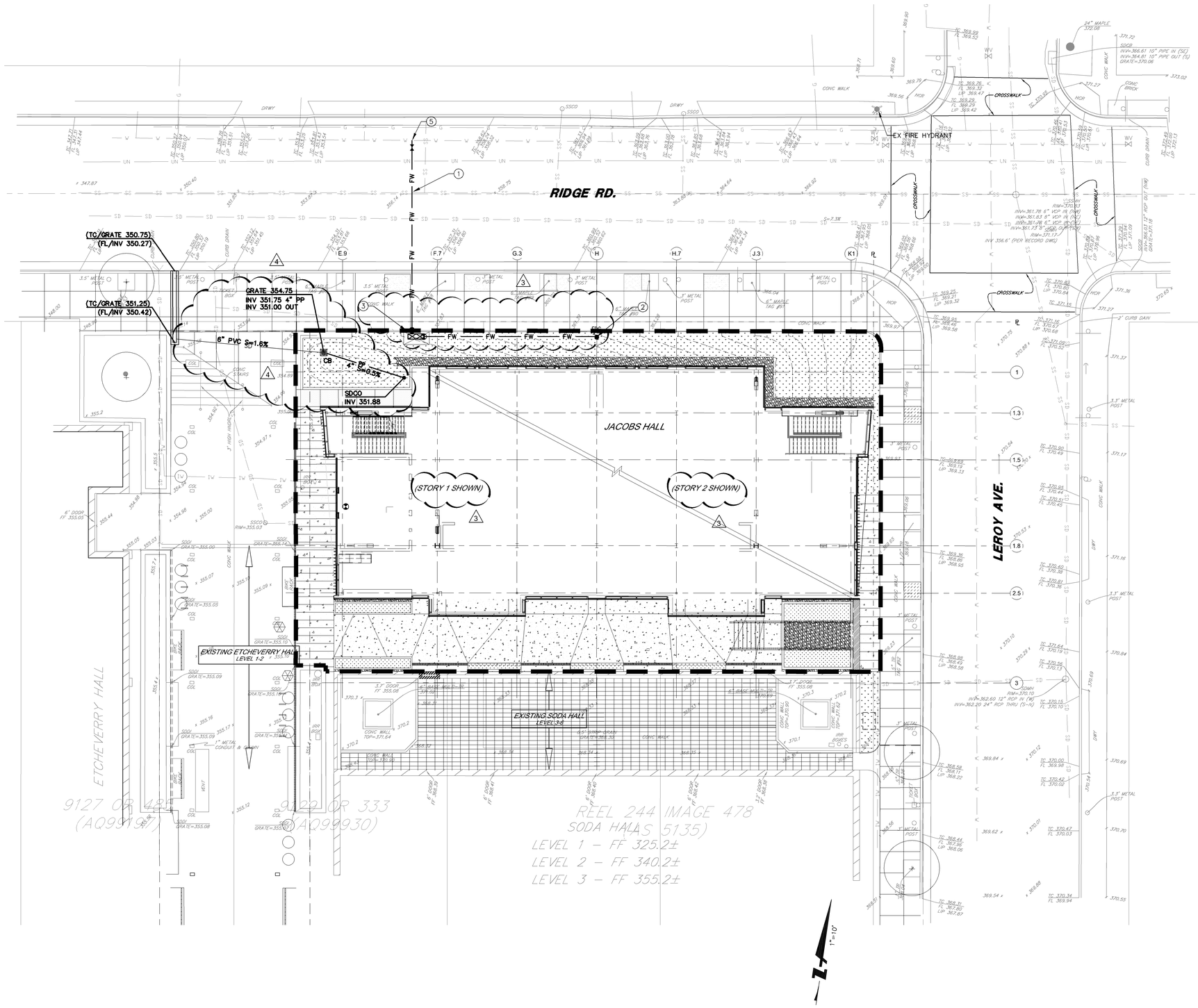
DATE: Aug 15th, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE

EXISTING CONDITIONS

SHEET No

C1.00



LEGEND

- UTILITY POINT OF CONNECTION. SEE PLUMBING DRAWINGS FOR CONTINUATION.
- SDCO — NEW STORM DRAIN CLEAN OUT
- CB — NEW STORM DRAIN CATCH BASIN
- SD — NEW STORM DRAIN LINE
- FW FW FW — NEW FIRE WATER SEE CONSTRUCTION DETAIL FOR ADDITIONAL DETAILS. FIRE WATER SHALL BE PVC C900 CLASS 305 PIPE
- NEW CAST IN PLACE TRENCH DRAIN (C4.00 / 3)
- FDC — NEW FIRE DEPARTMENT CONNECTION (5 / C4.00)
- PP PP — NEW PERFORATED PIPE

SHEET NOTES

1. STORM DRAIN LINES SHALL BE PVC SDR 26 UNLESS NOTED OTHERWISE
2. SEE ELECTRICAL DRAWINGS FOR ELECTRICAL SERVICE DETAILS. ELECTRICAL SERVICE LINES SHOWN FOR COORDINATION ONLY.
3. LOCATE AND VERIFY DOWNSTREAM POINTS OF CONNECTION OF THE EXISTING SANITARY SEWER MAIN AS FIRST ORDER OF UTILITY WORK.
4. LEVEL 3 FLOOR PLAN HAS BEEN SHOWN FOR REFERENCE.

NUMBERED NOTES

1. 6" FIRE SERVICE BY EBMUD TO RIGHT OF WAY. SEE FIRE SPRINKLER PLANS FOR CONTINUATION.
2. 4" FIRE DEPARTMENT CONNECTION PIPING TO NEW FDC. PIPE SIZE TO BE CONFIRMED BY FIRE SPRINKLER DESIGNER.
3. FIRE BACKFLOW PREVENTER. SEE FIRE SPRINKLER PLANS FOR DETAILS. (3)
4. NOT USED
5. CONNECT FIRE WATER SERVICE TO EXISTING EBMUD WATER LINE. WORK TO BE DONE BY EBMUD

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

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PROJECT

JACOBS HALL

UNIVERSITY OF CALIFORNIA, BERKELEY, CA

REGISTERED PROFESSIONAL ENGINEER — JOHN WILLIAM [illegible] — No. 36739 — Exp. 6/30/16 — CIVIL — STATE OF CALIFORNIA

No	REVISION	DATE
	100% SD Pricing	09/11/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	Bid #3: Structure / Utilities / LV.P.	07/09/14
	ENCROACHEMINT PERMIT	07/23/14
3	Bid Package #3- Addendum 1	07/29/14
	90% CD SET	08/01/14
4	100% CD/ PERMIT SUBMISSION	08/15/14

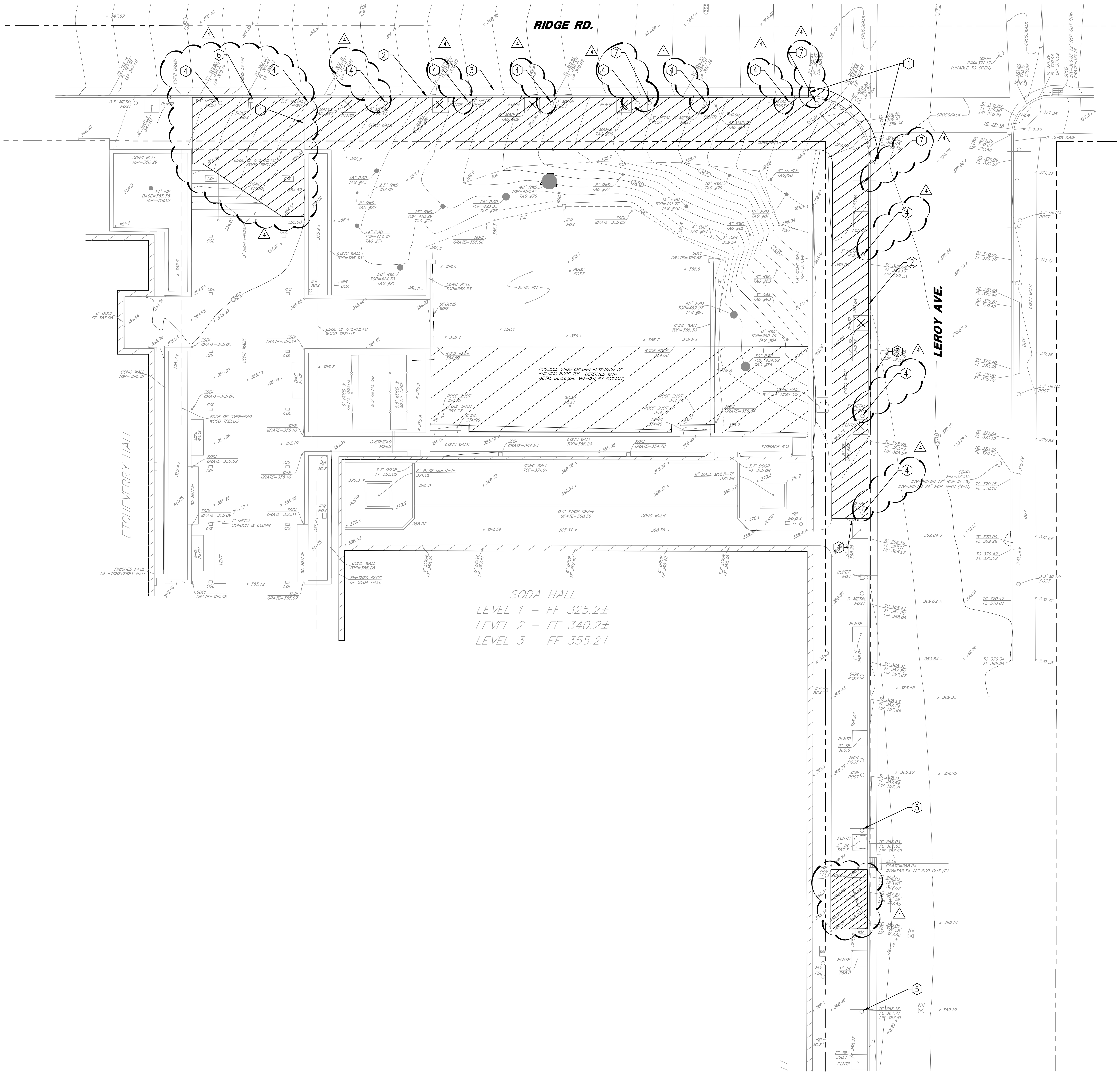
DATE: Aug 15th, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE

UTILITY PLAN

SHEET No

C2.00



DEMOLITION NOTES:

1. SAWCUT CONCRETE
2. SAWCUT CONCRETE AT BACK OF CONCRETE CURB.
3. EXISTING CURB AND GUTTER TO REMAIN. PROTECT IN PLACE.
4. REMOVE EXISTING 3-INCH METAL POST.
5. REMOVE EXISTING SIGN AND METAL POST.
6. PARKING METER KIOSK & PARKING SIGN & POST TO REMAIN. PROTECT IN PLACE.
7. EXISTING SIGN & POST TO REMAIN. PROTECT IN PLACE.

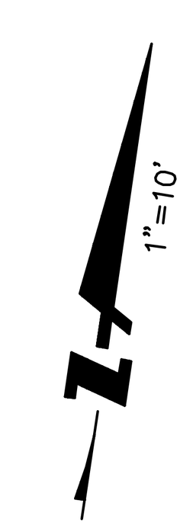
GENERAL DEMOLITION NOTES:

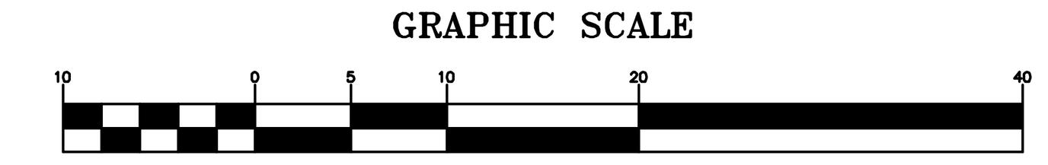
1. ALL DEMOLITION WORK SHALL BE PERMITTED BY THE CITY.
2. SAWCUT SHALL BE DONE IN A CLEAN LINE.
3. ALL STREET SIGNS WITHIN THE SIDEWALK DEMOLITION SHALL BE REMOVED AND REINSTALLED WITH THE CONSTRUCTION OF NEW CONCRETE SIDEWALK.

LEGEND:

REMOVE EXISTING SIDEWALK PAVEMENT

REMOVE EXISTING TREE





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CONSULTANTS

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TEL: (925) 396-7700
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PROJECT

JACOBS HALL

UNIVERSITY OF CALIFORNIA, BERKELEY, CA

No	REVISION	DATE
	100% SD Pricing	09/11/13
	Fire Marshal Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	Bid #1: Shoring / Excavation	05/30/14
1	Bid #1: Addendum	06/17/14
	ENCROACHEMNT PERMIT	07/23/14
	90% CD SET	08/01/14
4	100% CD/ PERMIT SUBMISSION	08/15/14

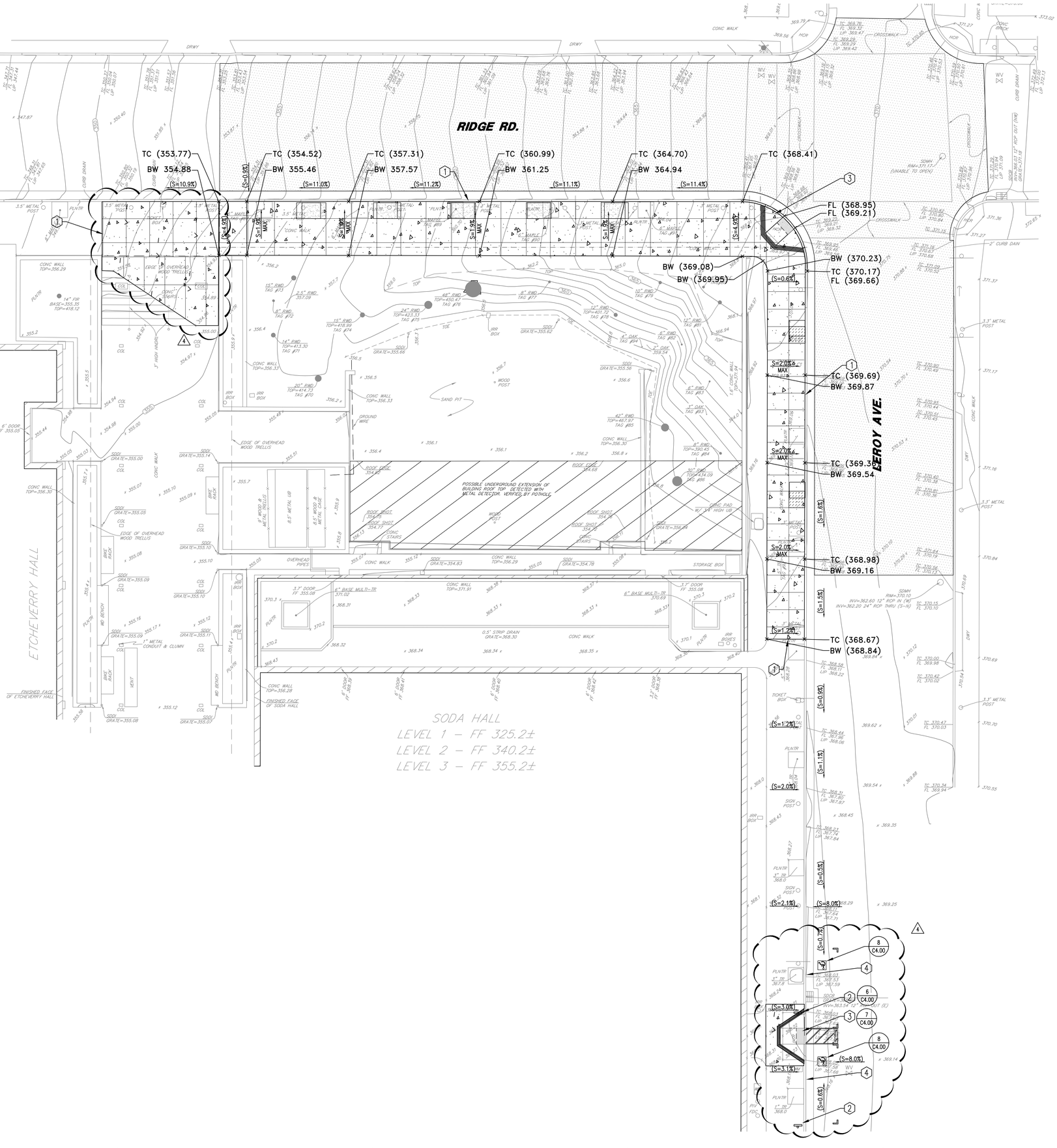
DATE: Aug 15th, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE

OFFSITE
DEMOLITION PLAN

SHEET No

C3.00



OFFSITE PAVING NOTES:

1. INSTALL DOWELS AT ALL LOCATIONS WHERE NEW CONCRETE ABUTS EXISTING CONCRETE PAVING
2. INSTALL NEW ADA SIGNAGE ON METAL POST
3. INSTALL NEW ADA CURB RAMP. RAMP SHALL BE IN COMPLIANCE WITH 2010 ADA STANDARDS
4. PAINT CONCRETE CURB BLUE ALONG NEW ADA PARKING. (20 LF) (X2).

GENERAL OFFSITE PAVING NOTES:

1. NEW CONCRETE SIDEWALK SHALL BE INSTALLED PER CITY OF BERKELEY STANDARDS. CROSS SLOPE SHALL BE 2% MAXIMUM.
2. ONCE NEW OVERLAY IS IN PLACE, INSTALL ALL NEW TRAFFIC PAINT MARKINGS TO MATCH EXISTING CONDITIONS.
3. CITY OF BERKELEY TO REVIEW MONUMENTS, TRAFFIC CONTROL PLAN AND UTILITY ADJUSTMENTS PRIOR TO WORK.
4. CITY OF BERKELEY TO REPAIR WORK IN FIELD WITH 1" AND GRIND PRIOR TO PAVE.
5. CITY OF BERKELEY TO COMPLETE BASE REPAIR WORK ON LEROY PRIOR TO UC PAVING. PROVIDE CITY WITH 2 MONTHS ADVANCE NOTICE.
6. REFER TO LANDSCAPE DWGS FOR SIDEWALK PAVING PATTERN.

LEGEND:

CONSTRUCT NEW CONCRETE SIDEWALK PAVEMENT PER CITY STANDARDS

CONSTRUCT NEW 2" AC OVERLAY (MILL AND FILL) PAVEMENT PER CITY STANDARDS

1"=10'

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

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JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY, CA

REGISTERED PROFESSIONAL ENGINEER MOUTAM No. 36739 CIVIL STATE OF CALIFORNIA

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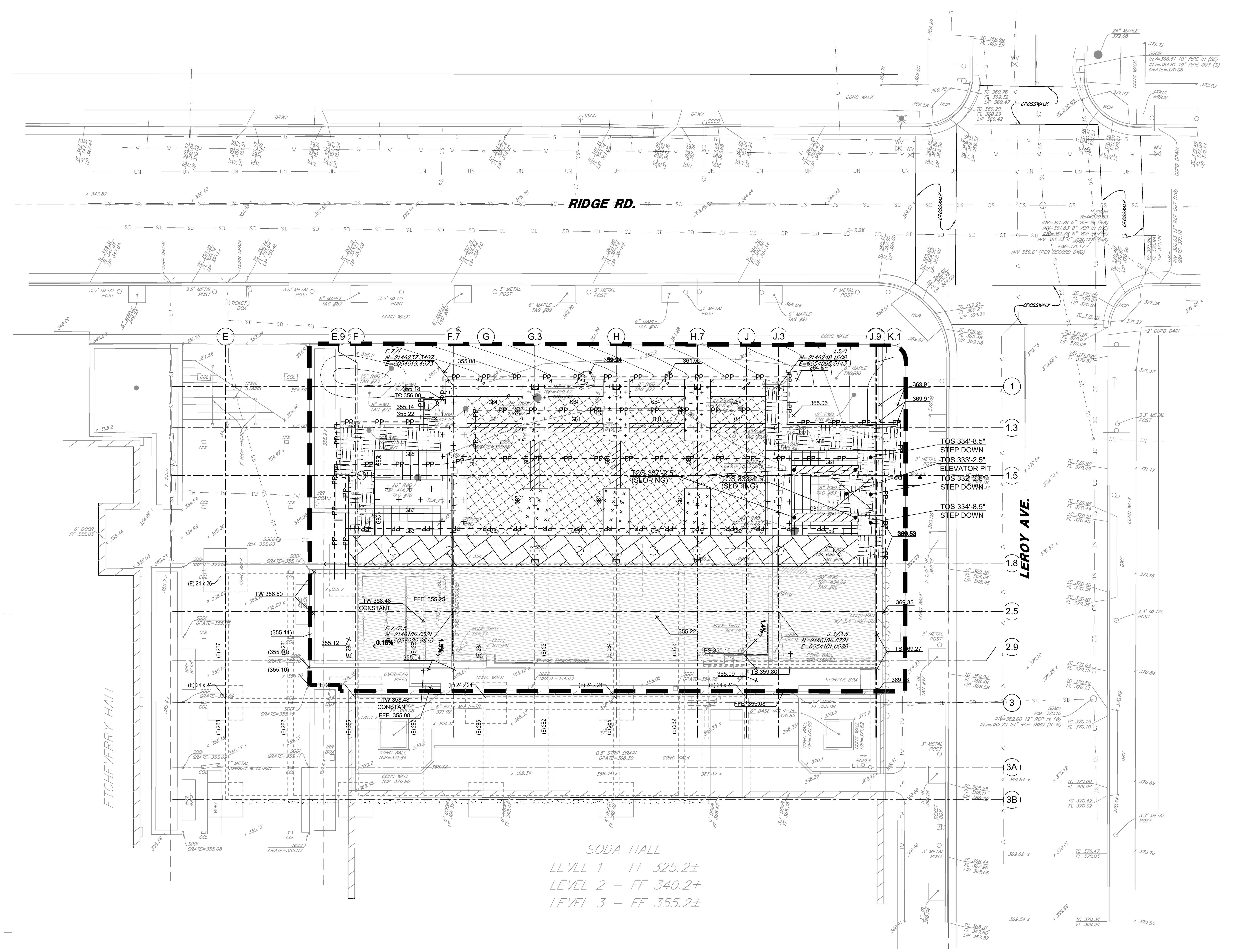
SCALE:

SHEET TITLE

OFFSITE PAVING PLAN

SHEET No

C3.10



LEGEND

GB1 – GRADE BEAM 2'-0" WIDE (24" THICK)
TOP OF SUB GRADE (TOS) 338'-2.5" UNLESS NOTED OTHERWISE

GB2 – GRADE BEAM 6'-0" WIDE (36" THICK)
TOP OF SUB GRADE (TOS) 337'-2.5" UNLESS NOTED OTHERWISE

GB3 – GRADE BEAM 7'-2" WIDE (36" THICK)
TOP OF SUB GRADE (TOS) 337'-2.5"

GB4 – GRADE BEAM 4' WIDE (36" THICK)
TOP OF SUB GRADE (TOS) 337'-2.5"

GB5/5b – GRADE BEAM 6'/VARIES WIDE (36" THICK)
TOP OF SUB GRADE (TOS) 337'-2.5"

GB6 – GRADE BEAM 6' WIDE (36" THICK)
TOP OF SUB GRADE (TOS) 337'-2.5"

GB7 – GRADE BEAM 6' WIDE (36" THICK)
TOP OF SUB GRADE (TOS) 337'-2.5"

SOG1 – SLAB ON GRADE (6" THICK)
ON 12" THICK DRAINAGE LAYER
TOP OF SUB GRADE (TOS) 338'-8.5"

SOG2 – SLAB ON GRADE (12" THICK)
ON 12" THICK DRAINAGE LAYER
TOP OF SUB GRADE (TOS) 338'-2.5"

EXCAVATION OVER TOP OF EXISTING BUILDING BASEMENT. APPROX. 2 FEET OF EXISTING SAND TO BE REMOVED

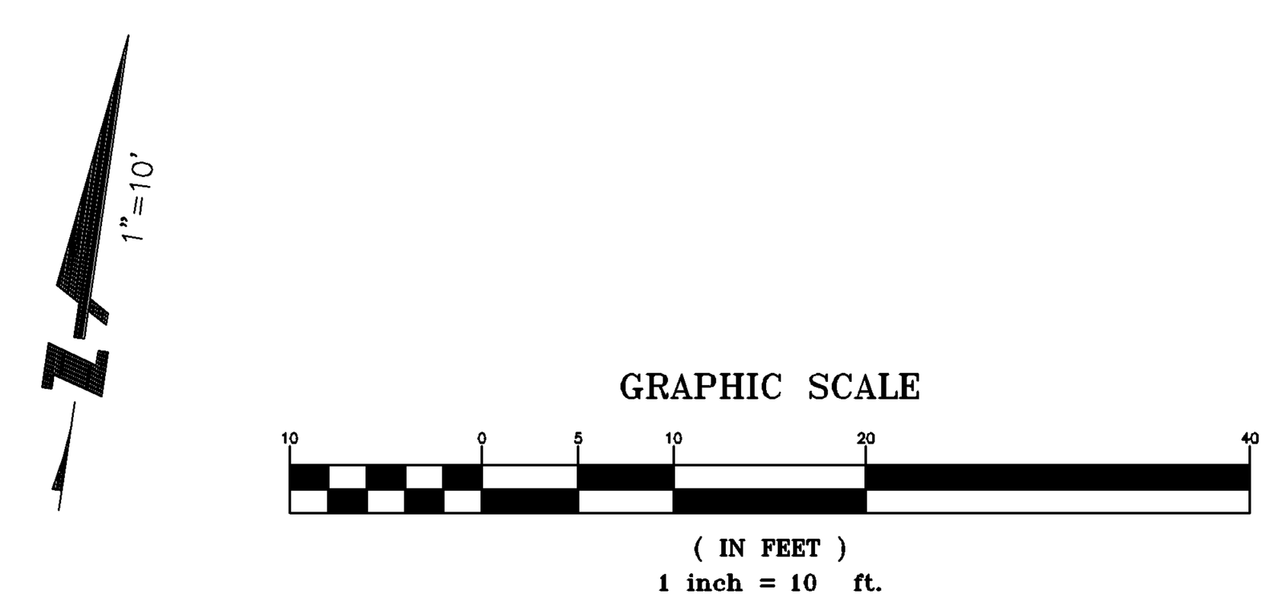
J.3/2.5
N=2146196.8721
E=6054101.0088
BUILDING GRID NORTHING AND EASTING BASED ON UC BERKELEY COORDINATE SYSTEM

– – PP– – PP–
PRELIMINARY PERFORATED PIPE FOR PERIMETER AND SLAB SUBDRAIN SYSTEM. FINAL DESIGN TO BE SHOWN IN BUILDING CONSTRUCTION DOCUMENTS

369.35
APPROXIMATE FUTURE DESIGN GRADE ELEVATION

SHEET NOTES

1. TOP OF CONCRETE SLAB ON GRADE ELEVATION 340'-2.5".
2. FOR STRUCTURAL AND CONCRETE DETAILS, PIER DEPTHS, ETC, SEE STRUCTURAL PLANS
3. APPROXIMATE FUTURE DESIGN GRADS AND CONTOURS PROVIDED FOR ESTIMATING PURPOSES AND ARE SUBJECT TO CHANGE IN THE BUILDING DESIGN PACKAGE



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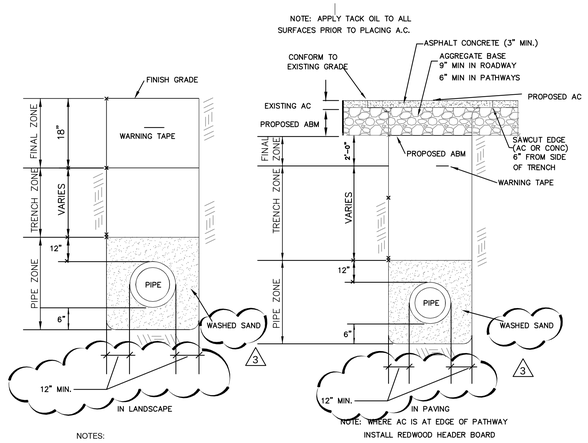
SHEET TITLE

EXCAVATION PLAN

SHEET No

C3.20

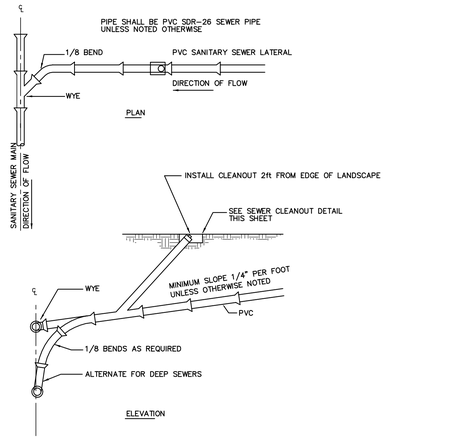


NOTES:

1. TRENCH ZONE: FILL MATERIALS INCLUDE IMPORTED CRUSHED ROCK (CL II AB) BACKFILL OR APPROVED NATIVE AS SPECIFIED IN THE SPECIFICATIONS. COMPACTION PER ASTM D1557 SHALL BE 90%.
2. FINAL ZONE:
   IN PAVEMENT-FILL MATERIALS INCLUDE IMPORTED CRUSHED ROCK BACKFILL OR APPROVED NATIVE AS SPECIFIED IN THE SPECIFICATIONS. COMPACTION PER ASTM D1557 SHALL BE 95%.
   IN LANDSCAPE-FILL MATERIAL SHALL BE TOP SOIL AS SPECIFIED IN THE SPECIFICATIONS. COMPACTION PER ASTM D1557 SHALL BE 85%.

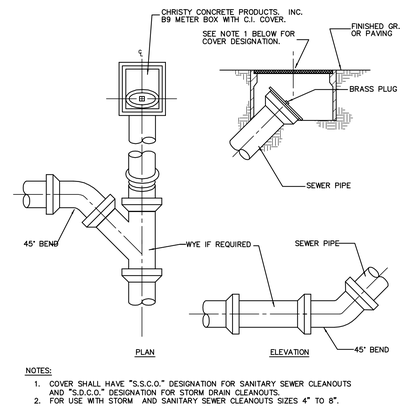
TRENCH BACKFILL & RESURFACING

1



SANITARY SEWER LATERAL

2



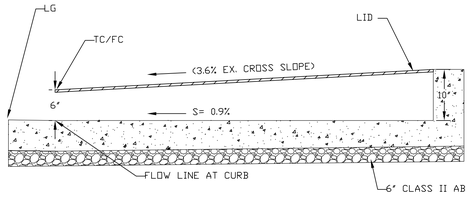
NOTES:

1. COVER SHALL HAVE "S.S.C.O." DESIGNATION FOR SANITARY SEWER CLEANOUTS AND "S.D.C.O." DESIGNATION FOR STORM DRAIN CLEANOUTS.
2. FOR USE WITH STORM AND SANITARY SEWER CLEANOUTS SIZES 4" TO 8".

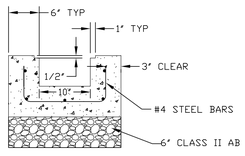
STORM AND SANITARY SEWER CLEANOUT

3

BOLT DOWN ACCESS LID:
SHALL BE ¼" THICK, SOLID AND RATED FOR H25 LOADING. SHALL MEET AND EXCEED REQUIREMENTS FOR ASTM/ANSI SLIP RESISTANCE AND SHALL HAVE A COEFFICIENT OF FRICTION EQUAL TO OR GREATER THAN 0.5 (FOR WET AND DRY CONDITIONS). ERIC'SONS MODEL 12C24DI OR EQUIVALENT

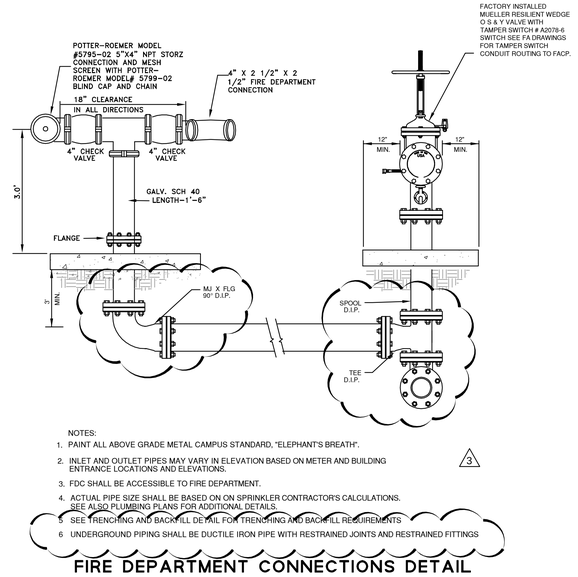


TYPICAL CAST IN PLACE TRENCH DRAIN PROFILE VIEW



TYPICAL CAST IN PLACE TRENCH DRAIN SECTION

4



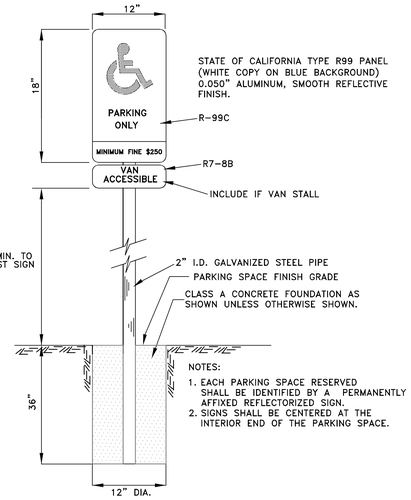
NOTES:

1. PAINT ALL ABOVE GRADE METAL CAMPUS STANDARD, "ELEPHANT'S BREATH".
2. INLET AND OUTLET PIPES MAY VARY IN ELEVATION BASED ON METER AND BUILDING ENTRANCE LOCATIONS AND ELEVATIONS.
3. FDC SHALL BE ACCESSIBLE TO FIRE DEPARTMENT.
4. ACTUAL PIPE SIZE SHALL BE BASED ON ON SPRINKLER CONTRACTOR'S CALCULATIONS. SEE ALSO PLUMBING PLANS FOR ADDITIONAL DETAILS.
5. SEE TRENCHING AND BACKFILL DETAIL FOR TRENCHING AND BACKFILL REQUIREMENTS
6. UNDERGROUND PIPING SHALL BE DUCTILE IRON PIPE WITH RESTRAINED JOINTS AND RESTRAINED FITTINGS

3

FIRE DEPARTMENT CONNECTIONS DETAIL

5



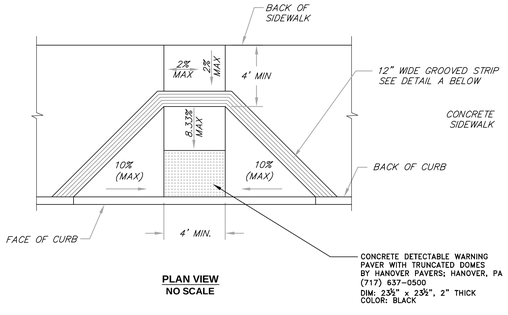
STATE OF CALIFORNIA TYPE R99 PANEL (WHITE COPY ON BLUE BACKGROUND) 0.050" ALUMINUM, SMOOTH REFLECTIVE FINISH.

NOTES:

1. EACH PARKING SPACE RESERVED SHALL BE IDENTIFIED BY A PERMANENTLY AFFIXED REFLECTORIZED SIGN.
2. SIGNS SHALL BE CENTERED AT THE INTERIOR END OF THE PARKING SPACE.

ACCESSIBLE PARKING SIGN AND POST

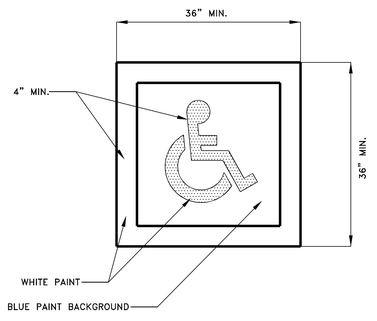
6



PLAN VIEW
NO SCALE

ADA RAMP

7



NOTE:
LEGEND TO BE PAINTED ON THE SURFACE OF EACH PARKING SPACE

ACCESSIBLE PAVEMENT SYMBOL

8

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CIVIL DETAILS

SHEET No

C4.00

LAYOUT NOTES

1. CONFORM WORK TO REQUIREMENTS OF LATEST ADOPTED EDITION OF UNIFORM BUILDING CODE AND APPLICABLE LOCAL AND STATE CODES, PLANS, SPECIFICATIONS, ORDINANCES AND REGULATIONS.

2. PRIOR TO BEGINNING WORK, BECOME FAMILIAR WITH EXISTING SITE CONDITIONS, INCLUDING UNDERGROUND AND ABOVEGROUND UTILITIES, ELECTRICAL VAULTS AND ABOVE GRADE FEATURES SUCH AS GRADING, WALLS, FENCES, STRUCTURES, PIPING ETC. COORDINATE WITH ARCHITECTURAL AND CIVIL ENGINEERS DRAWINGS FOR ACCURACY AND BRING ATTENTION TO ANY DISCREPANCIES OR QUESTIONS. CONTRACTOR WILL BE HELD RESPONSIBLE FOR HIS OWN DAMAGE.

3. UPON BEING AWARDED CONTRACT, MAKE NECESSARY ARRANGEMENTS TO INSURE THAT MATERIALS, SUPPLIES, AND MANPOWER WILL BE AVAILABLE WHEN NEEDED TO CONSTRUCT THIS PROJECT IN AN ORDERLY AND TIMELY FASHION.

4. DO NOT BEGIN WORK UNTIL CONTRACTOR'S "CONSTRUCTION SET" DRAWINGS ARE CURRENT AND HAVE REQUIRED PUBIC AGENCY APPROVALS.

5. VERIFY PROPERTY LINES AND LIMITS OF WORK PRIOR TO COMMENCING WORK.

6. REFER TO PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION.

7. OBTAIN NECESSARY PERMITS AND PAY FOR RELATED INSPECTION FEES REQUIRED TO INSTALL WORK.

8. WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALING OF DRAWINGS. DO NOT SCALE FROM REDUCED DRAWING SHEETS. REFERENCE TO NORTH REFERS TO TRUE NORTH.

9. TAKE ALL DIMENSIONS PERPENDICULAR TO ANY REFERENCE LINE, WORK LINE, FACE OF BUILDING, FACE OF WALL, BUILDING GRID LINES OR CENTERLINE. DIMENSIONS ARE TO THE FACE OF PLANTER WALLS, UNLESS INDICATED OTHERWISE.

10. UNLESS OTHERWISE NOTED, ALL ANGLES TO BE 90 DEGREES AND ALL LINES OF PAVING AND FENCING TO BE PARALLEL. MAINTAIN HORIZONTAL ALIGNMENT OF ADJACENT ELEMENTS AS NOTED PER DRAWINGS.

11. HOLD TOPS OF WALLS AND FENCES LEVEL UNLESS NOTED OTHERWISE.

12. WHERE NOT SHOWN ON LANDSCAPE DRAWINGS, SEE CIVIL ENGINEERS DRAWINGS FOR ROADWAY CENTERLINES, BUILDING SETBACKS, BENCHMARKS AND ARCHITECTURAL DRAWINGS FOR ARCHITECTURAL PODIUM GRID LINES.

13. NOTES AND DETAILS ON SPECIFIC DRAWINGS TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS.

14. WHERE CONFLICTS OCCUR BETWEEN DRAWINGS AND ACTUAL FIELD CONDITIONS, NOTIFY OWNER'S AUTHORIZED REPRESENTATIVE IMMEDIATELY FOR CLARIFICATION. FAILURE TO PROVIDE NOTIFICATION MAY HOLD CONTRACTOR LIABLE FOR COSTS INCURRED TO RECTIFY PROBLEM, IF REQUIRED.

15. DO NOT INSTALL ANY WORK ON STRUCTURE PRIOR TO REVIEW OF WATERPROOFING BY ARCHITECT.

16. DO NOT WILLFULLY PROCEED WITH CONSTRUCTION OPERATIONS WHEN IT IS OBVIOUS THAT UNKNOWN OBSTRUCTIONS AND GRADE DIFFERENCES EXIST THAT MAY NOT HAVE BEEN KNOWN DURING THE DESIGN PROCESS. BRING THESE CONDITIONS IMMEDIATELY TO ATTENTION OF OWNER'S AUTHORIZED REPRESENTATIVE FOR RESOLUTION. ASSUME FULL RESPONSIBILITY FOR COSTS INCURRED AND REQUIRED MODIFICATIONS DUE TO LACK OF PROVIDING SUCH NOTIFICATION.

17. BE RESPONSIBLE FOR COORDINATING WORK WITH OWNER, OWNER'S AUTHORIZED REPRESENTATIVE, GENERAL CONTRACTOR AND HIS SUB-CONTRACTOR'S, PUBLIC AGENCIES,AND PROJECT DESIGN CONSULTANTS.

18. ENSURE THAT CONTRACTOR-INSTALLED UNDERGROUND ELEMENTS SUCH AS DRAINLINES, IRRIGATION MAINLINES AND LATERALS, ELECTRICAL CONDUIT, SLEEVES, ETC. ARE IN PLACE, OPERATIONAL,AND APPROVED BY PUBLIC AGENCY INSPECTION PRIOR TO INSTALLATION OF HARDSCAPE WORK.

19. PAVING MOCK-UPS ARE REQUIRED ON THIS PROJECT - REFER TO PAVING SCHEDULE AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

20. NOTIFY OWNER'S AUTHORIZED REPRESENTATIVE WITH PROPER AMOUNT OF LEAD-TIME AS INDICATED IN SPECIFICATIONS PRIOR TO A CONTRACTOR-REQUESTED SITE MEETING. FAILURE TO PROVIDE APPROPRIATE LEAD TIME MAY RESULT IN CONTRACTOR BEING BACKCHARGED FOR OWNER'S AUTHORIZED REPRESENTATIVE'S TIME.

21. PROVIDE ISOLATION OR EXPANSION JOINTS WHEN PAVING ABUTS VERTICAL EDGES SUCH AS WALLS, STEPS, RAMPS, CURBS, AND COLUMNS.

IRRIGATION NOTES:

ALL PLANTING AREAS TO BE IRRIGATED BY A FULLY AUTOMATIC, WEATHER BASED SYSTEM SUPPLIED BY U.C. BERKELEY. ZONE TIMING WILL BE DEVELOPED BASED UPON INDIVIDUAL PLANT REQUIREMENTS AND ENVIRONMENTAL FACTORS. ZONE TIMING WILL BE CHANGED BY THE CONTROLLER ON A DAILY BASIS AS WEATHER CONDITIONS CHANGE. ALL ZONES WILL BE IRRIGATED WITH SUBSURFACE DRIP IRRIGATION PIPING AND PROVIDED WITH FLUSH VALVES TO KEEP PIPING AND EMITTERS CLEAN. THE SYSTEM WILL BE HARD PIPED (COPPER) THROUGH THE BUILDINGS AND PIPED WITH PVC IN THE PLANTING BEDS TO THE EMITTER LINES. BACKFLOW, MASTER VALVE, AND FILTER WILL BE FROM THE EXISTING IRRIGATION. POINT OF CONNECTIONS TO SODA HALL AND ETCHEVERRY HALL IRRIGATION SYSTEM. THE EXISTING IRRIGATION SYSTEM SHALL REMAIN OPERATIONAL FOR AREAS OUTSIDE OF THE LIMIT OF WORK THROUGHOUT THE CONSTRUCTION PERIOD.

ABBREVIATIONS

ARCH.	ARCHITECT
	ALIGN
BLDG.	BUILDING
B.O.C.	BACK OF CURB
CL	CENTER LINE
CONC.	CONCRETE
C.I.P.	CAST IN PLACE
DWGS.	DRAWINGS
(E)	EXISTING
EJ	EXPANSION JOINT
ELEC.	ELECTRICAL
EQ	EQUAL
F.D.C.	FIRE DEPARTMENT CONNECTION
F.O.B.	FACE OF BUILDING
F.O.C.	FACE OF CURB
GALV.	GALVANIZED
MANUF.	MANUFACTURER
MAX.	MAXIMUM
MIN.	MINIMUM
(N)	NEW
N.I.C.	NOT IN CONTRACT
O.C.	ON CENTER
PA	PLANTING AREA
PL	PROPERTY LINE
R	RADIUS
S.A.D.	SEE ARCHITECTURAL DRAWINGS
S.C.A.	SEE CIVIL DRAWINGS
S.P.D.	SEE PLUMBING DRAWINGS
S.S.A.	SEE STRUCTURAL DRAWINGS
SP.	SPACING
TYP.	TYPICAL
V.I.F.	VERIFY IN FIELD

X — DETAIL NUMBER
X — SHEET NUMBER

GRADING & DRAIN LEGEND

AD	AREA DRAIN
PD	PLANTER DRAIN
OD	OVERFLOW DRAIN
CB	CATCH BASIN
CO	CLEAN OUT
BS	BACK OF STAIR
TS	TOP OF STAIR
TW	TOP OF WALL
(356.25)	EXISTING GRADE
(356.25)	EXISTING INTERPOLATED GRADE
356.25	PROPOSED GRADE
356.25	PROPOSED GRADES BY CIVIL
1%	SLOPE

SHEET INDEX

MATERIALS LEGEND

SYMBOL	DESCRIPTION	DETAIL
PAVEMENT		
PP1	C.I.P. CONCRETE PAVING ON GRADE INTEGRAL COLOR CONCRETE COLOR: DARK GRAY, TO MATCH ARCHITECTURE FINISH: MEDIUM SAND BLAST	1/L6.0
PP2	C.I.P. CONCRETE PAVING ON GRADE AT PATH (NORTH-WEST BLDG. EXIT) COLOR: NATURAL GRAY FINISH: LIGHT SAND BLAST	1/L6.0
PP3	C.I.P. CONCRETE PAVING ON STRUCTURE INTEGRAL COLOR CONCRETE COLOR: DARK GRAY, TO MATCH ARCHITECTURE FINISH: MEDIUM SAND BLAST	2/L6.0
P1	C.I.P CONCRETE SIDEWALK SEE LAYOUT PLAN FOR SCORE PATTERN COLOR: S.C.D. FINISH: S.C.D.	S.C.D.
	DECOMPOSED GRANITE AT TREE WELL ON LE ROY AVE. SIDEWALK COLOR: GRAY	16/L6.0
	GRAVEL MULCH AT PLANTERS CRUSHED, CHARCOAL GRAY DECORATIVE GRAVEL 3/8" CRUSHED BLACK BASALT ROCK SUPPLIER: LYNGSO GARDEN MATERIALS http://www.lyngsogarden.com	SEE SPECS
	GRAVEL (TYPE A) AT SWALE ALONG NORTH BUILDING EDGE COLOR: GRAY SIZE: 1"-3"	4/L6.1 & SEE SPECS
	GRAVEL BAND (TYPE B) PEA GRAVEL IN BETWEEN CONCRETE PLANTER AND BLDG. COLOR: GRAY SIZE: 1/8" - 1/4"	17/L6.0 & SEE SPECS
SYMBOL	DESCRIPTION	DETAIL
WALLS AND EDGING		
	CONCRETE WALL ON GRADE C.I.P. CONCRETE W/ SALVAGED STONE CAP FROM (E) WALLS COLOR:NATURAL GRAY FINISH: TBD HEIGHT: VARIES, SEE GRADING PLAN WIDTH: +/- 14"	2/L6.2
	CONCRETE CURB C.I.P. CONCRETE CURB AT PATH (NORTH-WEST BLDG. EXIT) COLOR: NATURAL GRAY FINISH: SEE SPECS HEIGHT: VARIES, SEE GRADING PLAN WIDTH: 6"	11/L6.0
	PLANTER ON STRUCTURE (TYPE 1) C.I.P. CONCRETE WITH BOTTOM COLOR:NATURAL GRAY FINISH: LIGHT SAND BLAST ON VISIBLE SURFACES ONLY HEIGHT: SEE GRADING PLAN WIDTH: SEE DETAIL	4,6/L6.2
	PLANTER ON STRUCTURE (TYPE 2) C.I.P. CONCRETE WITH BOTTOM COLOR: NATURAL GRAY FINISH: LIGHT SAND BLAST ON VISIBLE SURFACES ONLY HEIGHT: SEE GRADING PLAN WIDTH: SEE DETAIL	9/L6.2
	METAL HEADER AT GRAVEL SWALE PERMALOC, STRUCTUREEDGE COLOR: MILL , GRAY SIZE: SEE DETAIL	18/L6.0
SYMBOL	DESCRIPTION	DETAIL
SITE FURNISHINGS		
	METAL PLANTER - ON STRUCTURE CUSTOM FABRICATED PRIMED AND PAINTED, GALVANIZED STEEL PLANTERS COLOR: TBD, TO BE APPROVED BY LANDSCAPE ARCHITECT SIZE: SEE PLAN & DETAILS	1,4/L6.3
	BENCH QUANTITY: 3	BY OTHERS
	BIKE RACK SEE 2/L1.0 FOR LAYOUT MANUFACTURER: BIKEPARKING.COM WELLE SERIES W/ ROUND PIPE & SURFACE FLANGE MODEL: WSH 3602-SF STAINLESS STEEL QUANTITY: 17	2/L6.3 & SPECS
SYMBOL	DESCRIPTION	DETAIL
PLANTING		
PA	PLANTING AREA, SEE PLANTING PLAN	1/L3.0
BRA	BIO-RETENTION AREA	6A, 6B/L6.1
	(E) TREES TO REMAIN	
	PROPOSED TREES, SEE PLANT LEGEND	

PLANT LEGEND

TREES

SYMBOL	QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	COMMENTS	ON-CENTER SPACING
	5	ACE RUB	ACER RUBRUM	RED MAPLE	36" BOX	STANDARD, MATCHING SPECIMEN	PER PLAN
	3	SEQ SEM	SEQUOIA SEMPERVIRENS	REDWOOD	36" BOX	STANDARD	PER PLAN
	5	QUE CRI	QUERCUS ROBUR 'CRIMSON SPIRE'	'CRIMSON SPIRE' ENGLISH OAK	24" BOX	STANDARD, MATCHING SPECIMEN	PER PLAN
	2	ULM FRO	ULMUS PARVIFOLIA 'FRONTIER'	'FRONTIER' ELM		TRANSPLANTED FROM SITE	PER PLAN
SHRUBS							
	16	COR ARC	CORNUS SERICEA 'ARCTIC FIRE'	'ARCTIC FIRE' REDTWIG DOGWOOD	5 G		48" O.C.
PERENNIALS / GROUNDCOVERS							
	24	ASP DEN	ASPARAGUS DENSIFLORUS	ASPARAGUS FERN	1 G		18" O.C.
	35	DES CES	DESCHAMPSIA CESPITOSA	TUFTED HAIR GRASS	1 G		24" O.C.
	24	HEU MAX	HEUCHERA MAXIMA	ISLAND ALUM ROOT	1 G		24" O.C.
	55	JUN PAT	JUNCUS PATENS	CALIFORNIA GRAY RUSH	1 G		24" O.C.
	83	POL MUN	POLYSTICHUM MUNITUM	WESTERN SWORD FERN	1 G		36" O.C.
	43	TIA TRI	TIARELLA TRIFOLIATA UNIFOLIATA	SUGAR SCOOP, WESTERN FOAMFLOWER	1 G		18" O.C.
	8	WOO FIM	WOODWARDIA FIMBRIATA	GIANT CHAIN FERN	1 G		48" O.C.

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PROJECT

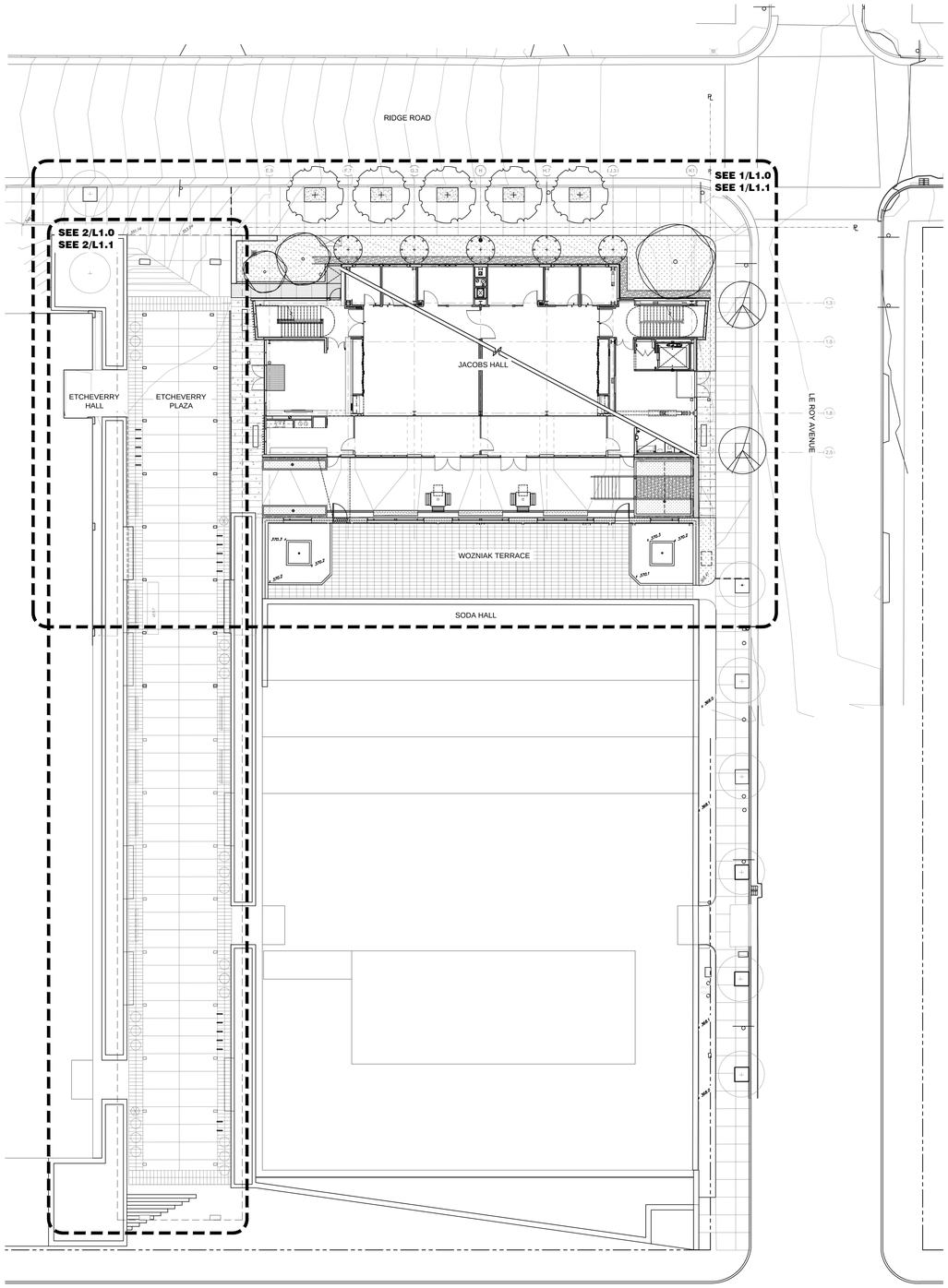
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	FIRE MARSHALL SUBMISSION	12/20/13
	DSA SUBMISSION	01/29/14
	CM CONTRACTOR RFP	03/31/14
	50% CDs	06/26/14
	ENCROACHMENT PERMIT SUBMISSION	07/23/14
	100% CDs / PERMIT SUBMISSION	08/15/14

DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : AS SHOWN

SHEET TITLE
LANDSCAPE NOTES & LEGENDS

SHEET No
L0.0



1/16"=1'-0"

16' 0' 8' 16' 32'

NORTH

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REGISTERED LANDSCAPE ARCHITECT
Signature
4.30.15
Date
STATE OF CALIFORNIA

CONSULTANTS

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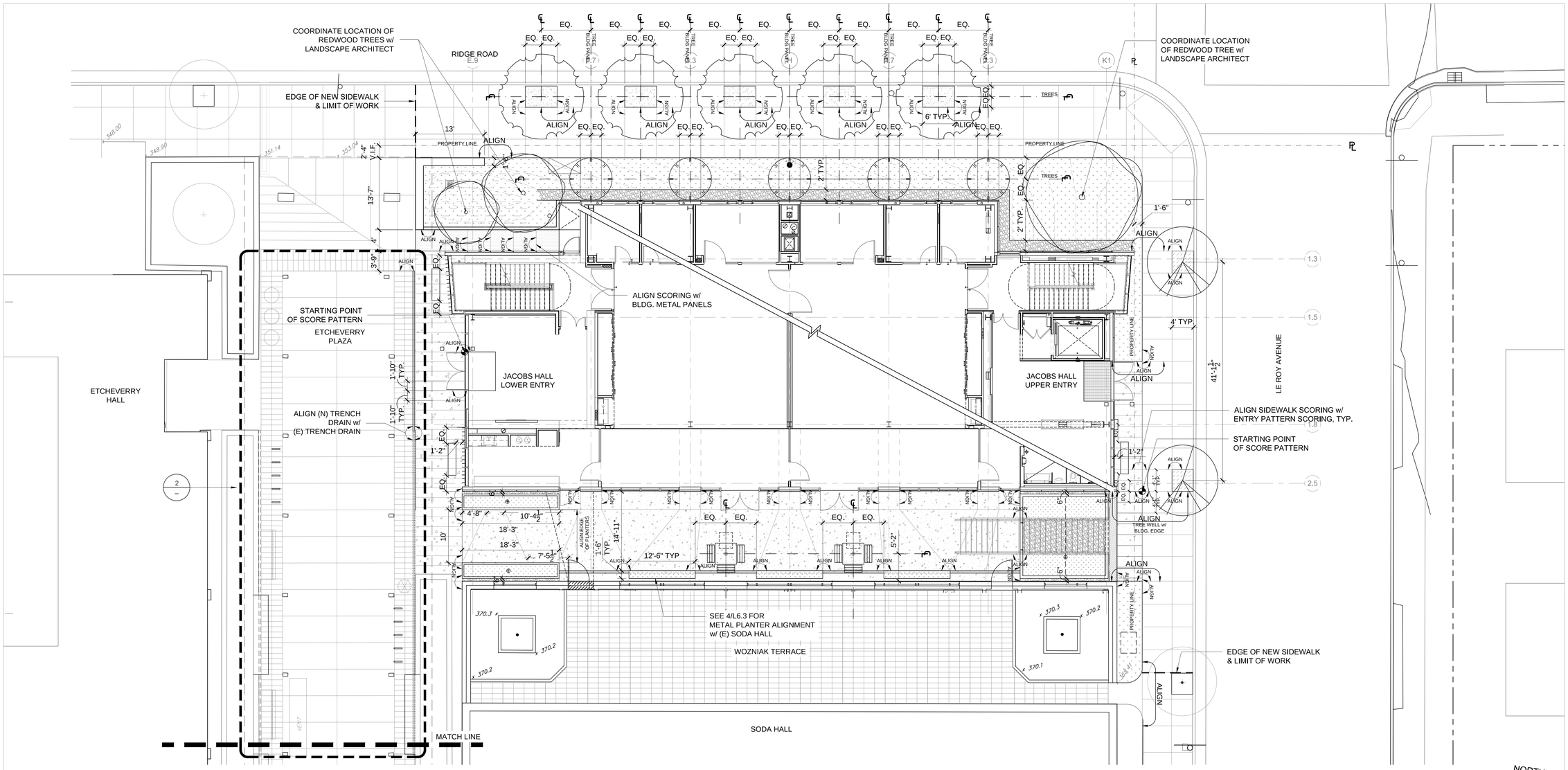
SHEET TITLE

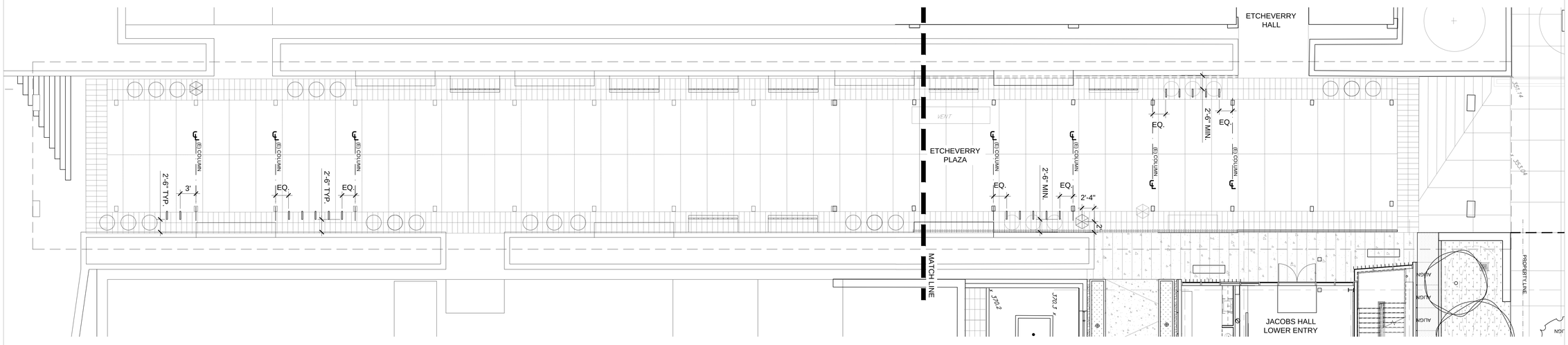
LANDSACPE KEY PLAN

SHEET No

L0.1



1 LAYOUT PLAN - JACOBS HALL



2 LAYOUT PLAN - ETCHEVERRY PLAZA SITE FURNITURE

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	100% CDs / PERMIT SUBMISSION	08/15/14

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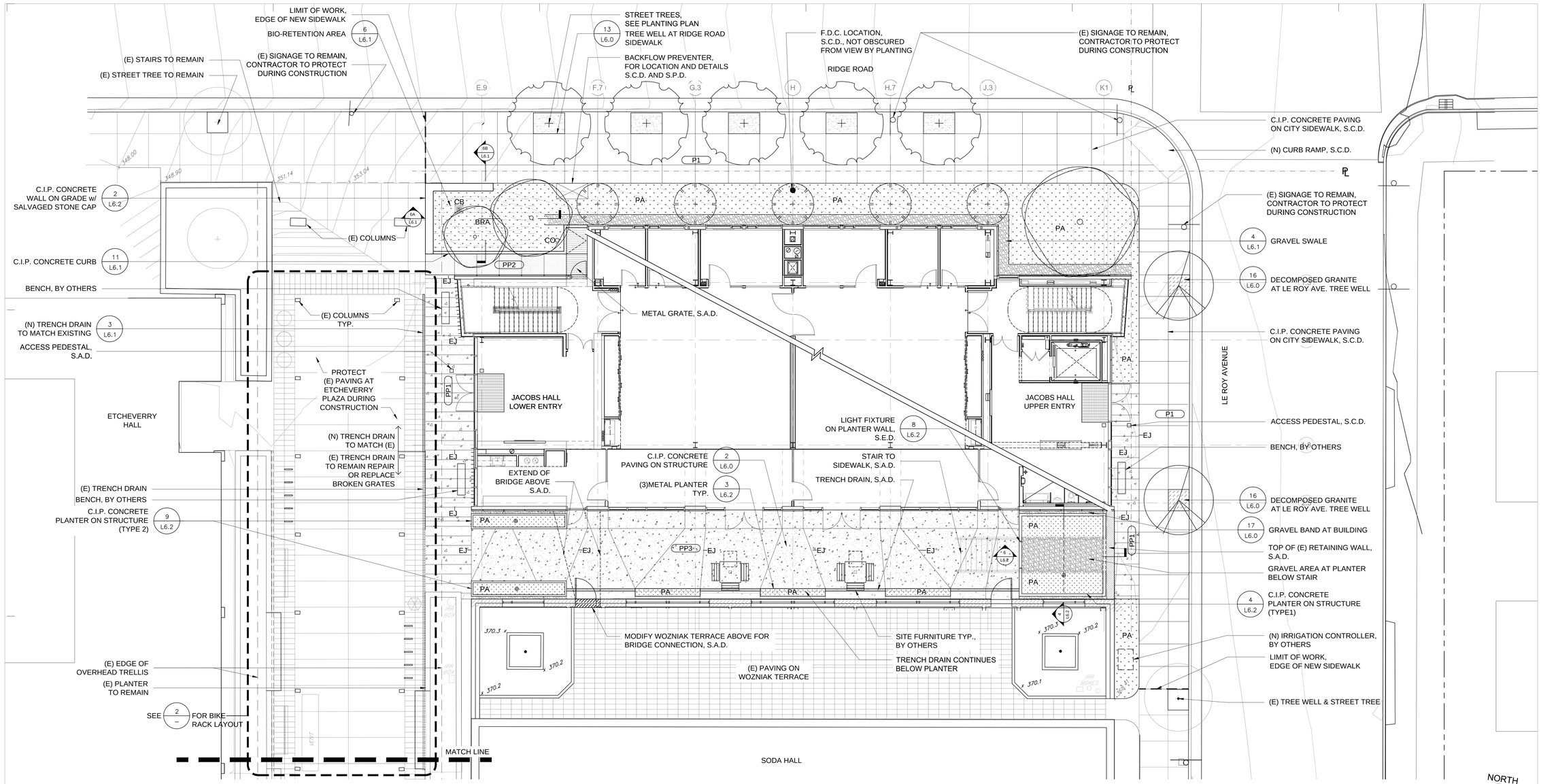
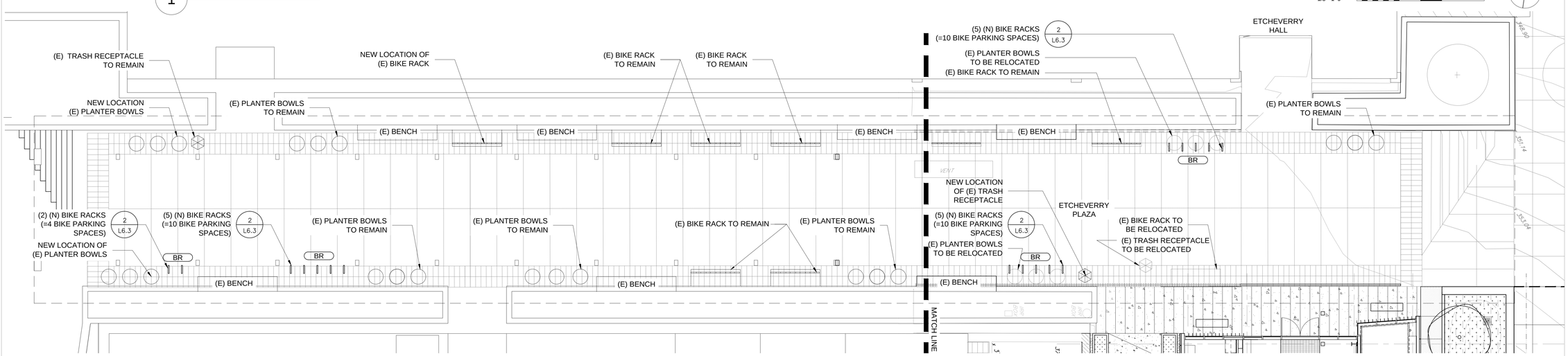
SHEET TITLE
LANDSCAPE LAYOUT PLAN

SHEET No
L1.0



1 MATERIALS PLAN - JACOBS HALL

1/8"=1'-0"



2 MATERIALS PLAN - ETCHEVERRY PLAZA SITE FURNITURE

1/8"=1'-0"

SEE L0.00 FOR MATERIALS LEGEND, SEE L2.0 FOR DRAINAGE INFORMATION

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	50% CDs	06/26/14
	ENCROACHMENT PERMIT SUBMISSION	07/23/14
	100% CDs / PERMIT SUBMISSION	08/15/14

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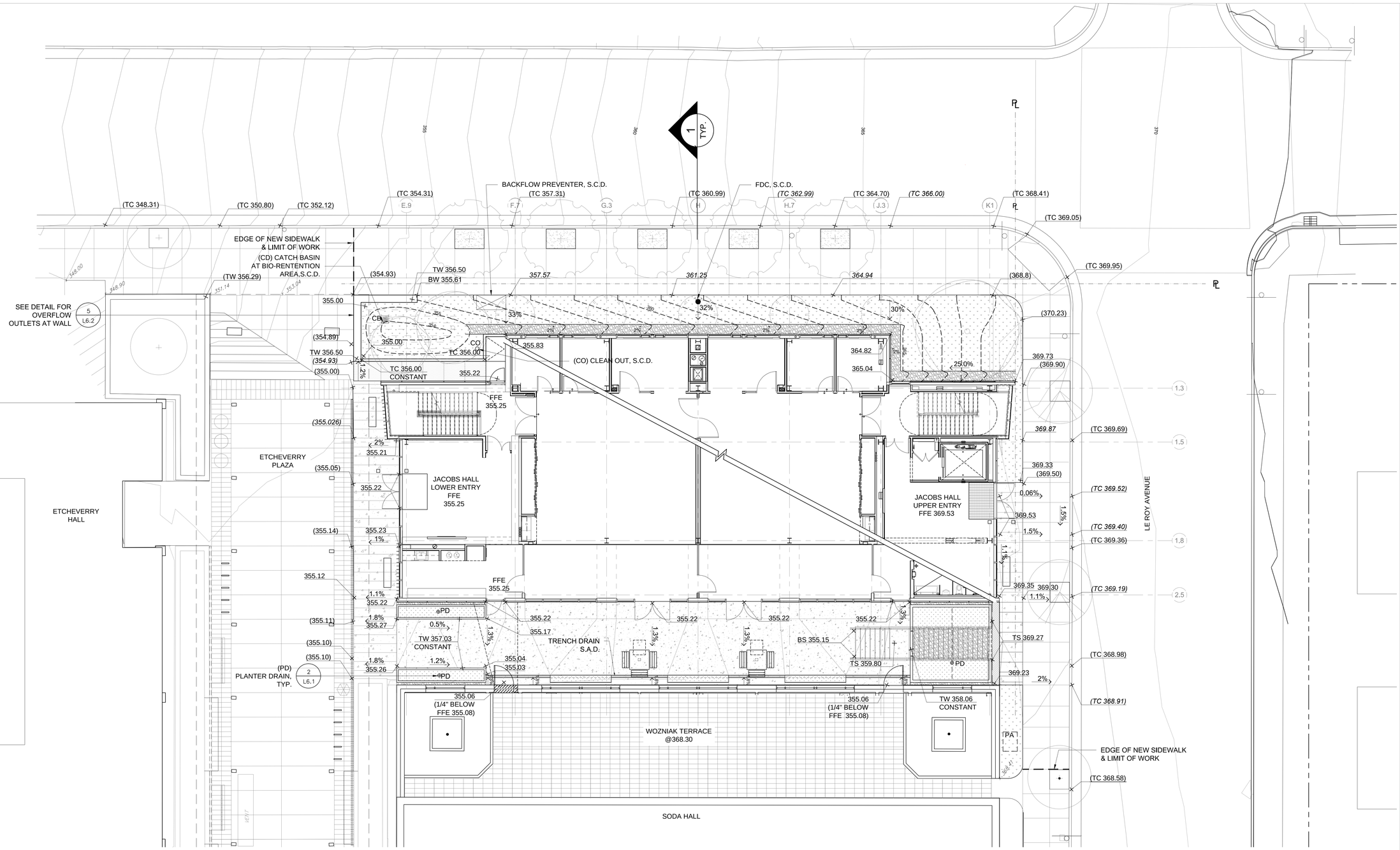
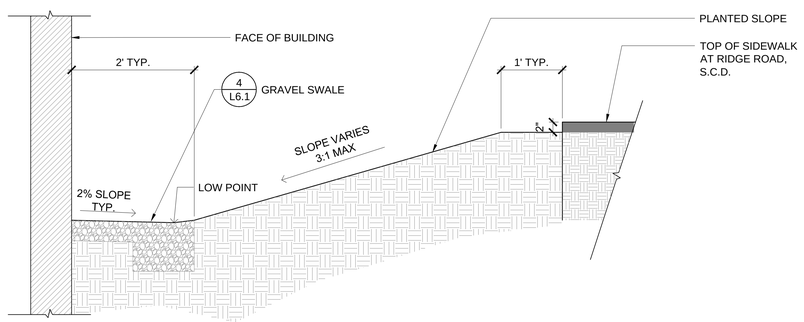
SHEET TITLE

LANDSCAPE MATERIALS PLAN

SHEET No

L1.1





1 NORTH SLOPE @ BUILDING - TYPICAL SECTION
1" = 1'-0" SECTION

1/8"=1'-0" 8' 0' 4' 8' 16'

NORTH

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	DSA SUBMISSION	01/29/14
	CM CONTRACTOR RFP	03/31/14
	BID#1 - SHORING / EXCAVATION	05/30/14
	50% CDs	06/26/14
	ENCROACHMENT PERMIT SUBMISSION	07/23/14
	100% CDS / PERMIT SUBMISSION	08/15/14

DATE : 15 August, 2014
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ISSUED FOR : PERMIT
PERMIT No :
SCALE : AS SHOWN

SHEET TITLE

LANDSCAPE GRADING PLAN

SHEET No

L2.0

RIDGE ROAD

E.9 F.7 G.3 H H.7 J.3 K1

(5) ACE RUB
SEE 1/L6.3 FOR TREE STAKING

(5) ACE RUB
(16) COR ARC
(5) QUE CRI
(43) TIA TRI
(57) POL MUN
(1) SEQ SEM
(24) HEU MAX
(2) ULM FRO
TRANSPLANTED FROM SITE
SEE 1/L6.3 FOR TREE STAKING
(19) DES CES
(4) WOO FIM
GRAVEL MULCH AT PLANTER
BELOW STAIRCASE, SEE SPECS
(4) WOO FIM
(16) DES CES
IRRIGATION CONTROLLER,
BY OTHERS

BACKFLOW PREVENTER, S.C.D.
FDC, S.C.D.

(14) POL MUN
(55) JUN PAT
(2) SEQ SEM

348.10 348.90 351.14 353.04

ETCHEVERRY PLAZA

ETCHEVERRY HALL

JACOBS HALL LOWER ENTRY

JACOBS HALL UPPER ENTRY

LE ROY AVENUE

1.5 1.8 2.5

(6) POL MUN
(24) ASP DEN
(6) POL MUN

370.3 370.2 370.2 370.3 370.2 370.1

WOZNIAK TERRACE

SODA HALL

VENT

IRR BOX

IRR BOXES

1/8"=1'-0" 8' 0' 4' 8' 16'

NORTH

SEE L0.00 FOR PLANT LEGEND
SEE L1.0 FOR TREE LAYOUT
SEE L6.3 PLANTING DETAILS

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SHEET TITLE

LANDSCAPE PLANTING PLAN

SHEET No

L3.0

IRRIGATION SYSTEM LEGEND

	EXISTING IRRIGATION SUPPLYLINE	
C	CONTROLLER ASSEMBLY	–PROVIDED BY UNIVERSITY
	IRRIGATION SUPPLYLINE	–1120/SCHEDULE 40 PVC PIPE –24" COVER
	SLEEVING	–1120/SCHEDULE 40 PVC PIPE –24" COVER
	ELECTRICAL CONDUIT	–1120/SCHEDULE 40 PVC ELECTRICAL CONDUIT –24" COVER
●	TREE BUBBLER (TWO PER TREE)	–RAINBIRD–1300A–F, TORO–514–20, HUNTER AFB, OR ACCEPTED SUBSTITUTE
	REMOTE CONTROL VALVE	–RAINBIRD–PEB SERIES, WEATHERMATIC 11000 SERIES, TORO P–220S SERIES, OR ACCEPTED SUBSTITUTE
◆	QUICK COUPLING VALVE	–RAINBIRD–33DNP, TORO 075–2SL–LVC, BUCKNER QB33NP07, OR ACCEPTED SUBSTITUTE
	DRIP CONTROL ZONE	–REMOTE CONTROL VALVE WITH DRIP FILTER AND PRESSURE REDUCER ASSEMBLY
	SUBSURFACE DRIPLINE	–NETAFIM–TLCV–6–12, NO KNOWN EQUAL –4" COVER
	MANUAL DRIP FLUSH VALVE	–SEE DETAIL K, SHEET L4.3
	IRRIGATION LATERAL	–1120/SCHEDULE 40 PVC PIPE –14" COVER
	ISOLATION VALVE	–STOCKHAM–B–140, NIBCO T113, HAMMOND IB 645, OR ACCEPTED SUBSTITUTE
○	STRUCTURAL PENETRATION	–BY MECHANICAL SECTION OF CONTRACT
	PIPING THROUGH STRUCTURE	–BY PLUMBING SECTION OF CONTRACT
sta gpm size	CONTROLLER/STATION NUMBER GALLONS PER MINUTE THROUGH VALVE CONTROL VALVE SIZE	

IRRIGATION SYSTEM NOTES

1. IRRIGATION SYSTEM IS DESIGNED FOR A MAXIMUM OF 16 G.P.M. AT 60 P.S.I. STATIC PRESSURE. VERIFY PRESSURE OF 60 P.S.I. AT THE POINT OF CONNECTION PRIOR TO INSTALLATION OF THE IRRIGATION SYSTEM. NOTIFY OWNERS REPRESENTATIVE IF PRESSURE EXCEEDS 80 P.S.I. OR IS LESS THAN 60 P.S.I.

2. NOTIFY OWNERS REPRESENTATIVE SIX (6) DAYS PRIOR TO INSTALLATION FOR A PRE–INSTALLATION CONFERENCE AND FIELD REVIEW COORDINATION FOR TRENCH DEPTHS, ASSEMBLY REVIEW, PRESSURE TESTS, COVERAGE TESTS, PRE– MAINTENANCE AND FINAL REVIEWS. A CONTINUITY TEST WILL BE REQUIRED FOR CONTROL WIRE STUBOUTS. NO SUBSTITUTIONS WILL BE ALLOWED WITHOUT PRIOR WRITTEN APPROVAL FROM THE OWNERS REPRESENTATIVE.

3. CONNECT TO EXISTING IRRIGATION SYSTEM WHERE SHOWN. CONNECT TO AND EXTEND ALL EXISTING LOW VOLTAGE WIRING TO NEW CONTROLLER. CONNECT TO STATION TERMINALS PER OWNERS REPRESENTATIVE.

4. INSTALL CONTROLLER ASSEMBLY WHERE INDICATED. EXACT LOCATION OF CONTROLLER ASSEMBLY TO BE DETERMINED AT JOBSITE BY OWNERS REPRESENTATIVE. CONNECT TO 120 VOLT ELECTRICAL SUPPLY PROVIDED IN IMMEDIATE VICINITY BT ELECTRICAL SECTION OF CONTRACT. USE THIN WALL METAL CONDUIT ABOVE GRADE. USE WATERPROOF CONNECTIONS FOR OUTDOOR INSTALLATION. PROGRAM CONTROLLER TO NOT EXCEED MAXIMUM FLOW RATE STATED IN NOTE NO. 1. INSTALL PER MANUFACTURERS SPECIFICATIONS. CONTROLLER SHALL BE PROPERLY GROUNDED PER ARTICLE 250 OF THE NATIONAL ELECTRIC CODE AND CONFORM TO LOCAL REGULATIONS AND MANUFACTURERS WRITTEN SPECIFICATIONS. INSTALL AS DETAILED. SEAL ALL CONDUIT HOLES WITH SILICONE OR EQUAL. PROGRAM CONTROLLER TO IRRIGATE USING MULTIPLE REPEAT CYCLES OF SHORT DURATIONS. CARE SHALL BE TAKEN TO PREVENT RUNOFF OF WATER AND SLOPE/SOIL EROSION DUE TO PROLONGED APPLICATIONS OF WATER. ALL WIRING, GROUNDING AND INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURERS WRITTEN SPECIFICATIONS.

5. INSTALL ALL EQUIPMENT AS DETAILED. INSTALL R.C.V. ID TAGS MANUFACTURED BY T. CHRISTY ENT. STANDARD SIZE, 1 1/8" HOT STAMPED BLACK LETTERS ON YELLOW BACKGROUND ON SOLENOID WIRES. LETTERS TO CONFORM TO CONTROLLER/STATION NUMBER.

6. ALL HEADS SHALL HAVE RISER ASSEMBLY AS DETAILED. INSTALL CHECK VALVES AS SHOWN ON BUBBLER RISER ASSEMBLY DETAILS WHERE LOW HEAD DRAINAGE OCCURS. NOTE ESPECIALLY TO AVOID DRAINAGE AT SIDEWALKS AND OTHER POINTS WHERE PUDDLING WILL CAUSE DAMAGE OR HAZARD.

7. ADJUST ALL BUBBLERS AT TREES AS REQUIRED FOR DEEP ROOT WATERING.

8. ALL VALVE CONTROL WIRE SHALL BE MINIMUM NO. 14 AWG COPPER UL APPROVED FOR DIRECT BURIAL IN GROUND. CONNECT WIRES USING 3M DBR/Y–6 WATERPROOF CONNECTORS PER MANUFACTURERS SPECIFICATIONS. RUN ONE (1) EXTRA CONTROL WIRE OF DIFFERENT COLOR THROUGH ALL VALVE LOCATIONS FROM THE CONTROLLER. EACH WIRE AT VALVES SHALL HAVE 24" EXCESS COILED LOOP IN VALVE BOXES. TAPE WIRES IN BUNDLES EVERY TEN FEET (10').

9. PRIOR TO INSTALLATION OF SUBSURFACE DRIP SYSTEMS ENSURE THAT THE SOIL IS ROTOTILLED TO A UNIFORM DEPTH.

10. PRIOR TO INSTALLATION OF SUBSURFACE DRIP SYSTEMS REVIEW DRIP COMPONENTS, EQUIPMENT AND INSTALLATION TECHNIQUES WITH MANUFACTURER'S REPRESENTATIVE. SPECIAL ATTENTION SHALL BE PAID WHEN COORDINATING INSTALLATION OF PLANT MATERIALS AND DRIP SYSTEM. AVOID CONFLICTS BETWEEN INSTALLATION OF SUBSURFACE DRIP AND PLANT LOCATIONS. IF CONFLICTS IN INSTALLATION LOCATIONS OCCUR, THEN PLANT INSTALLATION LOCATIONS SHALL HAVE PRIORITY.

11. DRIP IRRIGATION SYSTEMS SHOWN ARE DIAGRAMMATIC ONLY. INSTALL SPECIFIED SUBSURFACE DRIP AS DETAILED.

12. PROVIDE THE FOLLOWING MATERIALS TO THE OWNER:
    10 EACH COUPLINGS FOR SUBSURFACE DRIPLINE
    100' SUBSURFACE DRIPLINE

13. PROVIDE LITERATURE OF ALL DRIP SYSTEM COMPONENTS INCLUDING ANY PREVENTATIVE MAINTENANCE AND TROUBLE SHOOTING GUIDES TO OWNER AND REVIEW MAINTENANCE PROCEDURES INCLUDING:
    CLEANING FILTER IN WYE STRAINERS
    REPAIRING BREAKS IN PIPES AND RISERS

14. MAINTENANCE CONSIDERATIONS:
    FILTER CLEANING AND FLUSHING SHOULD START OUT AS A MONTHLY PROCEDURE(MORE FREQUENT FOR DIRTY WATER SITUATIONS) AND ADJUST TIMING AS APPROPRIATE.
    VISUALLY CHECK FOR INDICATIONS OF PIPE BREAKS OR CLOGGED EMITTERS ON A REGULAR BASIS.
    DURING WINTER MONTHS, WHEN THE SYSTEM IS NOT IN USE, THE EMITTERLINE SYSTEM(S) SHOULD BE RUN ABOUT EVERY 2 WEEKS FOR 2–4 MINUTE MINIMUM RUNTIME.

15. AT JOB COMPLETION, SUPPLY OWNER WITH TWO (2) SETS OF MATCHING Q.C.V. KEYS AND HOSE SWIVELS.

16. REFER TO SPECIFICATIONS FOR FURTHER INFORMATION REGARDING THIS PROJECT.

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DAVID LANGENDOERFER
CERTIFIED LANDSCAPE HYDRAULIC ENGINEER
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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	50% CDs	06/26/14
	ENCROACHMENT PERMIT	07/23/14
	100% CDs/PERMIT SUBMISSION	08/15/14

DATE : 15 August, 2014
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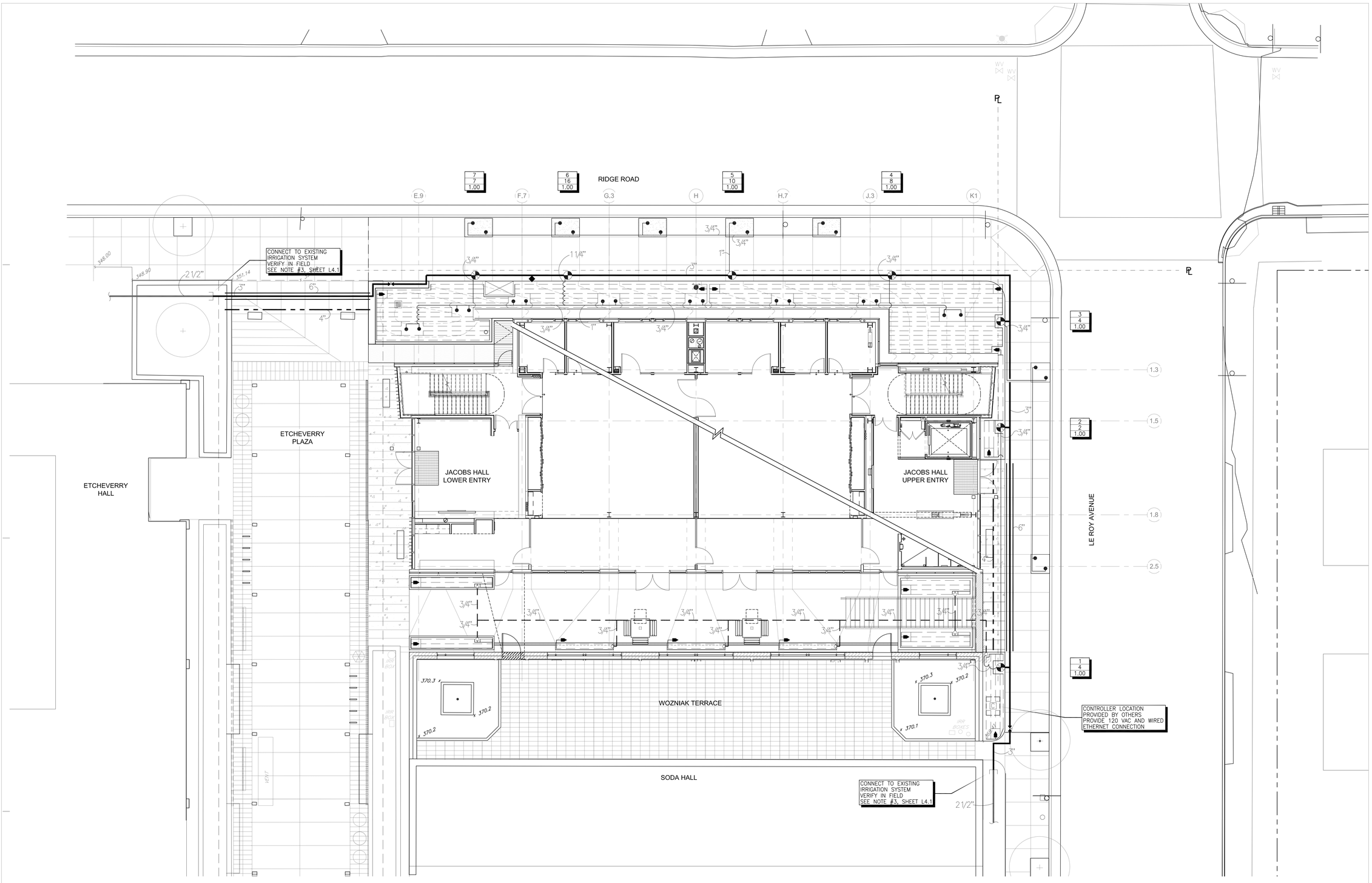
SHEET TITLE
IRRIGATION NOTES AND LEGEND

SHEET No
L4.1



NORTH

1/8"=1'-0" 8' 0' 4' 8' 16'

SEE L4.1 FOR IRRIGATION NOTES AND LEGEND
SEE L4.3 FOR IRRIGATION DETAILS

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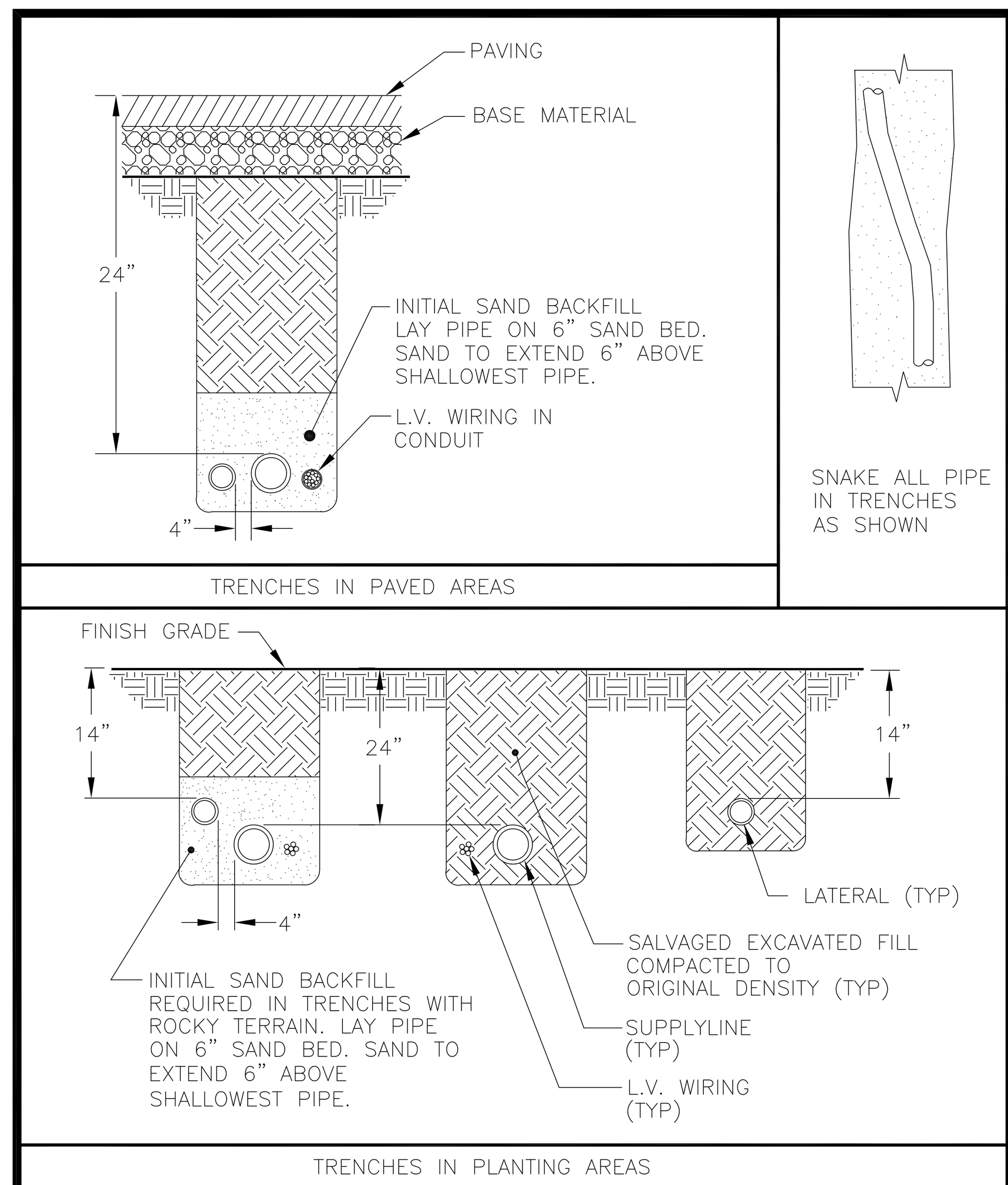
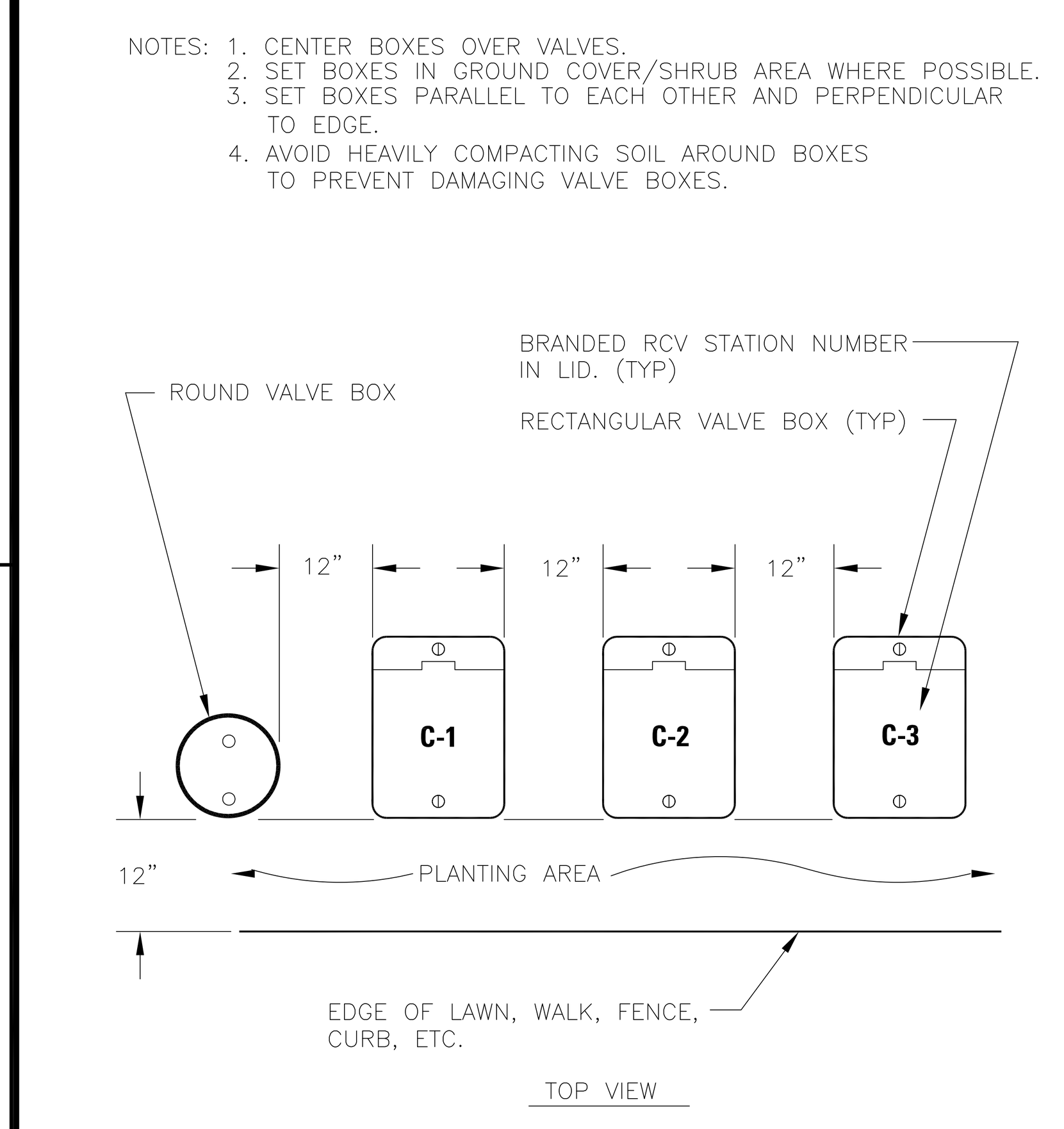
SHEET TITLE
IRRIGATION PLAN

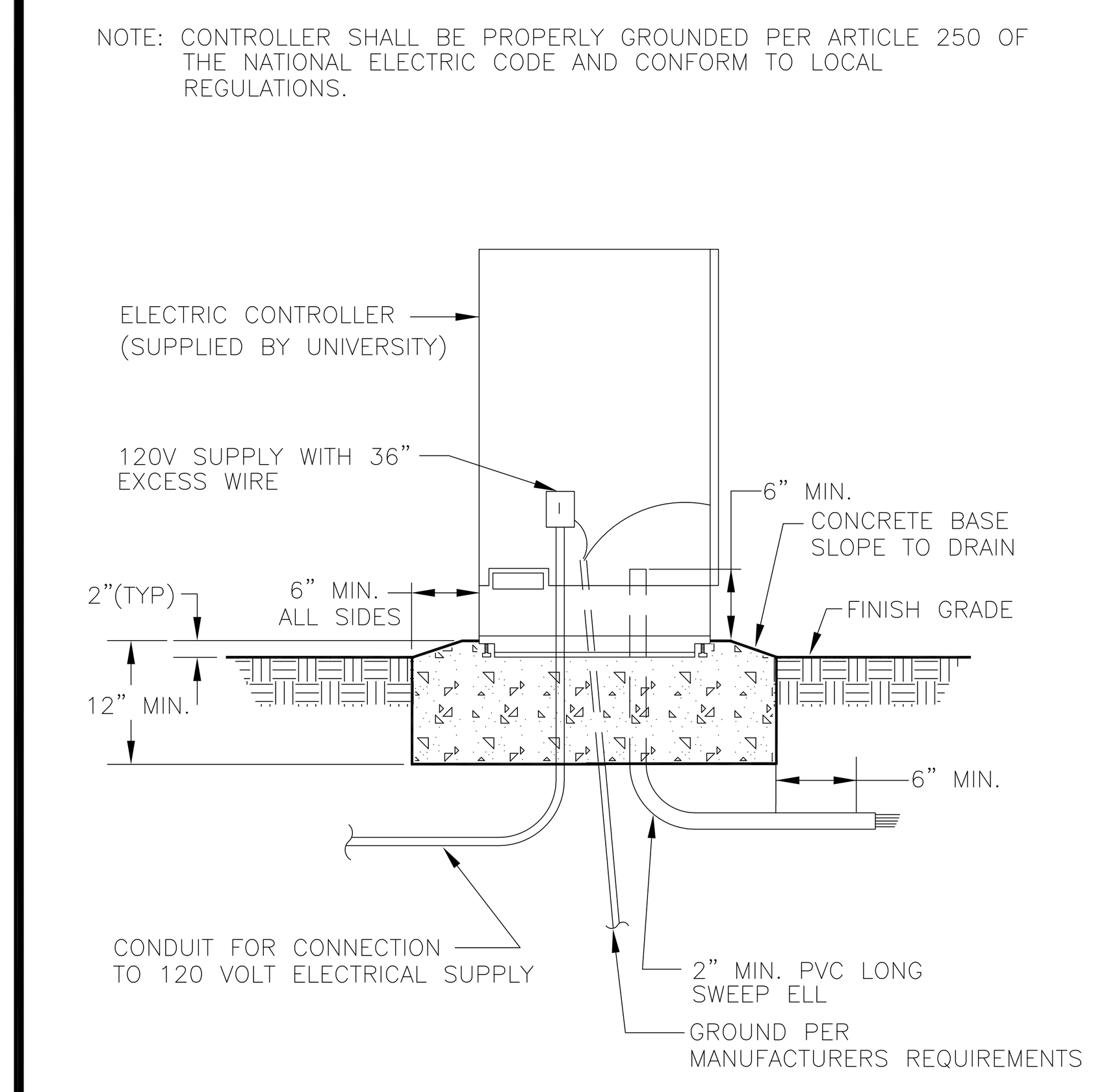
SHEET No
L4.2


PAVING
BASE MATERIAL
24"
INITIAL SAND BACKFILL LAY PIPE ON 6" SAND BED. SAND TO EXTEND 6" ABOVE SHALLOWEST PIPE.
L.V. WIRING IN CONDUIT
4"
SNAKE ALL PIPE IN TRENCHES AS SHOWN
TRENCHES IN PAVED AREAS
FINISH GRADE
14"
24"
14"
4"
LATERAL (TYP)
INITIAL SAND BACKFILL REQUIRED IN TRENCHES WITH ROCKY TERRAIN. LAY PIPE ON 6" SAND BED. SAND TO EXTEND 6" ABOVE SHALLOWEST PIPE.
SALVAGED EXCAVATED FILL COMPACTED TO ORIGINAL DENSITY (TYP)
SUPPLYLINE (TYP)
L.V. WIRING (TYP)
TRENCHES IN PLANTING AREAS

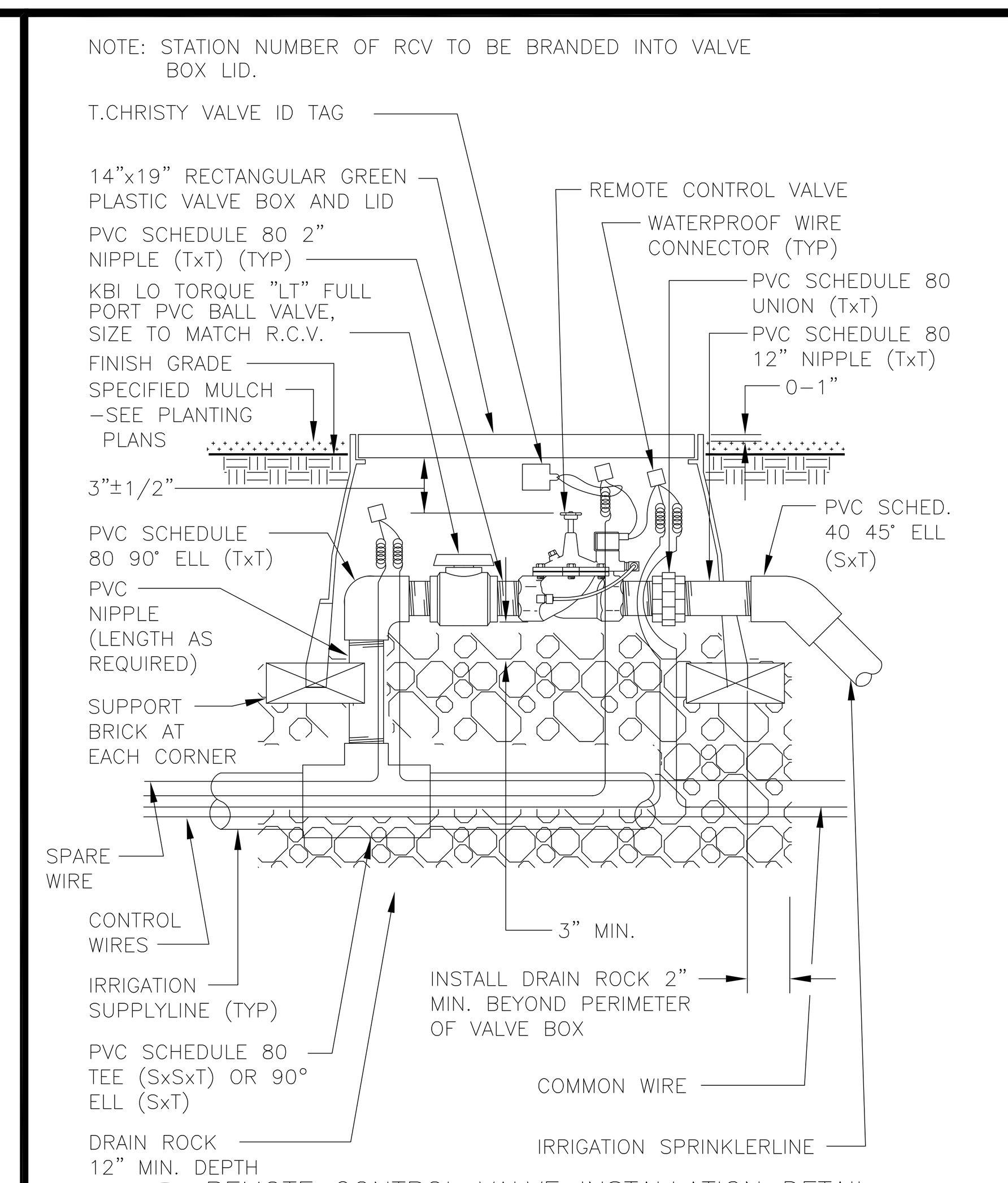
A TRENCHING DETAILS
NTS


NOTES: 1. CENTER BOXES OVER VALVES.
2. SET BOXES IN GROUND COVER/SHRUB AREA WHERE POSSIBLE.
3. SET BOXES PARALLEL TO EACH OTHER AND PERPENDICULAR TO EDGE.
4. AVOID HEAVILY COMPACTING SOIL AROUND BOXES TO PREVENT DAMAGING VALVE BOXES.
BRANDED RCV STATION NUMBER IN LID. (TYP)
ROUND VALVE BOX
RECTANGULAR VALVE BOX (TYP)
12"
12"
12"
C-1
C-2
C-3
12"
PLANTING AREA
EDGE OF LAWN, WALK, FENCE, CURB, ETC.
TOP VIEW

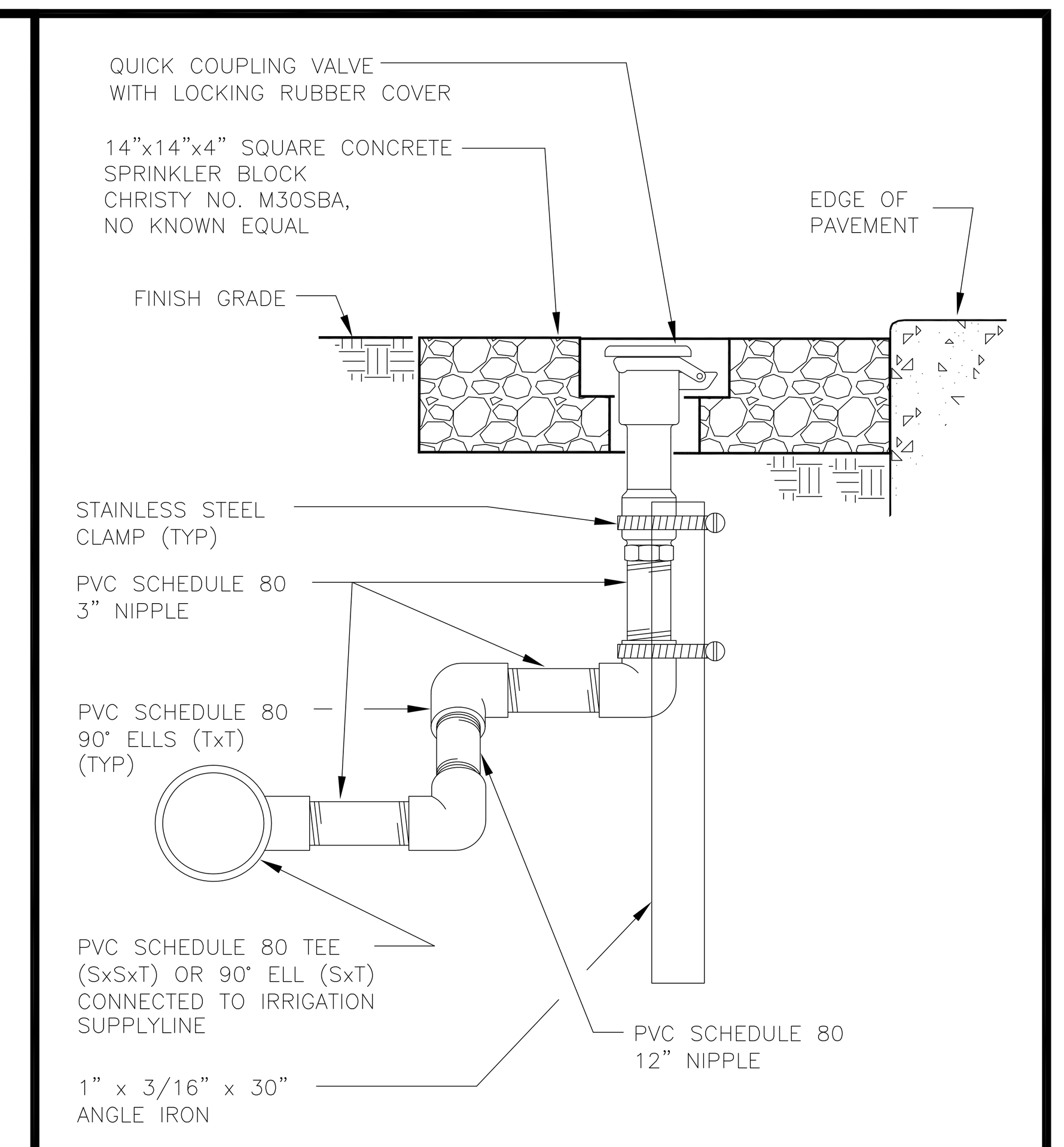
B VALVE BOX INSTALLATION DETAIL
NTS


NOTE: CONTROLLER SHALL BE PROPERLY GROUNDED PER ARTICLE 250 OF THE NATIONAL ELECTRIC CODE AND CONFORM TO LOCAL REGULATIONS.
ELECTRIC CONTROLLER (SUPPLIED BY UNIVERSITY)
120V SUPPLY WITH 36" EXCESS WIRE
6" MIN.
CONCRETE BASE SLOPE TO DRAIN
2"(TYP)
6" MIN. ALL SIDES
FINISH GRADE
12" MIN.
6" MIN.
CONDUIT FOR CONNECTION TO 120 VOLT ELECTRICAL SUPPLY
2" MIN. PVC LONG SWEEP ELL
GROUND PER MANUFACTURERS REQUIREMENTS

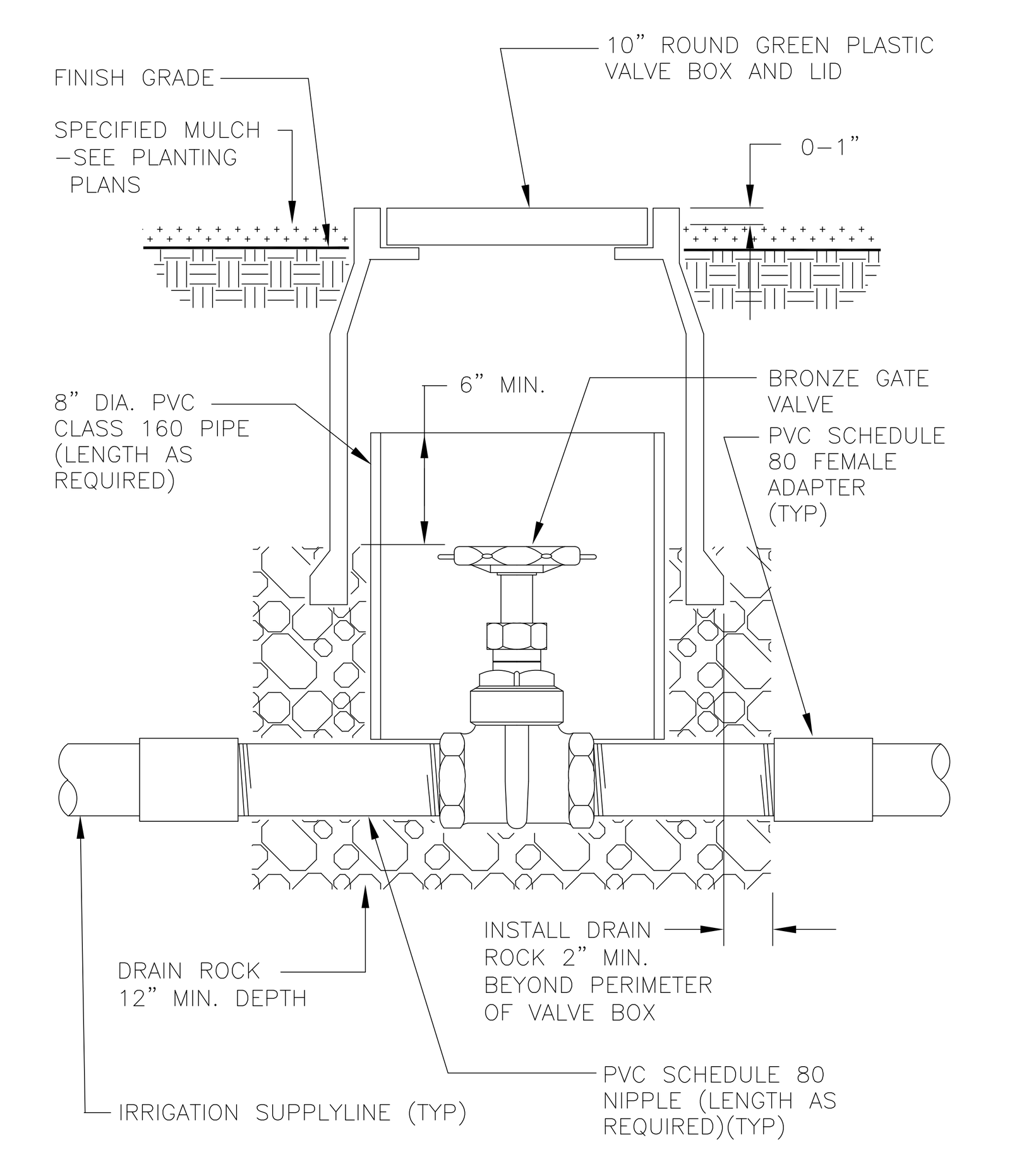
C CONTROLLER INSTALLATION DETAIL
NTS


NOTE: STATION NUMBER OF RCV TO BE BRANDED INTO VALVE BOX LID.
T.CHRISTY VALVE ID TAG
14"x19" RECTANGULAR GREEN PLASTIC VALVE BOX AND LID
REMOTE CONTROL VALVE
PVC SCHEDULE 80 2" NIPPLE (TxT) (TYP)
WATERPROOF WIRE CONNECTOR (TYP)
KBI LO TORQUE "LT" FULL PORT PVC BALL VALVE, SIZE TO MATCH R.C.V.
PVC SCHEDULE 80 UNION (TxT)
FINISH GRADE
PVC SCHEDULE 80 12" NIPPLE (TxT)
SPECIFIED MULCH -SEE PLANTING PLANS
0-1"
3"±1/2"
PVC SCHED. 40 45° ELL (SxT)
PVC SCHEDULE 80 90° ELL (TxT)
PVC NIPPLE (LENGTH AS REQUIRED)
SUPPORT BRICK AT EACH CORNER
SPARE WIRE
CONTROL WIRES
3" MIN.
IRRIGATION SUPPLYLINE (TYP)
INSTALL DRAIN ROCK 2" MIN. BEYOND PERIMETER OF VALVE BOX
PVC SCHEDULE 80 TEE (SxSxT) OR 90° ELL (SxT)
COMMON WIRE
DRAIN ROCK 12" MIN. DEPTH
IRRIGATION SPRINKLERLINE

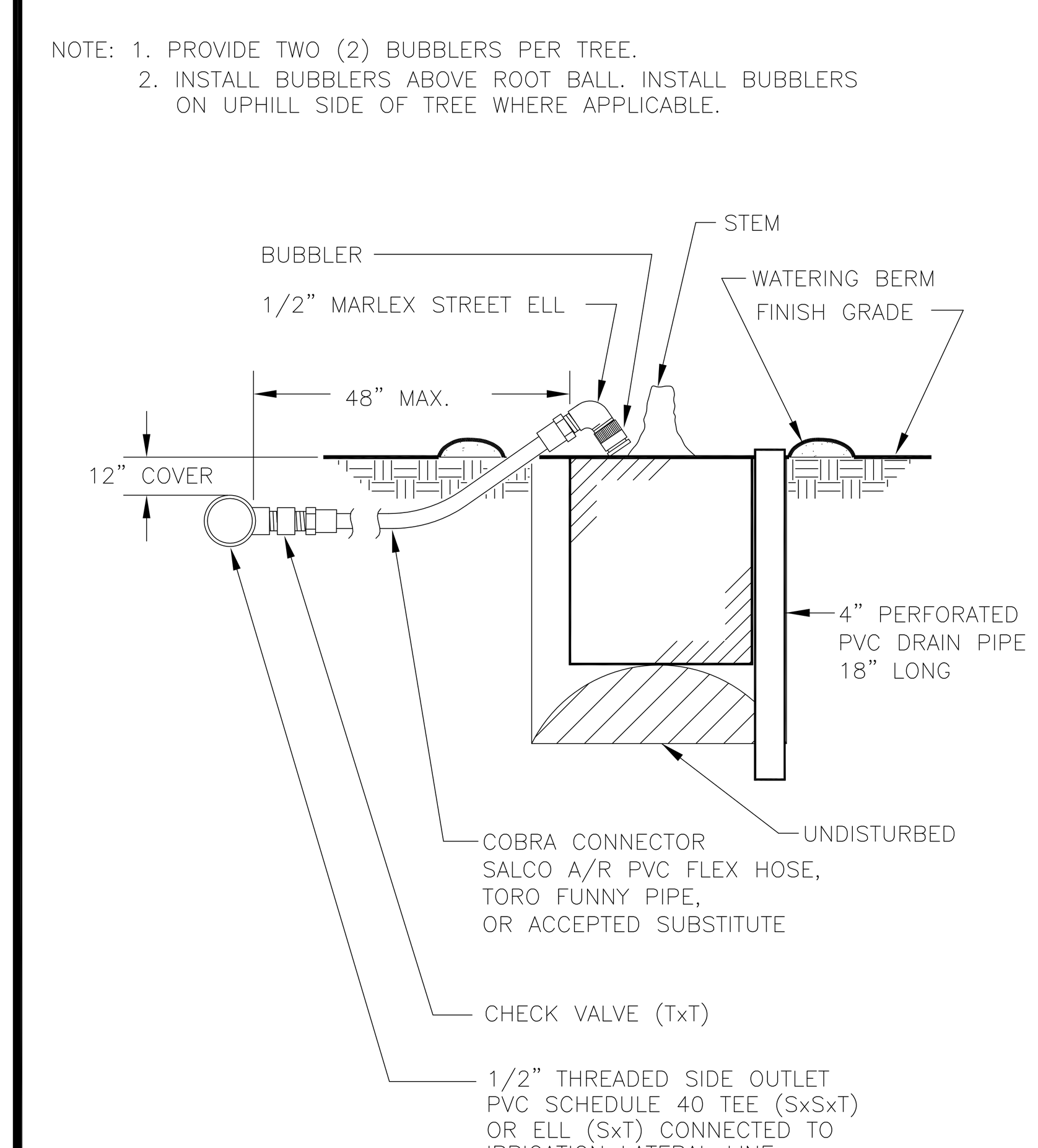
D REMOTE CONTROL VALVE INSTALLATION DETAIL
NTS


QUICK COUPLING VALVE WITH LOCKING RUBBER COVER
14"x14"x4" SQUARE CONCRETE SPRINKLER BLOCK CHRISTY NO. M30SBA, OR KNOWN EQUAL
EDGE OF PAVEMENT
FINISH GRADE
STAINLESS STEEL CLAMP (TYP)
PVC SCHEDULE 80 3" NIPPLE
PVC SCHEDULE 80 90° ELLS (TxT) (TYP)
PVC SCHEDULE 80 TEE (SxSxT) OR 90° ELL (SxT) CONNECTED TO IRRIGATION SUPPLYLINE
PVC SCHEDULE 80 12" NIPPLE
1" x 3/16" x 30" ANGLE IRON

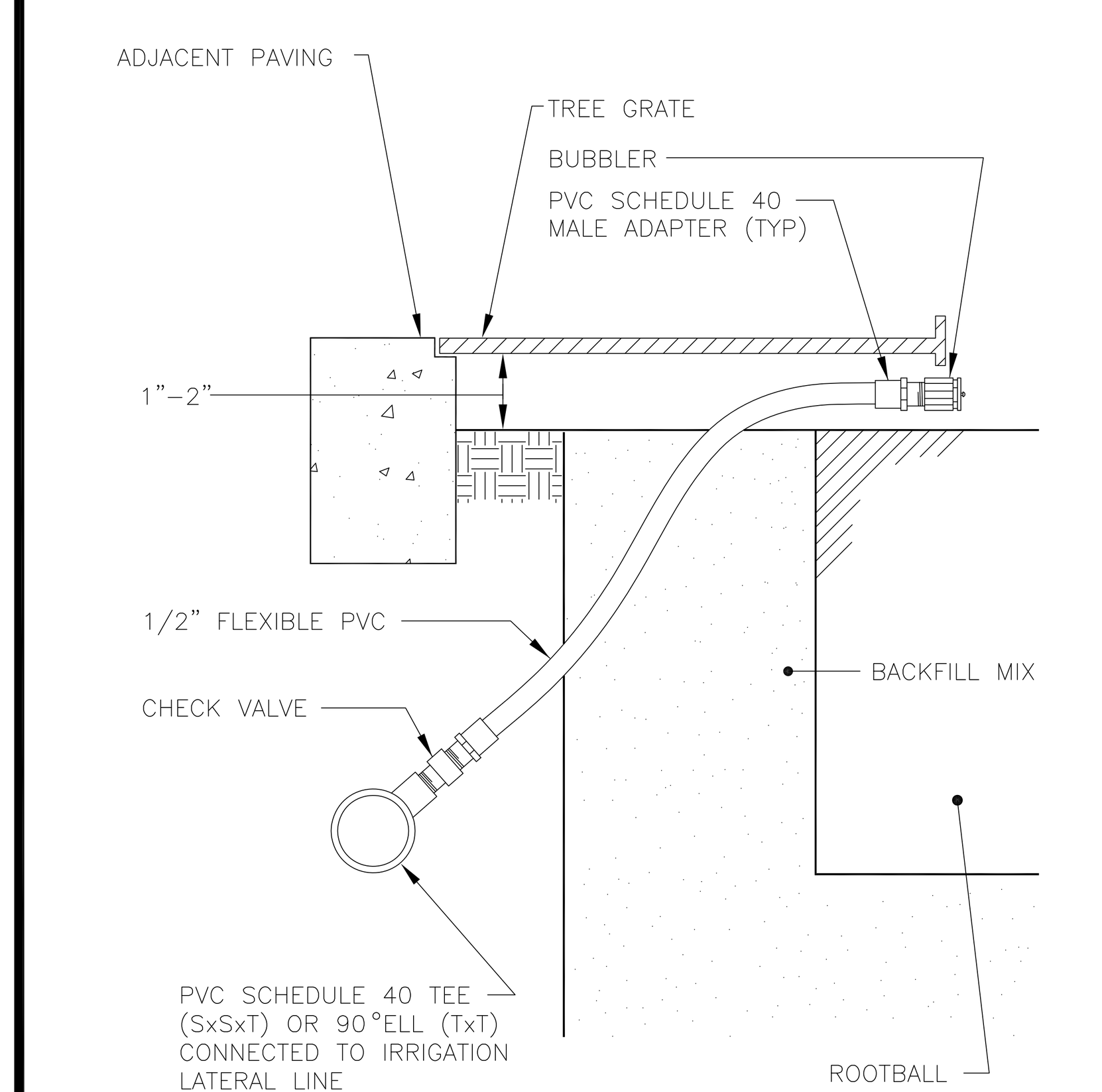
E QUICK COUPLING VALVE RISER ASSEMBLY DETAIL
NTS


FINISH GRADE
10" ROUND GREEN PLASTIC VALVE BOX AND LID
SPECIFIED MULCH -SEE PLANTING PLANS
0-1"
6" MIN.
8" DIA. PVC CLASS 160 PIPE (LENGTH AS REQUIRED)
BRONZE GATE VALVE
PVC SCHEDULE 80 FEMALE ADAPTER (TYP)
DRAIN ROCK 12" MIN. DEPTH
INSTALL DRAIN ROCK 2" MIN. BEYOND PERIMETER OF VALVE BOX
PVC SCHEDULE 80 NIPPLE (LENGTH AS REQUIRED)(TYP)
IRRIGATION SUPPLYLINE (TYP)

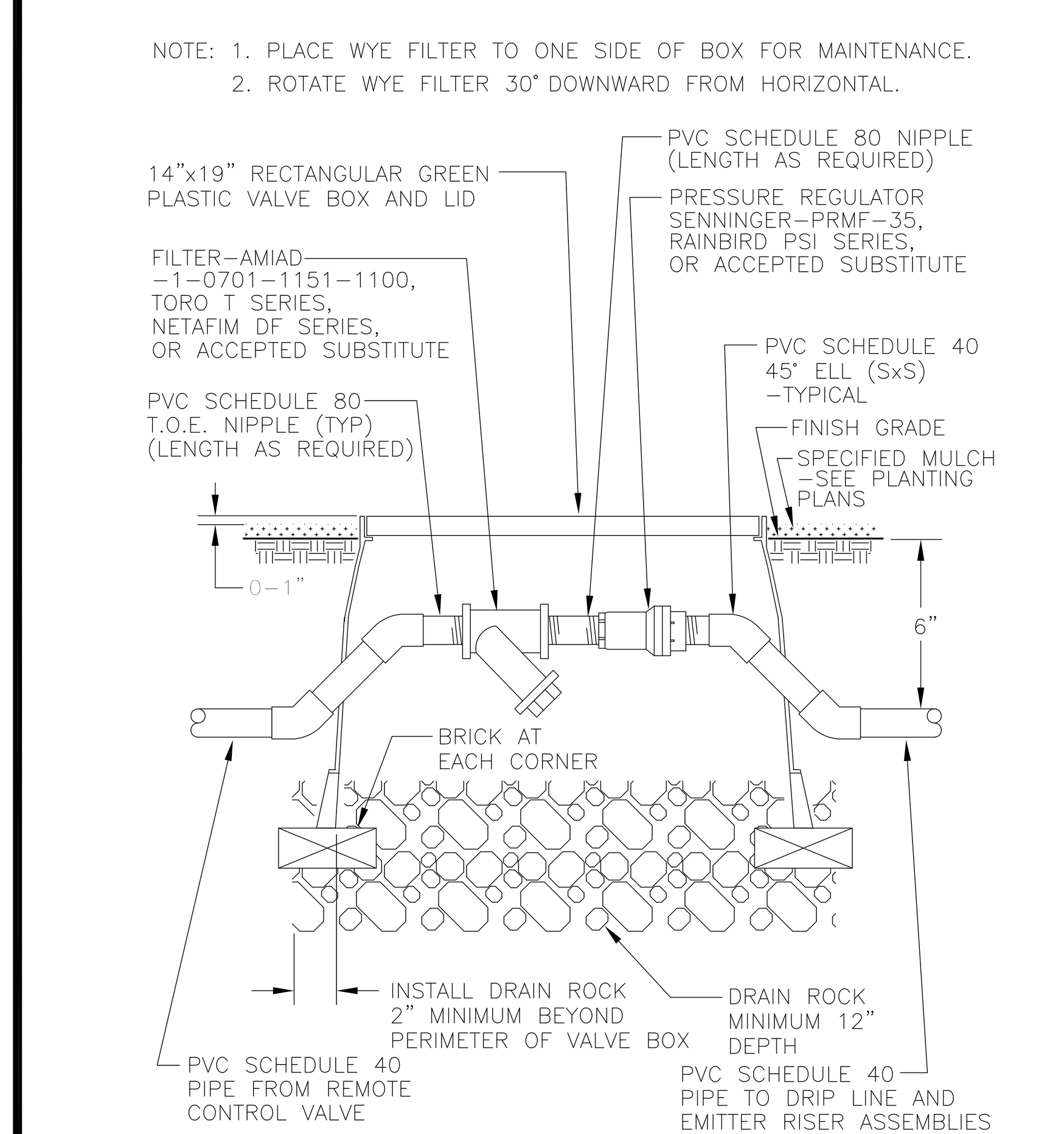
F GATE VALVE INSTALLATION DETAIL
NTS


NOTE: 1. PROVIDE TWO (2) BUBBLERS PER TREE.
2. INSTALL BUBBLERS ABOVE ROOT BALL. INSTALL BUBBLERS ON UPHILL SIDE OF TREE WHERE APPLICABLE.
STEM
BUBBLER
WATERING BERM
1/2" MARLEX STREET ELL
FINISH GRADE
48" MAX.
12" COVER
4" PERFORATED PVC DRAIN PIPE 18" LONG
UNDISTURBED
COBRA CONNECTOR SALCO A/R PVC FLEX HOSE, TORO FUNNY PIPE, OR ACCEPTED SUBSTITUTE
CHECK VALVE (TxT)
1/2" THREADED SIDE OUTLET PVC SCHEDULE 40 TEE (SxSxT) OR ELL (SxT) CONNECTED TO IRRIGATION LATERAL LINE

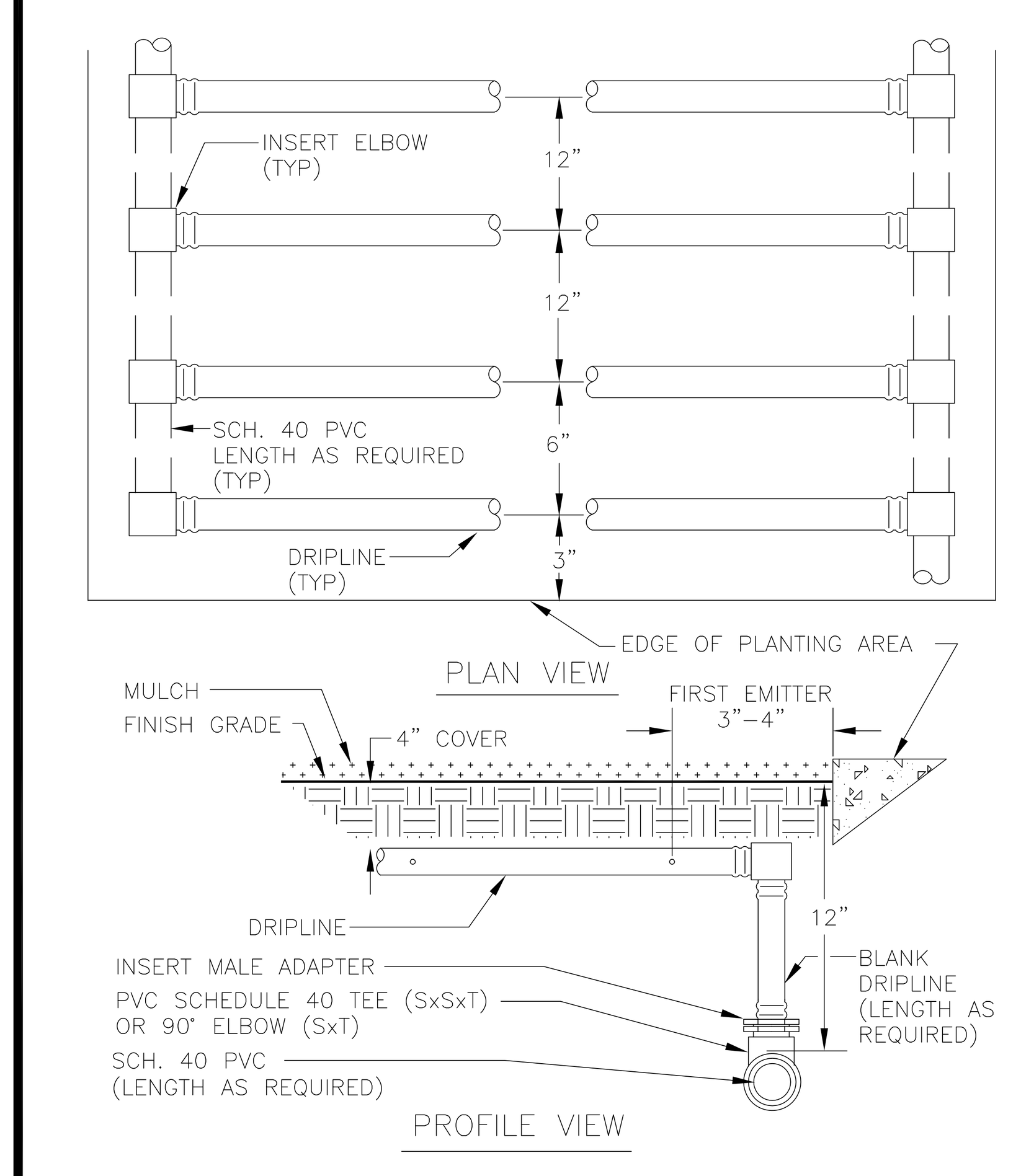
G BUBBLER INSTALLATION DETAIL FOR TREES
NTS



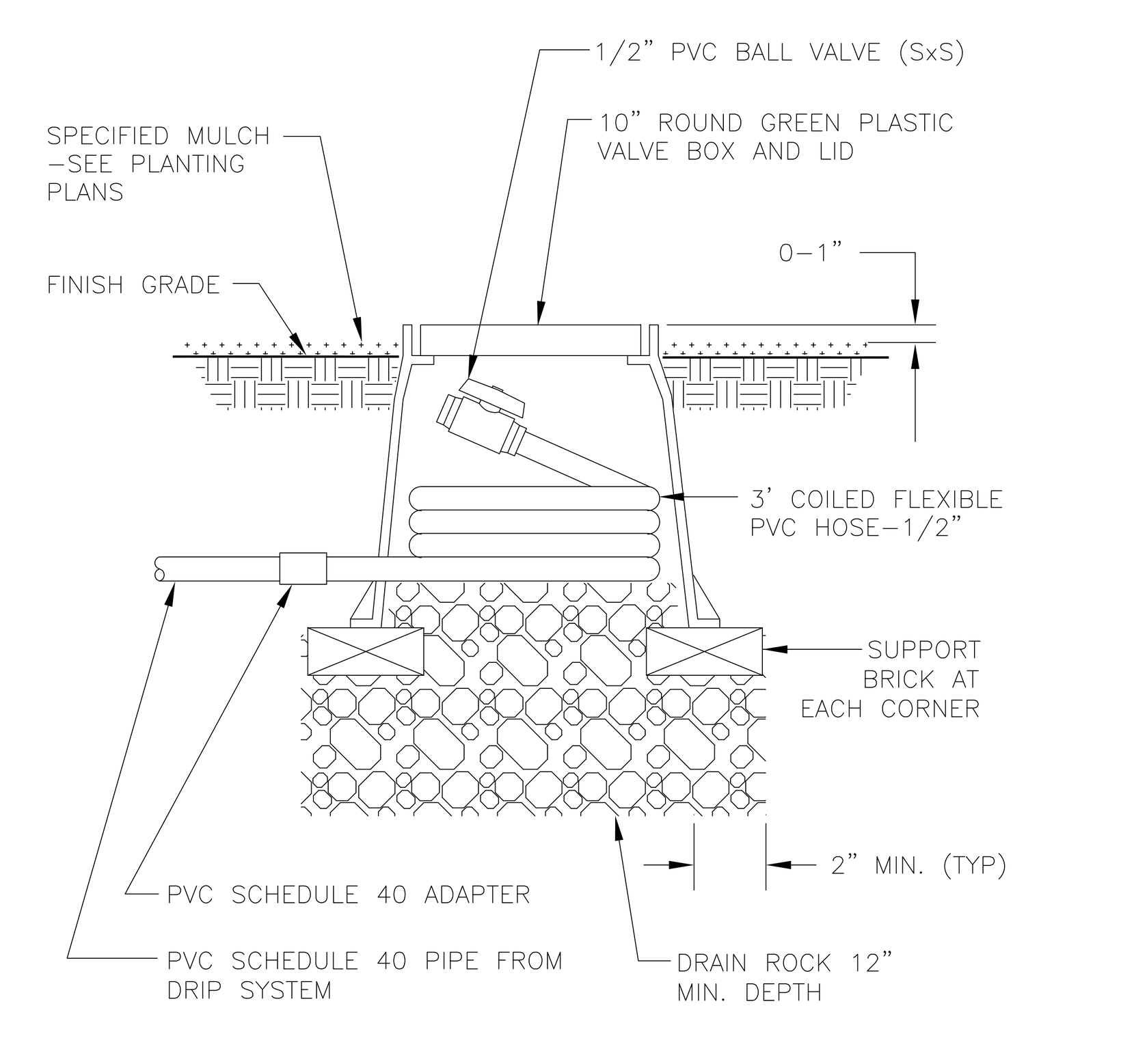
H BUBBLER INSTALLATION DETAIL FOR TREE IN TREE GRATE
NTS


NOTE: 1. PLACE WYE FILTER TO ONE SIDE OF BOX FOR MAINTENANCE.
2. ROTATE WYE FILTER 30° DOWNWARD FROM HORIZONTAL.
14"x19" RECTANGULAR GREEN PLASTIC VALVE BOX AND LID
PVC SCHEDULE 80 NIPPLE (LENGTH AS REQUIRED)
FILTER-AMIAD -1-0701-1151-1100, TORO T SERIES, NETAFIM DF SERIES, OR ACCEPTED SUBSTITUTE
PRESSURE REGULATOR SENNINGER-PRMF-35, RAINBIRD PSI SERIES, OR ACCEPTED SUBSTITUTE
PVC SCHEDULE 80 T.O.E. NIPPLE (TYP) (LENGTH AS REQUIRED)
PVC SCHEDULE 40 45° ELL (SxS) -TYPICAL
FINISH GRADE
SPECIFIED MULCH -SEE PLANTING PLANS
0-1"
6"
BRICK AT EACH CORNER
PVC SCHEDULE 40 PIPE FROM REMOTE CONTROL VALVE
INSTALL DRAIN ROCK 2" MINIMUM BEYOND PERIMETER OF VALVE BOX
DRAIN ROCK MINIMUM 12" DEPTH
PVC SCHEDULE 40 PIPE TO DRIP LINE AND EMITTER RISER ASSEMBLIES

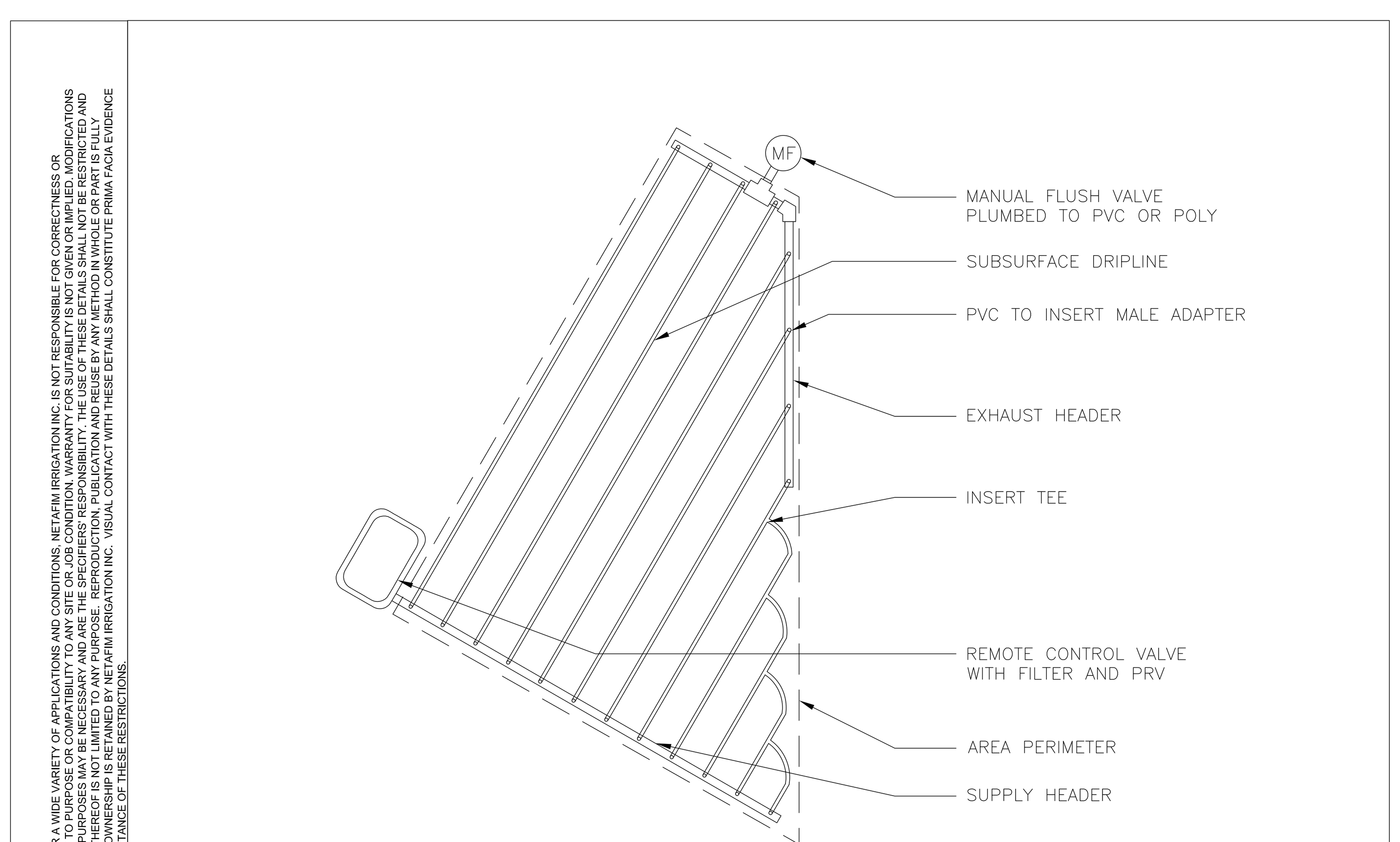
I DRIP FILTER & PRESSURE REDUCER ASSEMBLY
NTS


INSERT ELBOW (TYP)
12"
12"
SCH. 40 PVC LENGTH AS REQUIRED (TYP)
6"
DRIPLINE (TYP)
3"
EDGE OF PLANTING AREA
PLAN VIEW
MULCH
FIRST EMITTER 3"-4"
FINISH GRADE
4" COVER
DRIPLINE
12"
INSERT MALE ADAPTER
BLANK DRIPLINE (LENGTH AS REQUIRED)
PVC SCHEDULE 40 TEE (SxSxT) OR 90° ELBOW (SxT)
SCH. 40 PVC (LENGTH AS REQUIRED)
PROFILE VIEW

J SUBSURFACE DRIP INSTALLATION DETAIL
NTS


1/2" PVC BALL VALVE (SxS)
SPECIFIED MULCH -SEE PLANTING PLANS
10" ROUND GREEN PLASTIC VALVE BOX AND LID
FINISH GRADE
0-1"
3' COILED FLEXIBLE PVC HOSE-1/2"
SUPPORT BRICK AT EACH CORNER
2" MIN. (TYP)
PVC SCHEDULE 40 ADAPTER
PVC SCHEDULE 40 PIPE FROM DRIP SYSTEM
DRAIN ROCK 12" MIN. DEPTH

K FLUSH VALVE INSTALLATION DETAIL
NTS



L Techline® CV IRREGULAR AREAS: Triangular
NOT TO SCALE
DETAIL – C104

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DAVID LANGENDORF
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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

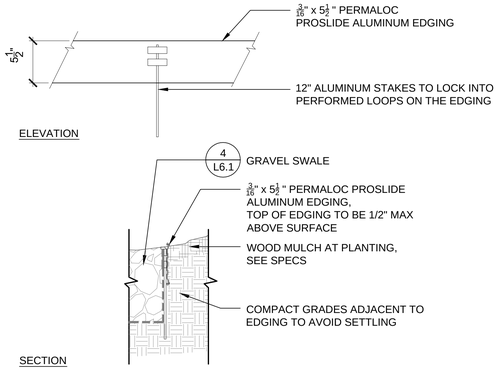
No	REVISION	DATE
	50% CDs	06/26/14
	ENCROACHMENT PERMIT	07/23/14
	100% CDs/PERMIT SUBMISSION	08/15/14

DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : AS SHOWN

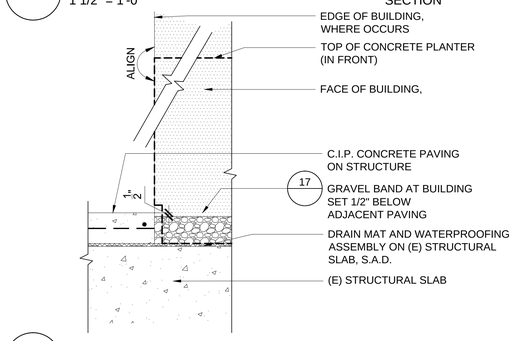
SHEET TITLE
IRRIGATION DETAILS

I.S.C. GROUP, INC. IRRIGATION SYSTEM CONSULTANTS
MEMBER • AMERICAN SOCIETY OF IRRIGATION CONSULTANTS
340 Church Street, Livermore, CA 94550
Phone 925/371-8230 Fax 925/371-8240
14003-100

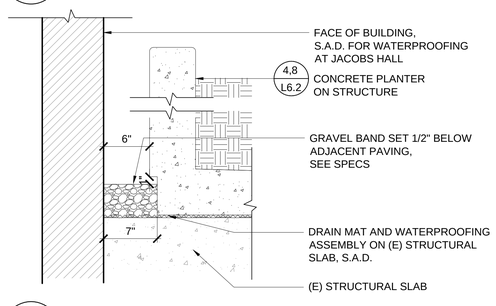
SHEET No
L4.3



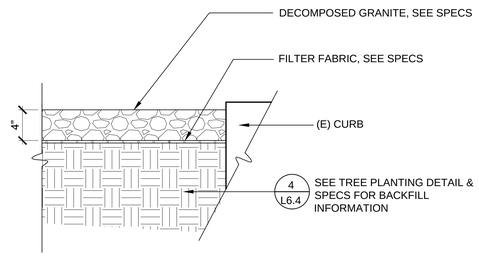
19 METAL EDGE @ GRAVEL SWALE
1 1/2" = 1'-0" SECTION



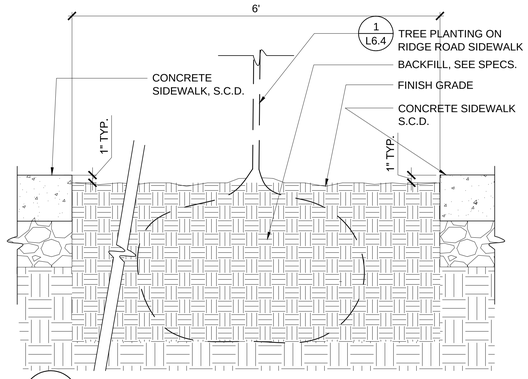
18 GRAVEL BAND @ BUILDING
1 1/2" = 1'-0" SECTION



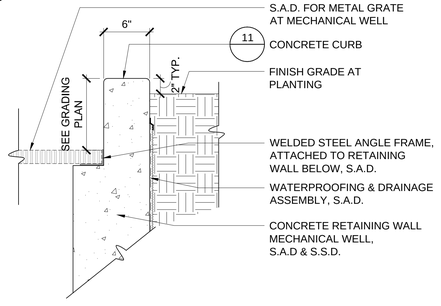
17 GRAVEL BAND @ BUILDING
1 1/2" = 1'-0" SECTION



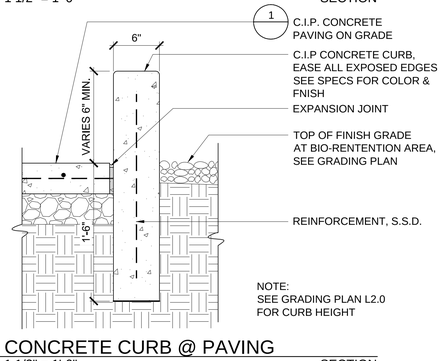
16 DECOMPOSED GRANITE @ LER ROY AVE. TREE WELL
1 1/2" = 1'-0" SECTION



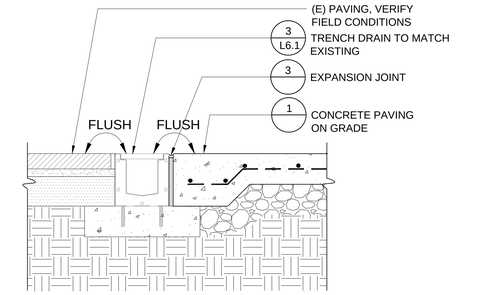
13 CONCRETE SIDEWALK @ RIDGE ROAD TREE WELL
1 1/2" = 1'-0" SECTION



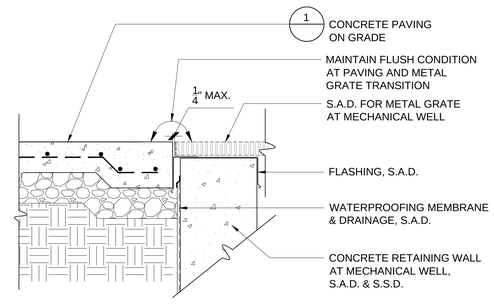
12 CONCRETE CURB @ METAL GRATE
1 1/2" = 1'-0" SECTION



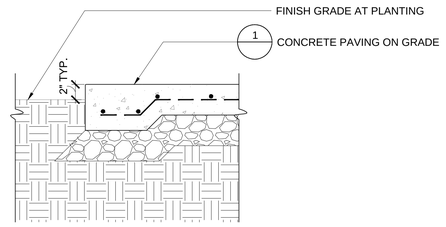
11 CONCRETE CURB @ PAVING
1 1/2" = 1'-0" SECTION



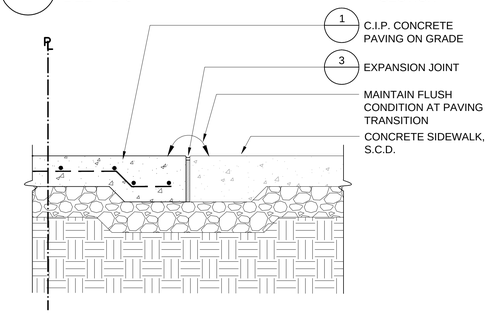
9 CONCRETE PAVING @ TRENCH DRAIN
1 1/2" = 1'-0" SECTION



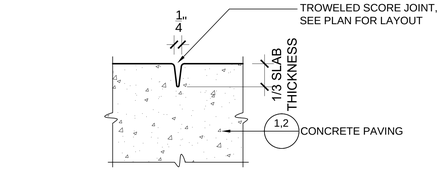
8 CONCRETE PAVING @ METAL GRATE
1 1/2" = 1'-0" SECTION



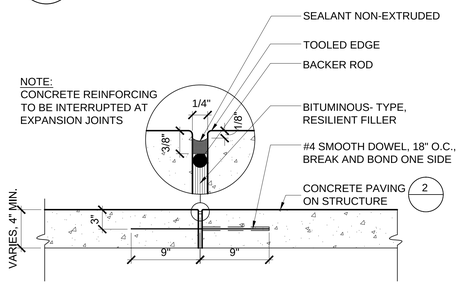
7 CONCRETE PAVING @ PLANTING TYP.
1 1/2" = 1'-0" SECTION



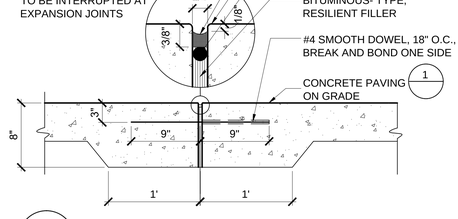
6 CONCRETE PAVING @ SIDEWALK
1 1/2" = 1'-0" SECTION



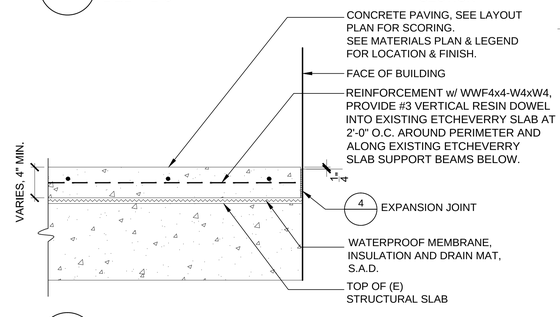
5 SCORE JOINT
NTS SECTION



4 EXPANSION JOINT ON STRUCTURE
1 1/2" = 1'-0" SECTION

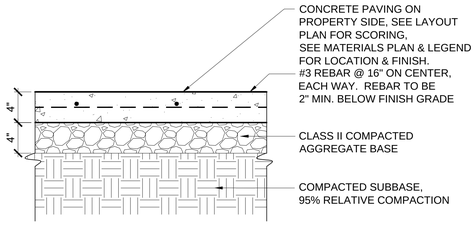


3 EXPANSION JOINT ON GRADE
1 1/2" = 1'-0" SECTION



2 CONCRETE PAVING ON STRUCTURE
1 1/2" = 1'-0" SECTION

NOTES:
1. DETAIL FOR IN-SITE ON GRADE CONCRETE PAVING ONLY
2. SEE CIVIL FOR CITY SIDEWALK & STANDARDS



1 CONCRETE PAVING ON GRADE
1 1/2" = 1'-0" SECTION

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PROJECT

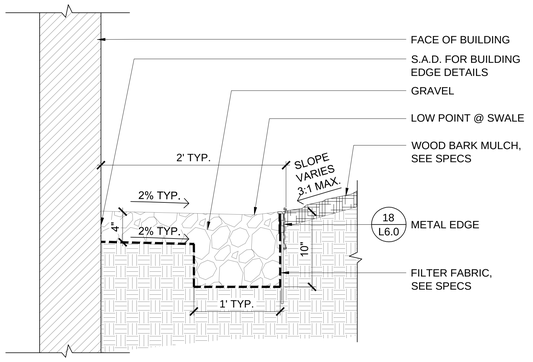
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	FIRE MARSHALL SUBMISSION	12/20/13
	DSA SUBMISSION	01/29/14
	CM CONTRACTOR RFP	03/31/14
	50% CDs	06/26/14
	ENCROACHMENT PERMIT SUBMISSION	07/23/14
	100% CDs / PERMIT SUBMISSION	08/15/14

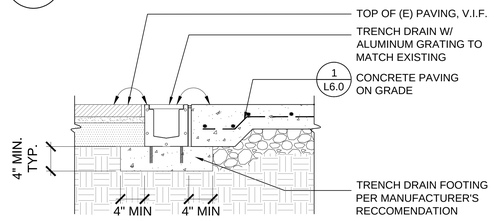
DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : AS SHOWN

SHEET TITLE
LANDSCAPE DETAILS PAVING

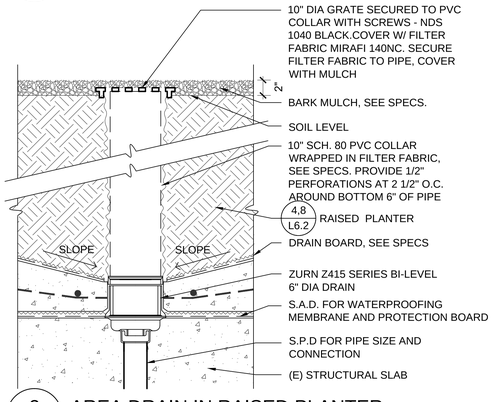
SHEET No
L6.0



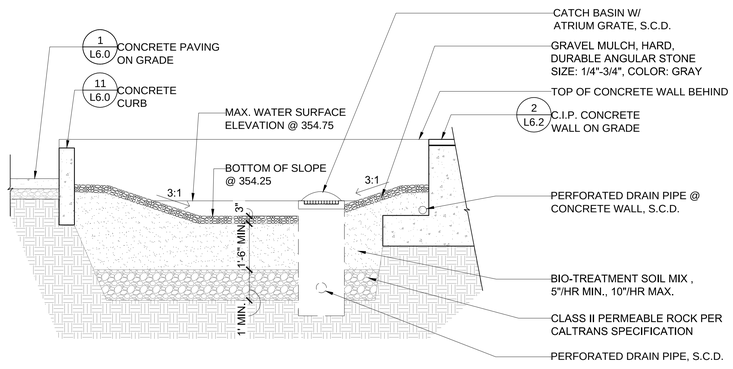
4 GRAVEL SWALE @ NORTH BUILDING EDGE
1 1/2" = 1'-0" SECTION



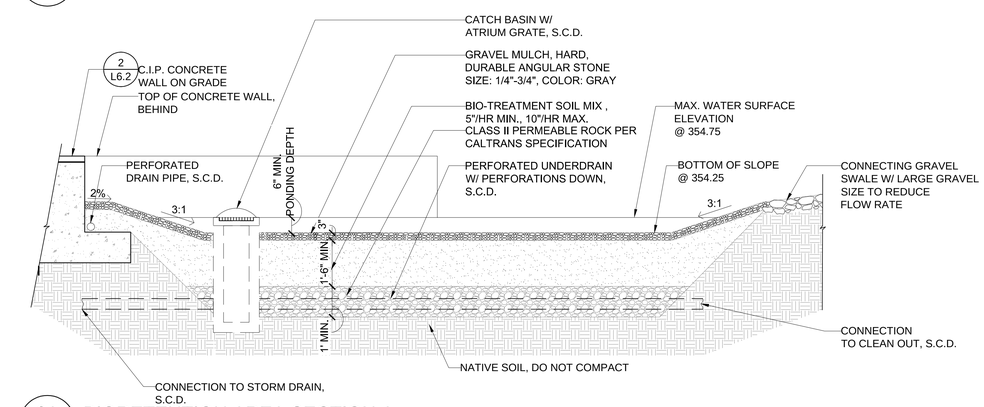
3 TRENCH DRAIN @ ETCHEVERRY PLAZA
N.T.S. SECTION



2 AREA DRAIN IN RAISED PLANTER
1/8" = 1'-0" SECTION



6B BIORETENTION AREA SECTION B
1/2"=1'-0" SECTION



6A BIORETENTION AREA SECTION A
1/2"=1'-0" SECTION

- NOT USED -

1 AREA DRAIN IN PLANTING ON GRADE
N.T.S. SECTION

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	DSA SUBMISSION	01/29/14
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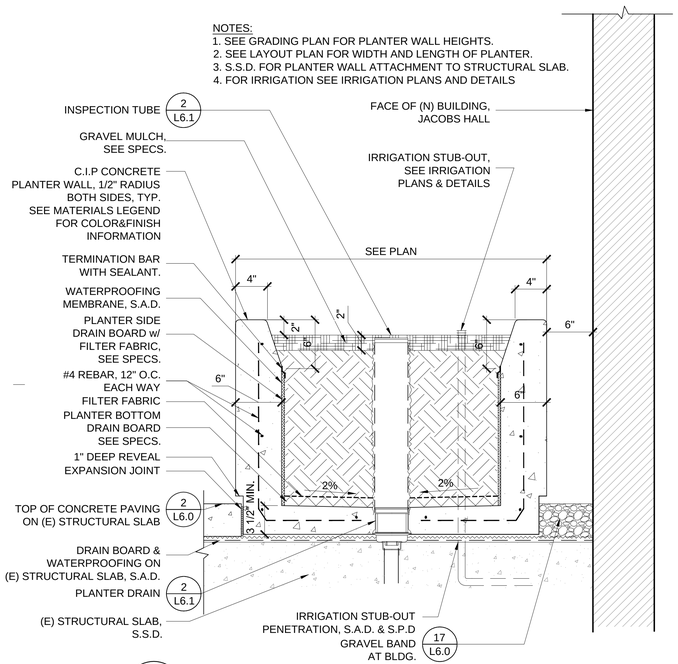
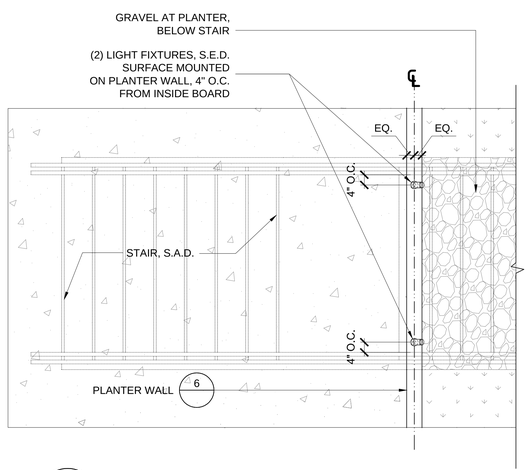
PERMIT No :
SCALE : AS SHOWN

SHEET TITLE
LANDSCAPE DETAILS DRAINAGE

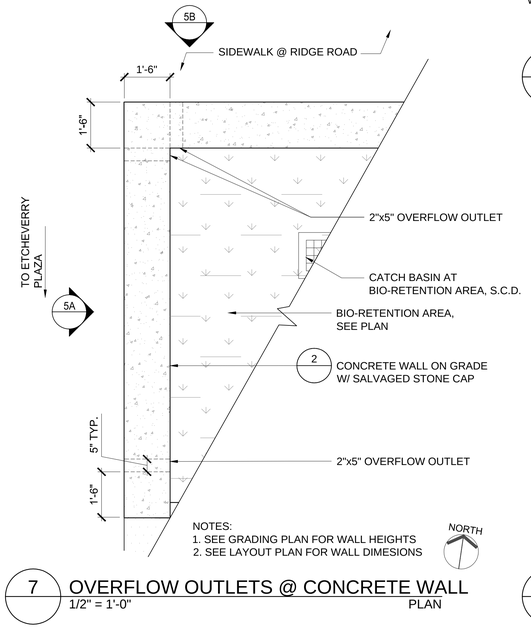
SHEET No
L6.1



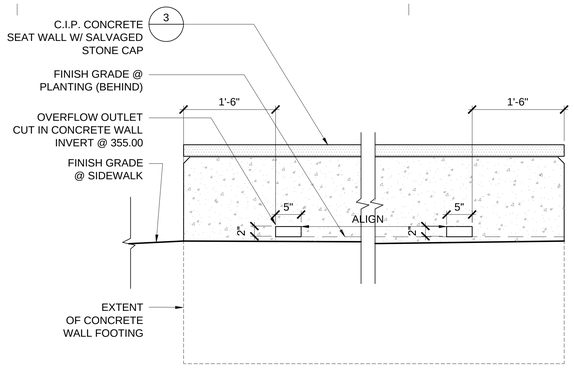
9 PLANTER ON STRUCTURE (TYPE 2)
1 1/2" = 1'-0" SECTION



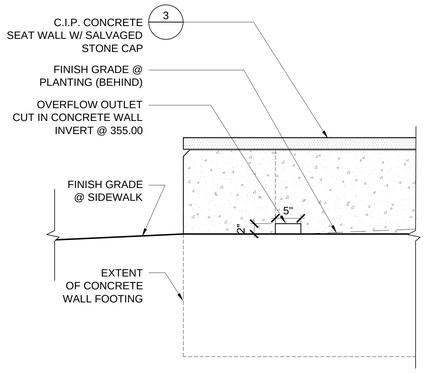
8 LIGHT FIXTURE ON PLANTER WALL
1/2" = 1'-0" PLAN



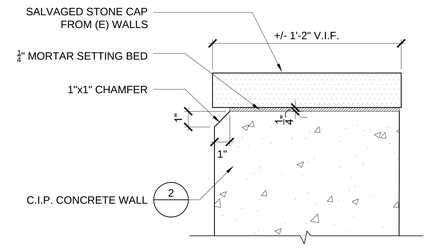
7 OVERFLOW OUTLETS @ CONCRETE WALL
1/2" = 1'-0" PLAN



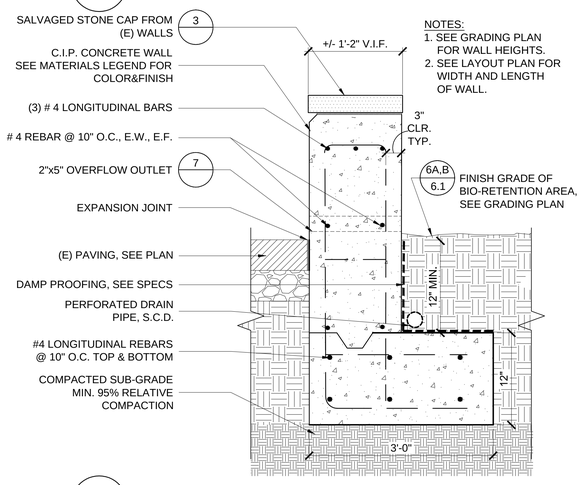
5B OVERFLOW OUTLET @ CONC. WALL-WEST SIDE
1" = 1'-0" ELEVATION



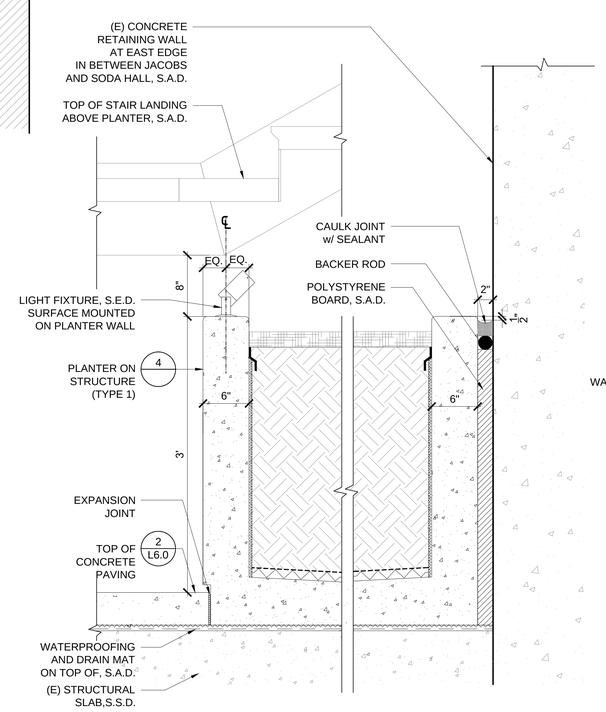
5A OVERFLOW OUTLET @ CONC. WALL-NORTH SIDE
1" = 1'-0" ELEVATION



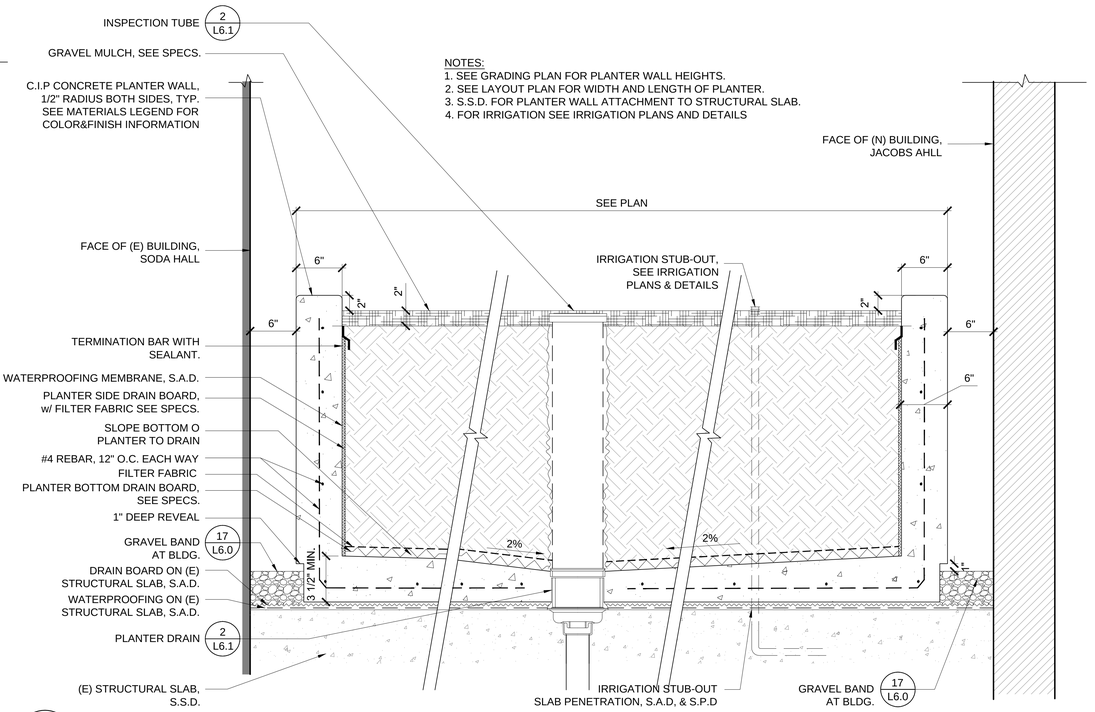
3 STONE CAP ON CONC. WALL
3" = 1'-0" SECTION



2 C.I.P. CONCRETE WALL ON GRADE
1 1/2" = 1'-0" SECTION



6 PLANTER (TYPE 1) - DETAIL SECTION
1 1/2" = 1'-0" SECTION



4 PLANTER ON STRUCTURE (TYPE 1) - DETAIL SECTION
1 1/2" = 1'-0" SECTION

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	FIRE MARSHALL SUBMISSION	12/20/13
	DSA SUBMISSION	01/29/14
	CM CONTRACTOR RFP	03/31/14
	50% CDs	06/26/14
	ENCROACHMENT PERMIT SUBMISSION	07/23/14
	100% CDs / PERMIT SUBMISSION	08/15/14

DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : AS SHOWN

SHEET TITLE
LANDSCAPE DETAILS WALLS

SHEET No
L6.2

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PROJECT

JACOBS HALL

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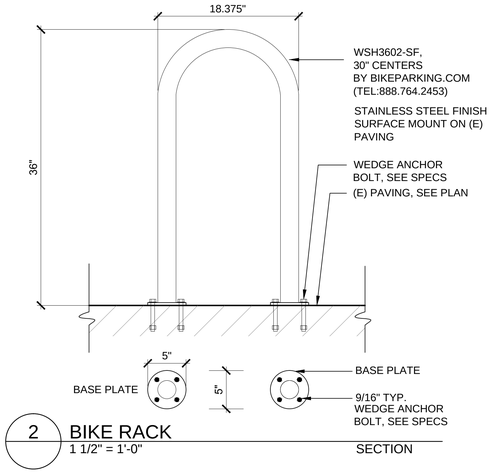
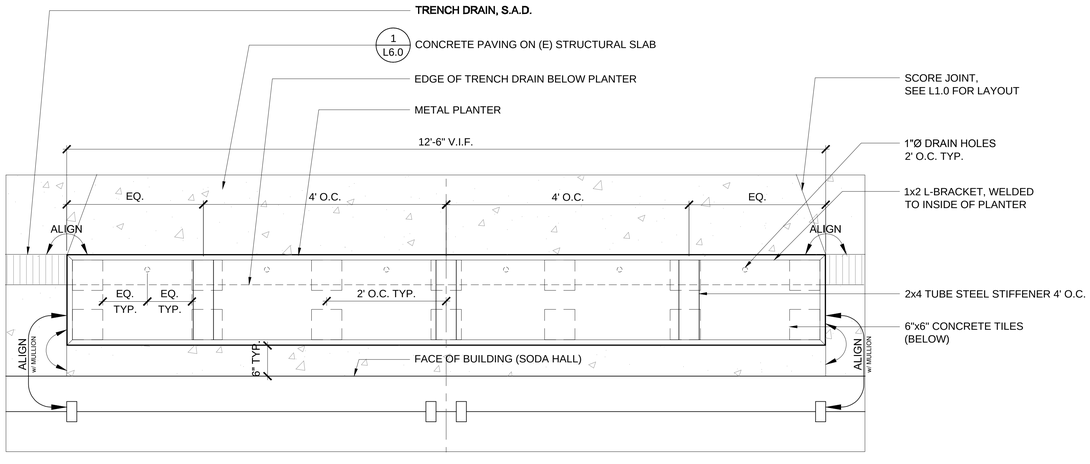
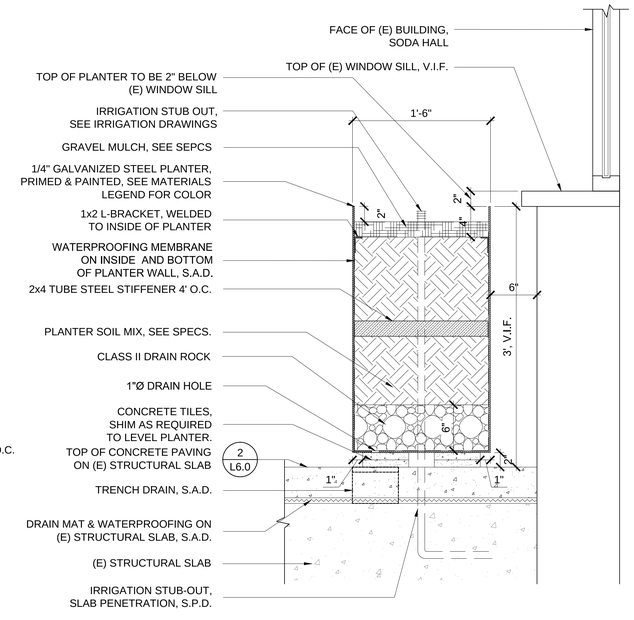


2 BIKE RACK
1 1/2" = 1'-0"
SECTION



4 METAL PLANTER
1" = 1'-0"
PLAN



1 METAL PLANTER
1 1/2" = 1'-0"
SECTION

No	REVISION	DATE
	FIRE MARSHALL SUBMISSION	12/20/13
	DSA SUBMISSION	01/29/14
	CM CONTRACTOR RFP	03/31/14
	50% CDs	06/26/14
	ENCROACHMENT PERMIT SUBMISSION	07/23/14
	100% CDs / PERMIT SUBMISSION	08/15/14

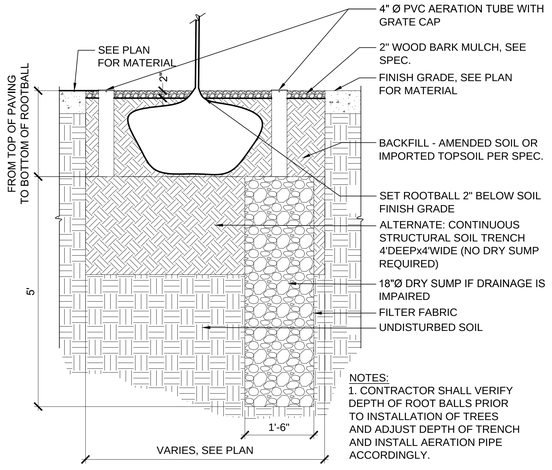
DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : AS SHOWN

SHEET TITLE

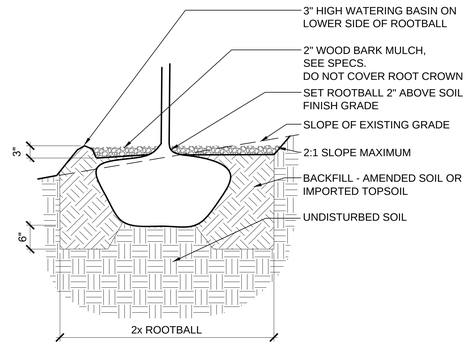
LANDSCAPE DETAILS FURNITURE

SHEET No

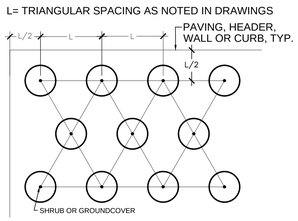
L6.3



7 TREE AERATION (IF REQUIRED)
3/4"=1'-0" SECTION

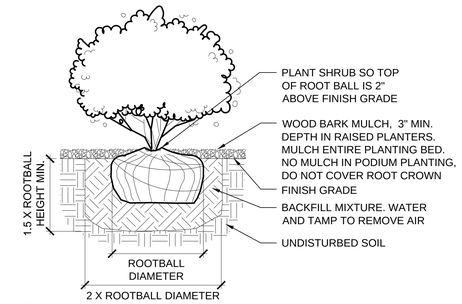


5 TREE PLANTING ON SLOPE
N.T.S. SECTION

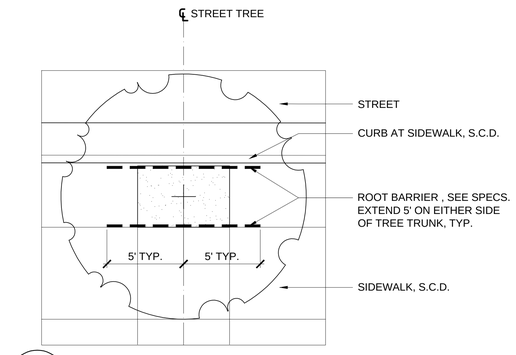


3 SHRUB TRIANGULAR SPACING
1/4" = 1'-0" SECTION

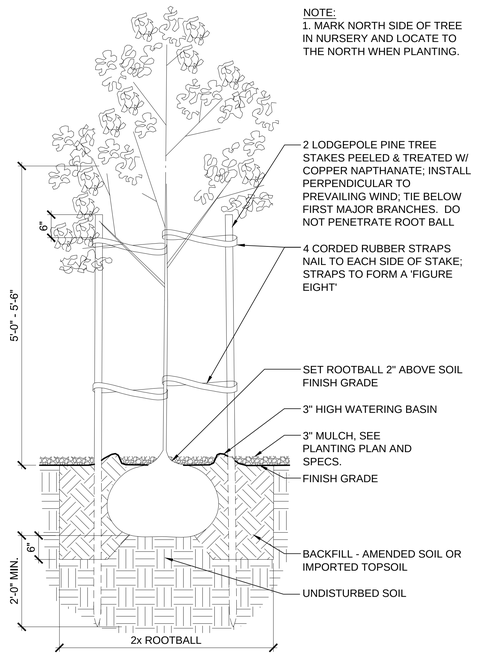
NOTE:
IN CONTAINER GROWN SHRUBS LOOSEN ROOTS AT SIDES OF ROOTBALL.



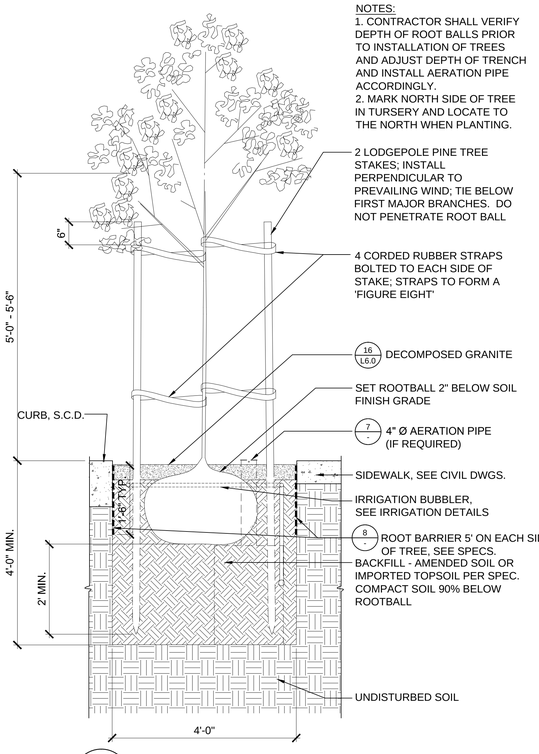
2 SHRUB PLANTING ON GRADE
N.T.S. SECTION



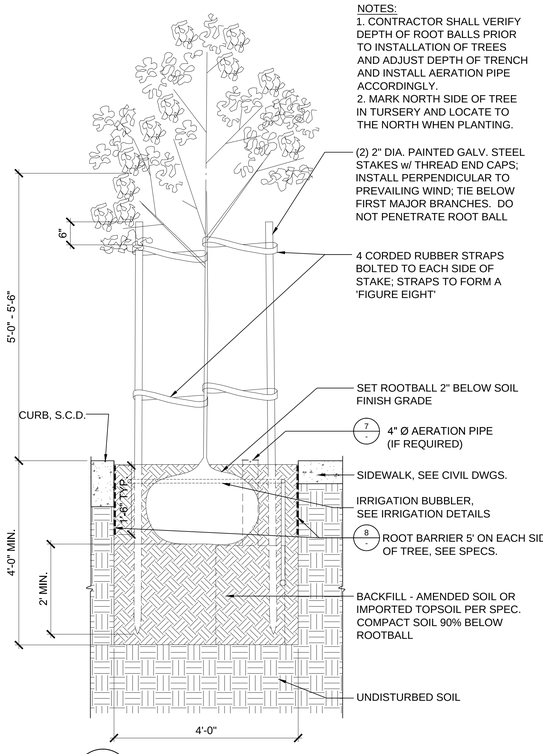
8 ROOT BARRIER AT STREET TREE PLANTING TYP.
1/4" = 1'-0" PLAN



6 TREE PLANTING ON GRADE
N.T.S. SECTION



4 STREET TREE PLANTING AT LE ROY AVE.
3/4"=1'-0" SECTION



1 STREET TREE PLANTING AT RIDGE ROAD
3/4"=1'-0" SECTION

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PROJECT

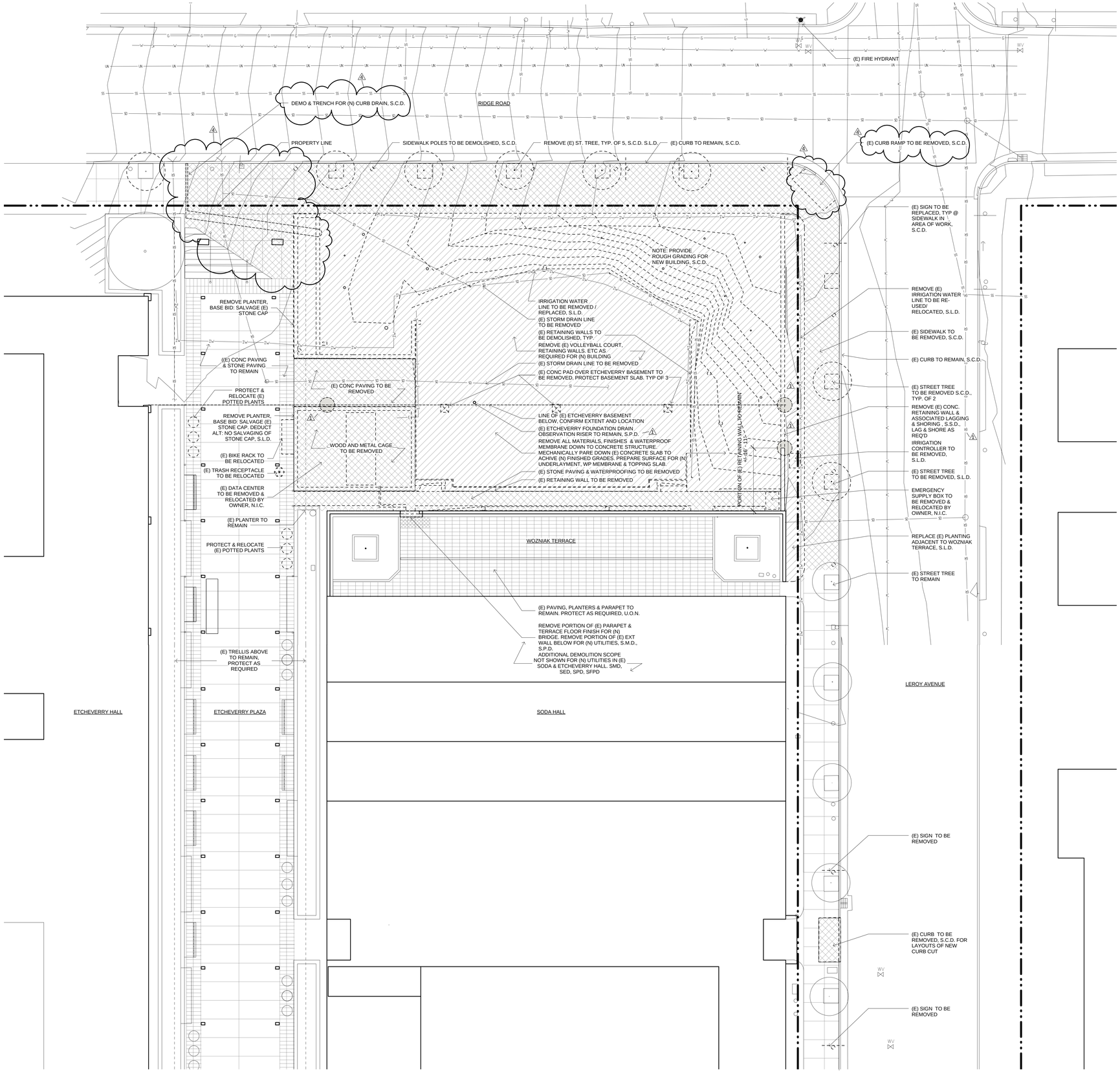
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% CDs / PERMIT SUBMISSION	08/15/14

DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : AS SHOWN

SHEET TITLE
LANDSCAPE DETAILS PLANTING

SHEET No
L6.4



1 A1.1 SITE DEMOLITION PLAN
SCALE: 3/32" = 1'-0"

SITE LEGEND:

- (N) CONCRETE PAVING / SIDEWALK, S.L.D.
- (N) PLANTING / LANDSCAPING, S.L.D.
- AREA OF (E) CONC. PAVING / SIDEWALK TO BE REMOVED
- AREA OF (E) LANDSCAPING, SITE ITEMS, ETC, TO BE REMOVED FOR (N) BUILDING
- (N) S.W. TREATMENT PLANTER, S.L.D.
- BIOSWALE, S.C.D., S.L.D.
- (E) ITEM TO BE REMOVED
- PROPERTY LINE
- (N) UTILITY CONNECTION, SEE SHEET NOTES
- (E) WATER LINE
- (E) STORM DRAIN LINE
- (E) IRRIGATION WATER LINE
- (E) SANITARY SEWER LINE
- (E) GAS LINE
- SITE ACCESSIBLE PATH OF TRAVEL. SEE A2.5 & A2.6 FOR ACCESSIBLE PATH OF TRAVEL WITHIN BLDG.
- PROVIDE SHORING CONFIGURATION AS REQ'D TO ACCESS WATERPROOFING TRANSITION FROM (N) BLDG TO (E) ETCHEVERRY HALL IN AREAS HIGHLIGHTED

GENERAL NOTES:

1. FOR ADDITIONAL OFF-SITE DEMOLITION SCOPE, SEE C3.00
2. FOR ADDITIONAL SITE SCOPE, S.L.D., S.C.D.
3. NO (N) PARKING IN PROJECT SCOPE. (E) ACCESSIBLE PARKING (2 SPACES) UPGRADED @ SODA HALL LEROY ENTRY
4. REMOVE (E) TREE STUMPS & UNDERGROUND ROOTS,
5. DECOMMISSION & REMOVE PIEZOMETERS, 50' DEEP, TYP OF 2. COORDINATE W/ GEOTECHNICAL ENGINEER.

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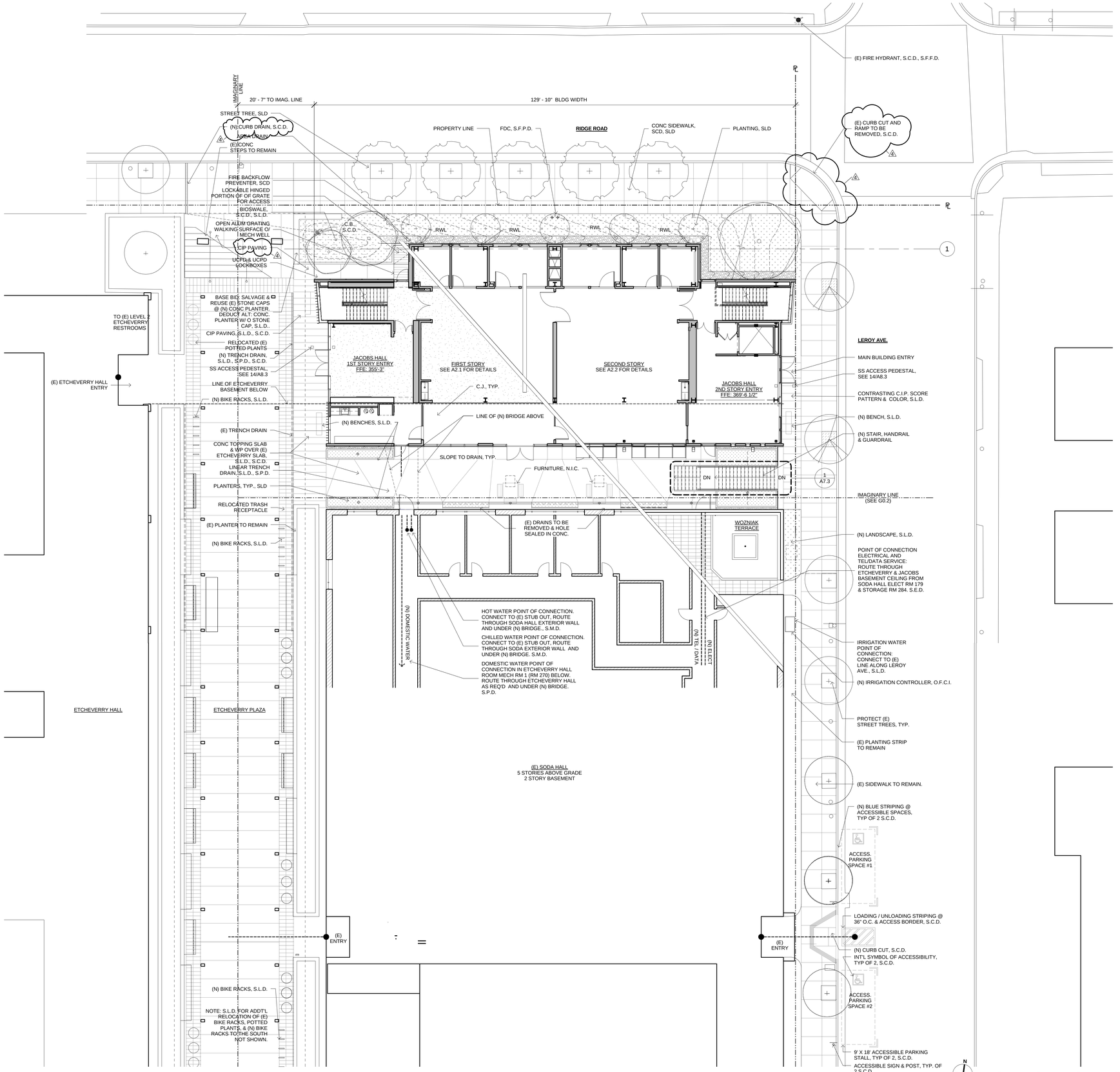
No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	CM / Contractor RFP	03/31/14
	BID # 1 - Shoring / Excavation	05/30/14
1	BID # 1 - Addendum 1	06/17/14
4	100% CDs / Permit Submission Rev	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE
SITE DEMOLITION PLAN

SHEET No
A1.1



1 A1.2 PROPOSED SITE PLAN
SCALE: 3/32" = 1'-0"

SITE LEGEND:

- (N) CONCRETE PAVING / SIDEWALK, S.L.D.
- (N) PLANTING / LANDSCAPING, S.L.D.
- AREA OF (E) CONC. PAVING / SIDEWALK TO BE REMOVED
- AREA OF (E) LANDSCAPING, SITE ITEMS, ETC., TO BE REMOVED FOR (N) BUILDING
- (N) S.W. TREATMENT PLANTER, S.L.D.
- BIOSWALE, S.C.D., S.L.D.
- (E) ITEM TO BE REMOVED
- PROPERTY LINE
- (N) UTILITY CONNECTION, SEE SHEET NOTES
- (E) WATER LINE
- (E) STORM DRAIN LINE
- (E) IRRIGATION WATER LINE
- (E) SANITARY SEWER LINE
- (E) GAS LINE
- SITE ACCESSIBLE PATH OF TRAVEL. SEE A2.5 & A2.6 FOR ACCESSIBLE PATH OF TRAVEL WITHIN BLDG.
- PROVIDE SHORING CONFIGURATION AS REQ'D TO ACCESS WATERPROOFING TRANSITION FROM (N) BLDG TO (E) ETCHEVERRY HALL IN AREAS HIGHLIGHTED

GENERAL NOTES:

1. FOR ADDITIONAL OFF-SITE DEMOLITION SCOPE, SEE C3.00
2. FOR ADDITIONAL SITE SCOPE, S.L.D., S.C.D.
3. NO (N) PARKING IN PROJECT SCOPE. (E) ACCESSIBLE PARKING (2 SPACES) UPGRADED @ SODA HALL LEROY ENTRY
4. REMOVE (E) TREE STUMPS & UNDERGROUND ROOTS,
5. DECOMMISSION & REMOVE PIEZOMETERS, 50' DEEP, TYP OF 2. COORDINATE W/ GEOTECHNICAL ENGINEER.

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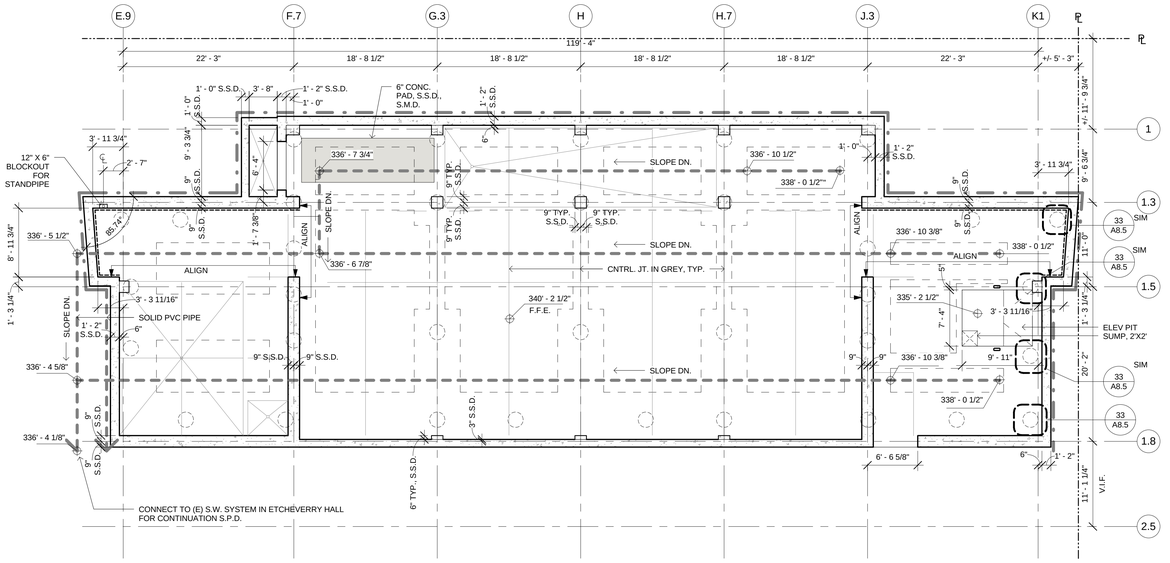
No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 1 - Shoring / Excavation	05/30/14
	BID # 3 - Structure / Site Utilities / M.P.	07/09/14
	BID # 3A - Elevator	08/01/14
4	100% CDs / Permit Submission Rev	08/15/14

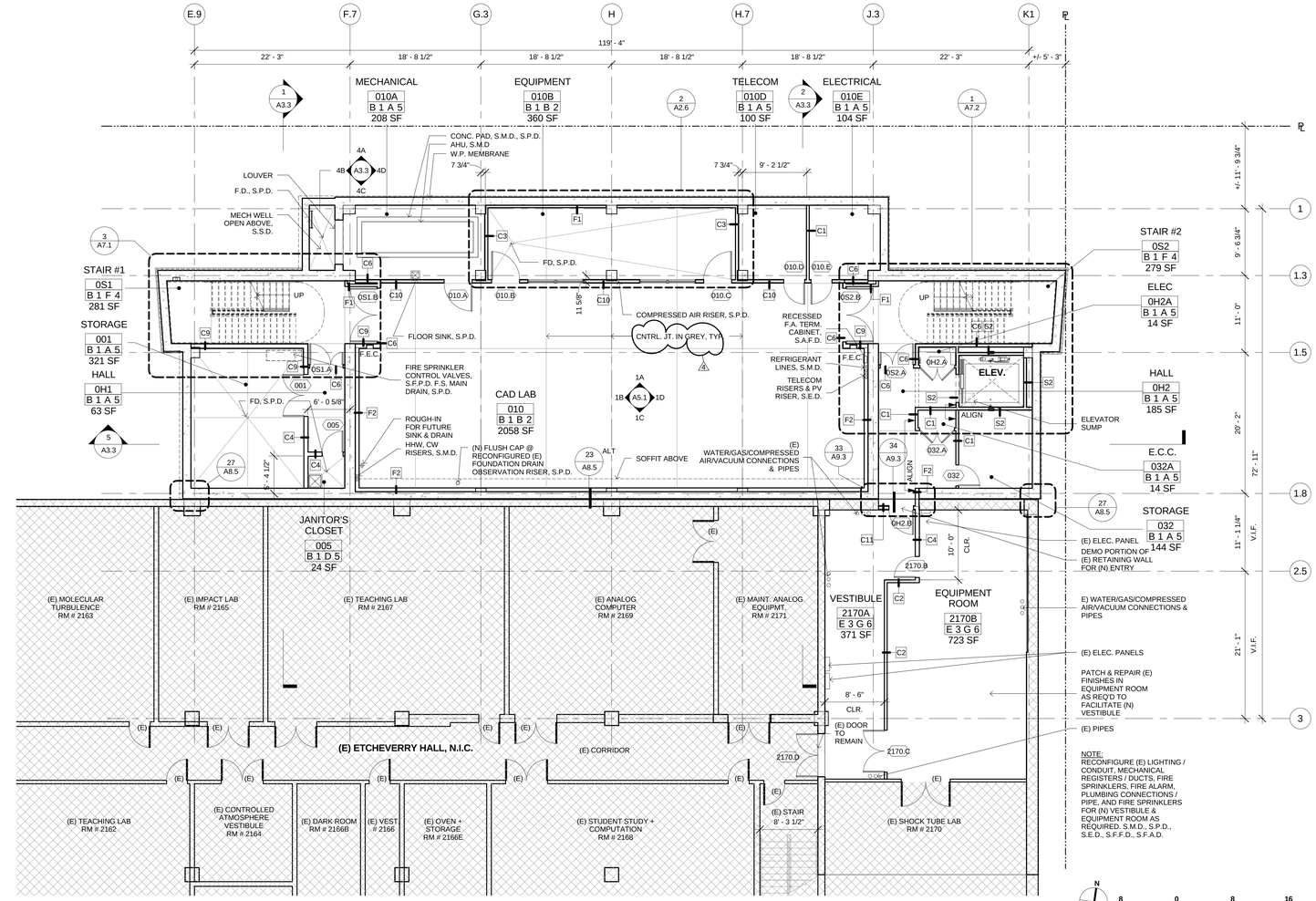
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE
SITE PLAN

SHEET No
A1.2



2 A2.0 BASEMENT SLAB EDGE PLAN (INCLUDING FOUNDATION & SUB-SLAB DRAINAGE)
SCALE: 1/8" = 1'-0"



1 A2.0 BASEMENT PLAN
SCALE: 1/8" = 1'-0"

WALL LEGEND:

- (N) FRAMED WALL
- (N) CONC. WALL, SSD
- (E) WALL TO REMAIN
- (E) WALL TO BE REMOVED
- PROPERTY LINE

SLAB EDGE PLAN LEGEND

- (N) FOUNDATION BELOW, S.S.D.
- CONC. SCORE JOINT, TYP.
- UNDERSLAB DRAINAGE SYSTEM: 4" MIN. SLOT PERF. PVC SCHEDULE 40 PIPE, SLOPE 0.5% TO DRAIN ROUTE BELOW GRADE BEAMS
- FOUNDATION DRAINAGE SYSTEM: PREFAB. DRAINAGE CONDUIT, SEPARATE FROM UNDERSLAB DRAINAGE SYSTEM, CONNECT WITH ETCHEVERRY HALL
- ARCH'TL CONC. WALL, S.S.D. CAST SCORE PATTERN & SANDBLASTED FINISH
- FLOOR DRAIN, SLOPE STRUCT. SLAB TO DRAIN

FINISH LEGEND
A 1 A 1 FLOOR BASE WALL CEILING
FLOOR
A. CARPET TILE B. SMOOTH TROWEL CONCRETE, SEALED C. GROUND & SEALED CONCRETE D. CERAMIC TILE E. (E) CONCRETE, CLEANED & SEALED
BASE
1. RUBBER 2. CERAMIC TILE 3. (E) TO REMAIN WHERE IN GOOD REPAIR, (N) RUBBER WHERE REQ'D
WALL
A. GYP. BD., PTD. B. GYP. BD., PTD.; EXT. GLAZING C. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS D. GYP. BD., PTD. W/ FRP FINISH TO 8' E. WR GYP. BD., FULL HT. CERAMIC TILE AT WET WALLS, SEE INT. ELEV. F. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS; CONCRETE G. (E) WALLS CLEANED & PTD., (N) WALLS GYP. BD PTD.
CEILING
1. SUSPENDED GYP. BD., PTD. 2. SUSPENDED ACOUST. CEILING; PTD EXPOSED BEAMS 3. PERFORATED PLYWOOD ACOUSTICAL CEILING; PTD, MTL. DECK 4. PTD. MTL. DECK 5. PTD. STRUCTURAL CONC. SLAB 6. (E) CONC. CLEANED & PTD.

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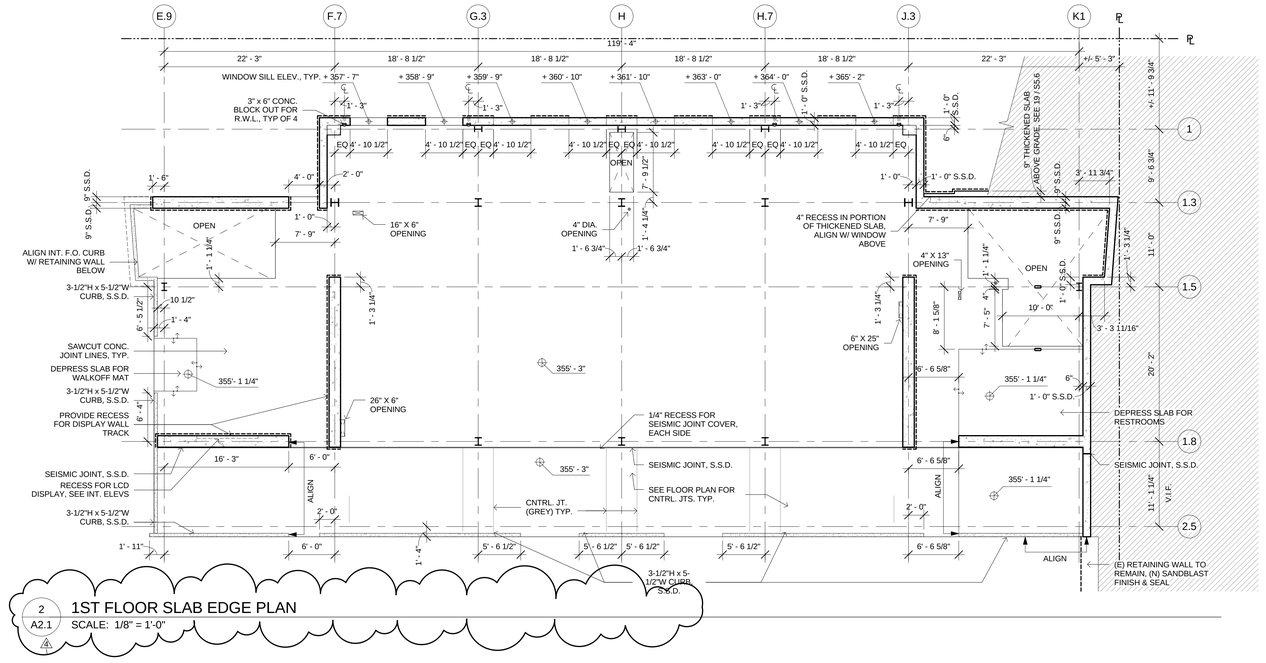
No	REVISION	DATE
	CM / Contractor RFP	03/31/14
	BID # 2 - Ext. Skin D/B	06/06/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
	BID # 3A - Elevator	08/01/14
4	100% CDs / Permit Submission Rev	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

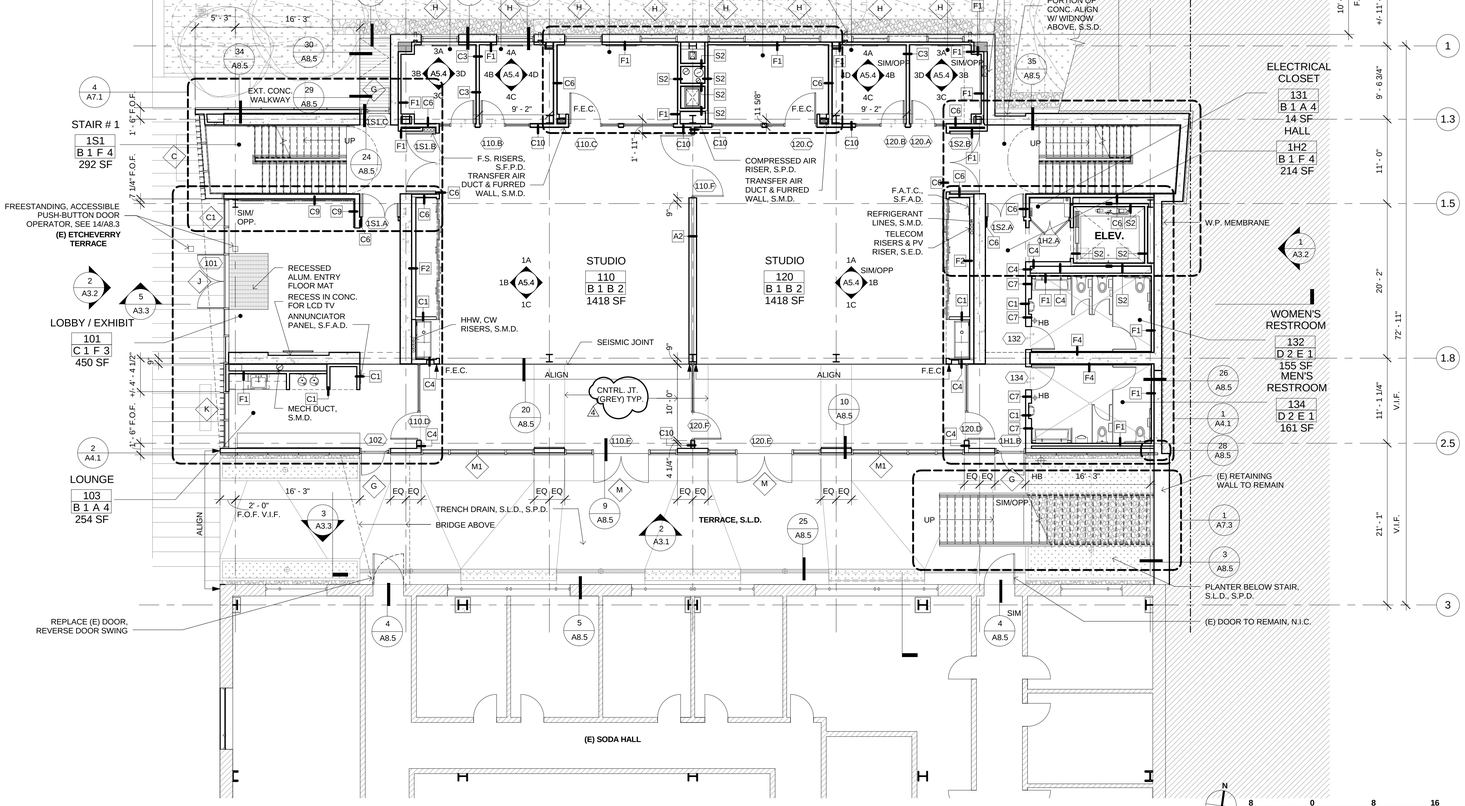
SHEET TITLE
BASEMENT PLAN

SHEET No
A2.0



2 A2.1 — 1ST FLOOR SLAB EDGE PLAN

SCALE: 1/8" = 1'-0"



1 A2.1 — 1ST FLOOR PLAN (SODA HALL LEVEL 3)

SCALE: 1/8" = 1'-0"

WALL LEGEND:

- (N) FRAMED WALL
- (N) CONC. WALL, SSD
- (E) WALL TO REMAIN
- (E) WALL TO BE REMOVED
- PROPERTY LINE

SLAB EDGE PLAN LEGEND

- (N) FOUNDATION BELOW, S.S.D.
- CONC. SCORE JOINT, TYP.
- UNDERSLAB DRAINAGE SYSTEM: 4" MIN. SLOT PERF. PVC SCHEDULE 40 PIPE, SLOPE 0.5% TO DRAIN ROUTE BELOW GRADE BEAMS
- FOUNDATION DRAINAGE SYSTEM: PREFAB. DRAINAGE CONDUIT, SEPARATE FROM UNDERSLAB DRAINAGE SYSTEM, CONNECT WITH ETCHEVERRY HALL
- ARCHT'L CONC. WALL, S.S.D. CAST SCORE PATTERN & SANDBLASTED FINISH
- FLOOR DRAIN, SLOPE STRUCT. SLAB TO DRAIN

FINISH LEGEND

FLOOR / BASE / WALL / CEILING — A 1 A 1

FLOOR

A. CARPET TILE
B. SMOOTH TROWEL CONCRETE, SEALED
C. GROUND & SEALED CONCRETE
D. CERAMIC TILE
E. (E) CONCRETE, CLEANED & SEALED

BASE

1. RUBBER
2. CERAMIC TILE
3. (E) TO REMAIN WHERE IN GOOD REPAIR, (N) RUBBER WHERE REQ'D

WALL

A. GYP. BD., PTD.
B. GYP. BD., PTD.; EXT. GLAZING
C. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS
D. GYP. BD., PTD. W/ FRP FINISH TO 8'
E. WR GYP. BD., FULL HT. CERAMIC TILE AT WET WALLS, SEE INT. ELEV.
F. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS; CONCRETE
G. (E) WALLS CLEANED & PTD.,
(N) WALLS GYP. BD PTD.

CEILING

1. SUSPENDED GYP. BD., PTD.
2. SUSPENDED ACOUST. CEILING; PTD EXPOSED BEAMS
3. PERFORATED PLYWOOD ACOUSTICAL CEILING; PTD. MTL. DECK
4. PTD. MTL. DECK
5. PTD. STRUCTURAL CONC. SLAB
6. (E) CONC. CLEANED & PTD.

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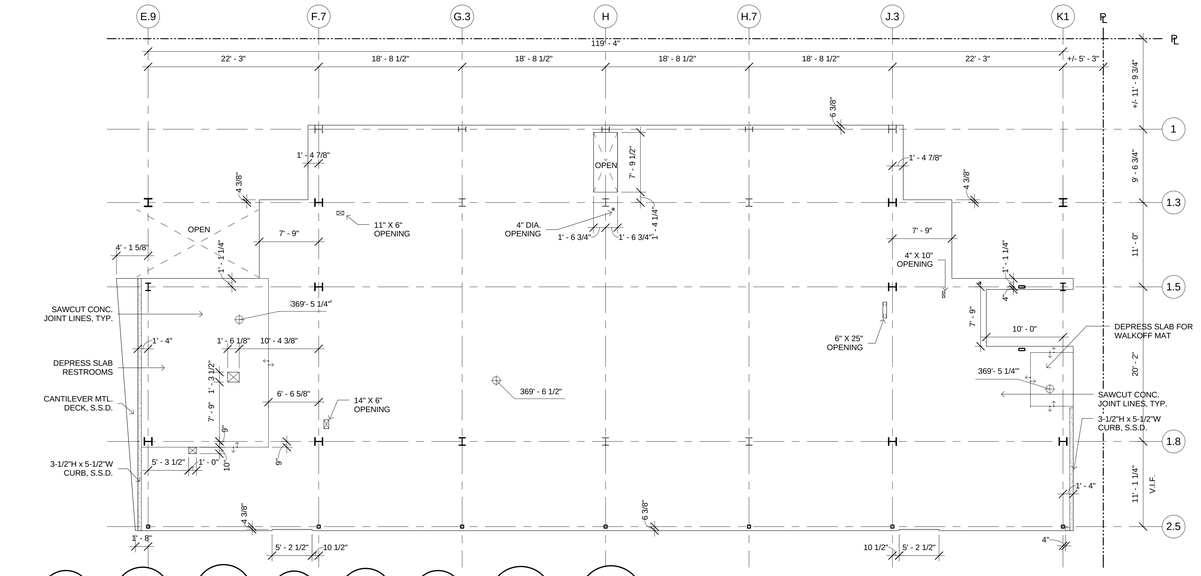
No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 2 - Ext. Skin D/B	06/06/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
	BID # 3A - Elevator	08/01/14
4	100% CDs / Permit Submission Rev	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

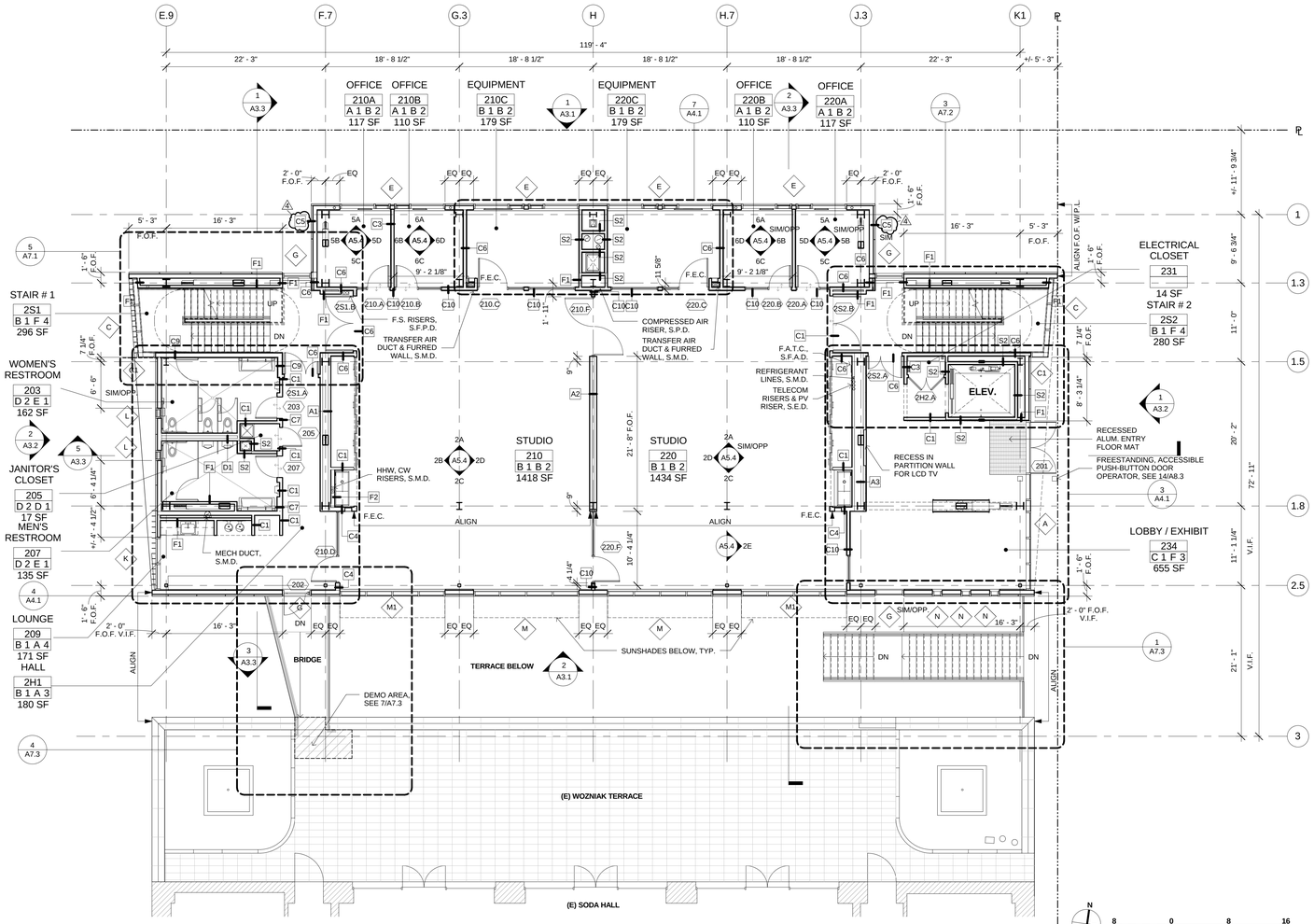
SHEET TITLE
1ST STORY FLOOR PLAN

SHEET No
A2.1



2 A2.2 — 2ND FLOOR SLAB EDGE PLAN

SCALE: 1/8" = 1'-0"



1 A2.2 — 2ND FLOOR PLAN (SODA HALL LEVEL 4)

SCALE: 1/8" = 1'-0"

WALL LEGEND:

- (N) FRAMED WALL
- (N) CONC. WALL, SSD
- (E) WALL TO REMAIN
- (E) WALL TO BE REMOVED
- PROPERTY LINE

SLAB EDGE PLAN LEGEND

- (N) FOUNDATION BELOW, S.S.D.
- CONC. SCORE JOINT, TYP.
- UNDERSLAB DRAINAGE SYSTEM: 4" MIN. SLOT PERF. PVC SCHEDULE 40 PIPE, SLOPE 0.5% TO DRAIN ROUTE BELOW GRADE BEAMS
- FOUNDATION DRAINAGE SYSTEM: PREFAB. DRAINAGE CONDUIT, SEPARATE FROM UNDERSLAB DRAINAGE SYSTEM, CONNECT WITH ETCHEVERRY HALL
- ARCH'L CONC. WALL, S.S.D. CAST SCORE PATTERN & SANDBLASTED FINISH
- FLOOR DRAIN, SLOPE STRUCT. SLAB TO DRAIN

FINISH LEGEND

A 1 A 1 — FLOOR, BASE, WALL, CEILING

FLOOR

A. CARPET TILE
B. SMOOTH TROWEL CONCRETE, SEALED
C. GROUND & SEALED CONCRETE
D. CERAMIC TILE
E. (E) CONCRETE, CLEANED & SEALED

BASE

1. RUBBER
2. CERAMIC TILE
3. (E) TO REMAIN WHERE IN GOOD REPAIR, (N) RUBBER WHERE REQ'D

WALL

A. GYP. BD., PTD.
B. GYP. BD., PTD.; EXT. GLAZING
C. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS,
D. GYP. BD., PTD. W/ FRP FINISH TO 8'
E. WR GYP. BD., FULL HT. CERAMIC TILE AT WET WALLS, SEE INT. ELEV.,
F. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS; CONCRETE
G. (E) WALLS CLEANED & PTD.,
(N) WALLS GYP. BD PTD.

CEILING

1. SUSPENDED GYP. BD., PTD.
2. SUSPENDED ACOUST. CEILING; PTD EXPOSED BEAMS
3. PERFORATED PLYWOOD ACOUSTICAL CEILING; PTD. MTL. DECK
4. PTD. MTL. DECK
5. PTD. STRUCTURAL CONC. SLAB
6. (E) CONC. CLEANED & PTD.

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	BID # 3A - Elevator	08/01/14
4	100% CDs / Permit Submission Rev	08/15/14

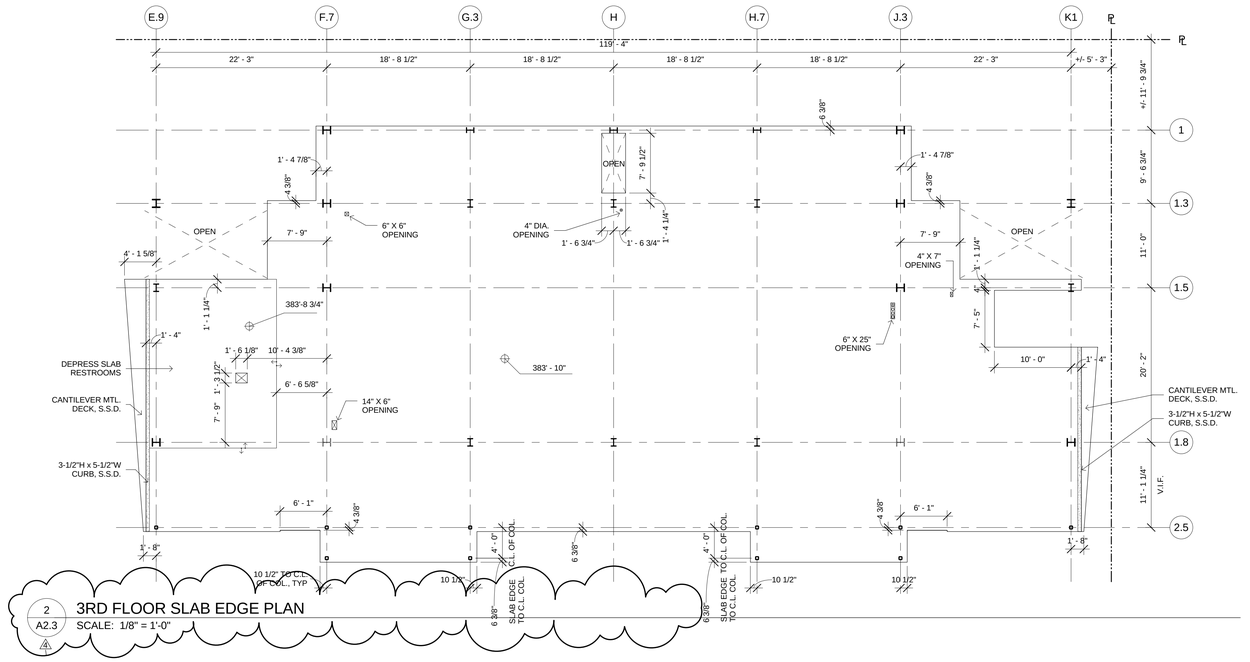
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

SHEET TITLE

2ND STORY FLOOR PLAN

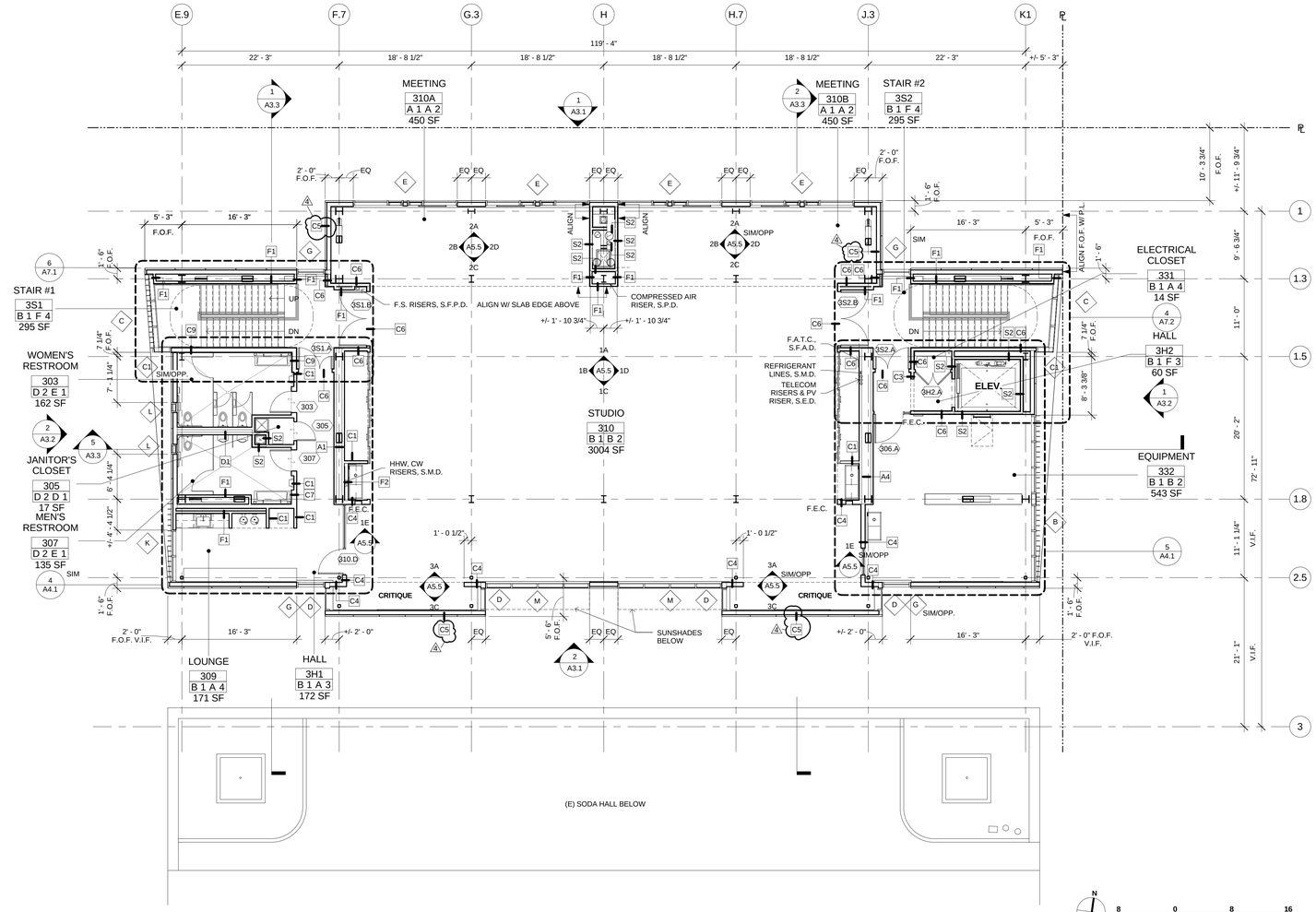
SHEET No

A2.2



2 A2.3 — 3RD FLOOR SLAB EDGE PLAN

SCALE: 1/8" = 1'-0"



1 A2.3 — 3RD FLOOR PLAN (SODA HALL LEVEL 5)

SCALE: 1/8" = 1'-0"

WALL LEGEND:

- (N) FRAMED WALL
- (N) CONC. WALL, SSD
- (E) WALL TO REMAIN
- (E) WALL TO BE REMOVED
- PROPERTY LINE

SLAB EDGE PLAN LEGEND

- (N) FOUNDATION BELOW, S.S.D.
- CONC. SCORE JOINT, TYP.
- UNDERSLAB DRAINAGE SYSTEM: 4" MIN. SLOT PERF. PVC SCHEDULE 40 PIPE, SLOPE 0.5% TO DRAIN ROUTE BELOW GRADE BEAMS
- FOUNDATION DRAINAGE SYSTEM; PREFAB. DRAINAGE CONDUIT, SEPARATE FROM UNDERSLAB DRAINAGE SYSTEM, CONNECT WITH ETCHEVERRY HALL
- ARCH'TL CONC. WALL, S.S.D. CAST SCORE PATTERN & SANDBLASTED FINISH
- FLOOR DRAIN, SLOPE STRUCT. SLAB TO DRAIN

FINISH LEGEND

A 1 A 1
FLOOR
BASE
WALL
CEILING

FLOOR

A. CARPET TILE
B. SMOOTH TROWEL CONCRETE, SEALED
C. GROUND & SEALED CONCRETE
D. CERAMIC TILE
E. (E) CONCRETE, CLEANED & SEALED

BASE

1. RUBBER
2. CERAMIC TILE
3. (E) TO REMAIN WHERE IN GOOD REPAIR, (N) RUBBER WHERE REQ'D

WALL

A. GYP. BD., PTD.
B. GYP. BD., PTD.; EXT. GLAZING
C. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS
D. GYP. BD., PTD. W/ FRP FINISH TO 8'
E. WR GYP. BD., FULL HT. CERAMIC TILE AT WET WALLS, SEE INT. ELEV.
F. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS; CONCRETE
G. (E) WALLS CLEANED & PTD., (N) WALLS GYP. BD PTD.

CEILING

1. SUSPENDED GYP. BD., PTD.
2. SUSPENDED ACOUST. CEILING; PTD EXPOSED BEAMS
3. PERFORATED PLYWOOD ACOUSTICAL CEILING; PTD. MTL. DECK
4. PTD. MTL. DECK
5. PTD. STRUCTURAL CONC. SLAB
6. (E) CONC. CLEANED & PTD.

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4	100% CDs / Permit Submission Rev	08/15/14

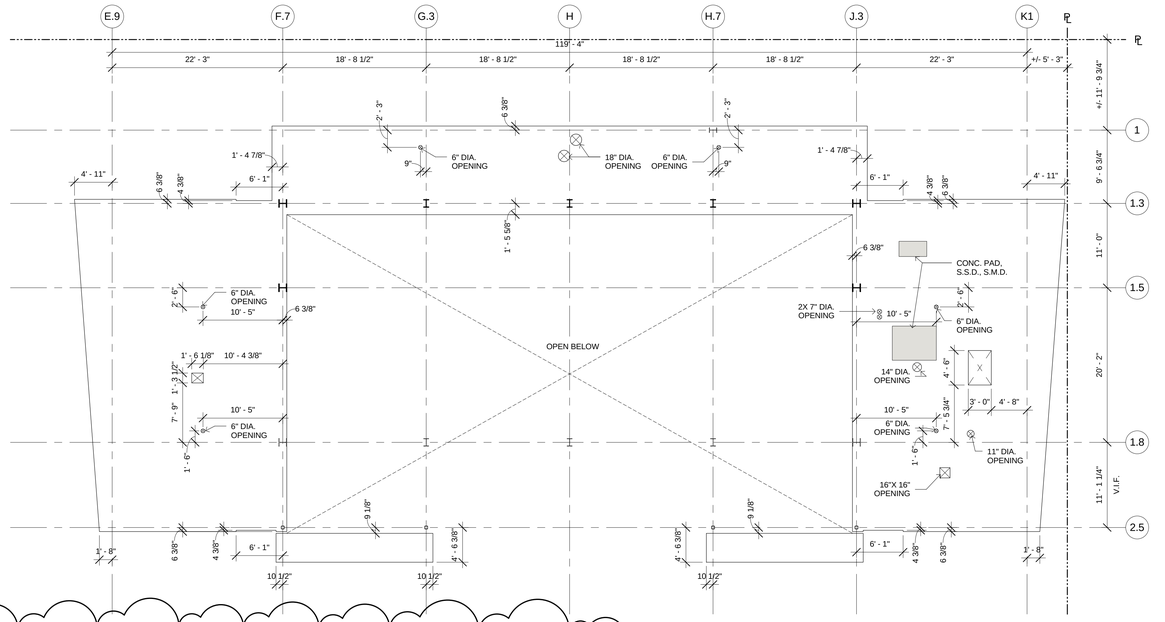
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

SHEET TITLE

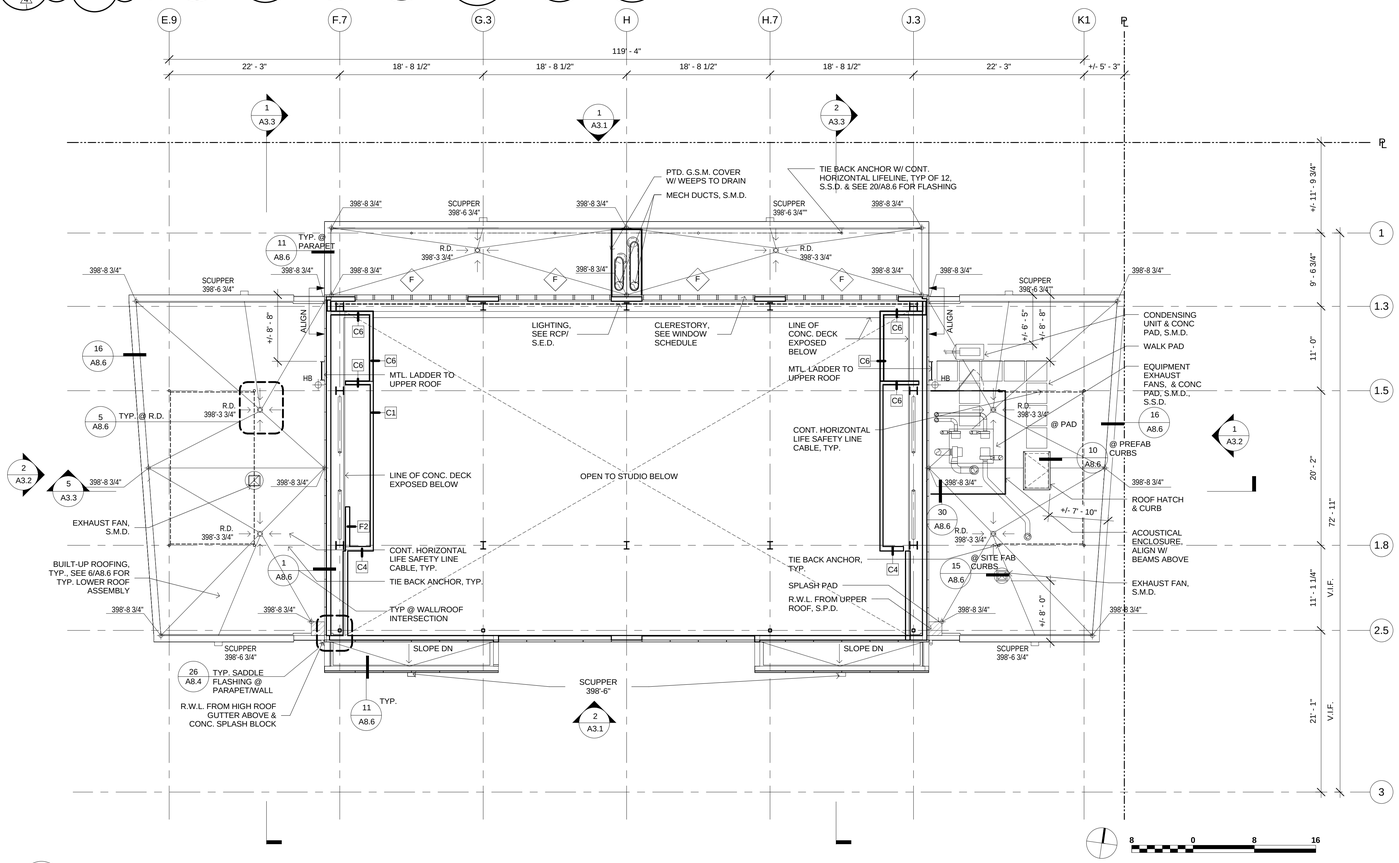
3RD STORY FLOOR PLAN

SHEET No

A2.3



2 A2.4 LOWER ROOF SLAB EDGE PLAN
SCALE: 1/8" = 1'-0"



1 A2.4 LOWER ROOF PLAN
SCALE: 1/8" = 1'-0"

WALL LEGEND:

- (N) FRAMED WALL
- (N) CONC. WALL, SSD
- (E) WALL TO REMAIN
- (E) WALL TO BE REMOVED
- PROPERTY LINE

SLAB EDGE PLAN LEGEND

- (N) FOUNDATION BELOW, S.S.D.
- CONC. SCORE JOINT, TYP.
- UNDERSLAB DRAINAGE SYSTEM: 4" MIN. SLOT PERF. PVC SCHEDULE 40 PIPE, SLOPE 0.5% TO DRAIN ROUTE BELOW GRADE BEAMS
- FOUNDATION DRAINAGE SYSTEM: PREFAB. DRAINAGE CONDUIT, SEPARATE FROM UNDERSLAB DRAINAGE SYSTEM, CONNECT WITH ETCHEVERRY HALL
- ARCHT'L CONC. WALL, S.S.D. CAST SCORE PATTERN & SANDBLASTED FINISH
- FLOOR DRAIN, SLOPE STRUCT. SLAB TO DRAIN

FINISH LEGEND

A 1 A 1
FLOOR
BASE
WALL
CEILING

FLOOR

A. CARPET TILE
B. SMOOTH TROWEL CONCRETE, SEALED
C. GROUND & SEALED CONCRETE
D. CERAMIC TILE
E. (E) CONCRETE, CLEANED & SEALED

BASE

1. RUBBER
2. CERAMIC TILE
3. (E) TO REMAIN WHERE IN GOOD REPAIR, (N) RUBBER WHERE REQ'D

WALL

A. GYP. BD., PTD.
B. GYP. BD., PTD.; EXT. GLAZING
C. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS
D. GYP. BD., PTD. W/ FRP FINISH TO 8'
E. WR GYP. BD., FULL HT. CERAMIC TILE AT WET WALLS, SEE INT. ELEV.
F. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS; CONCRETE
G. (E) WALLS CLEANED & PTD., (N) WALLS GYP. BD PTD.

CEILING

1. SUSPENDED GYP. BD., PTD.
2. SUSPENDED ACOUST. CEILING; PTD EXPOSED BEAMS
3. PERFORATED PLYWOOD ACOUSTICAL CEILING; PTD. MTL. DECK
4. PTD. MTL. DECK
5. PTD. STRUCTURAL CONC. SLAB
6. (E) CONC. CLEANED & PTD.

GENERAL NOTES:

1. SEE A8.6 FOR TYP. ROOFING & FLASHING DTL.S

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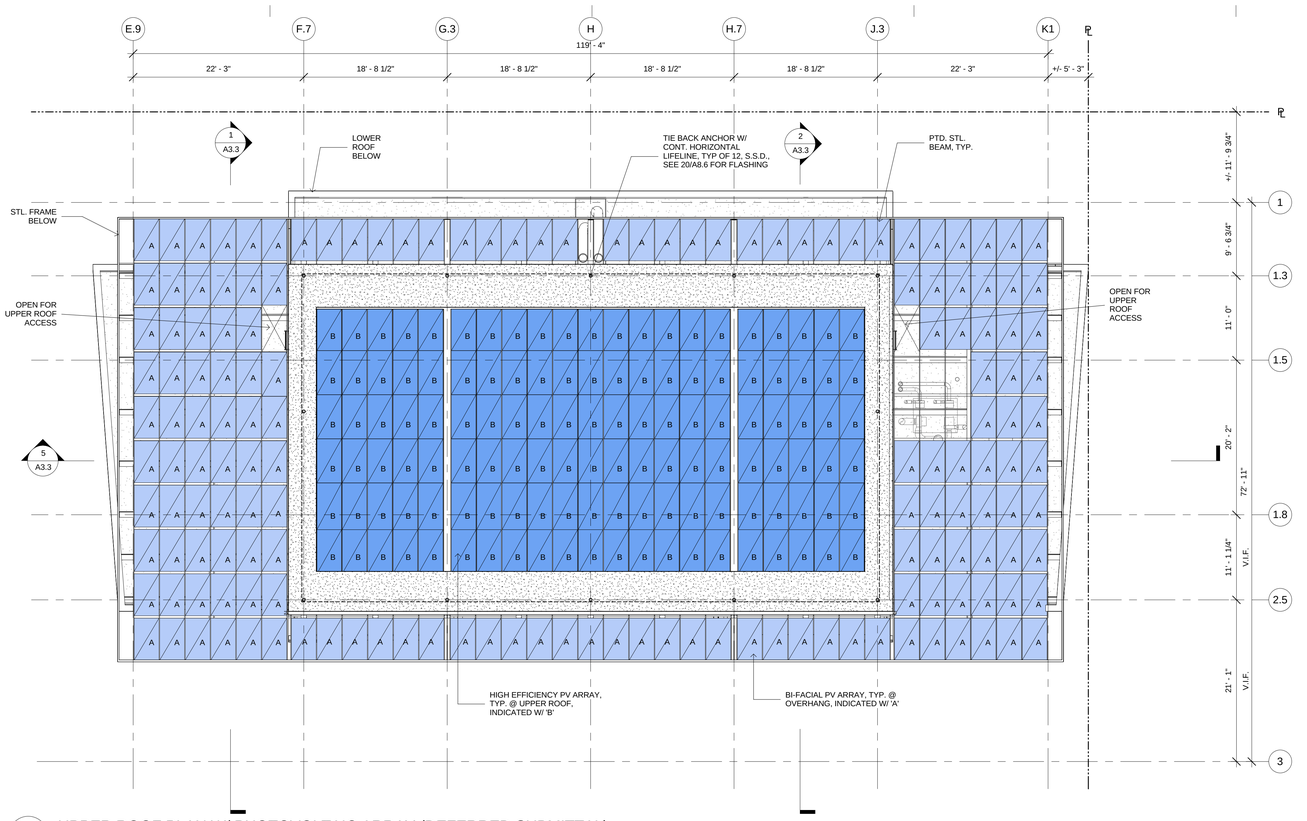
	BID # 3A - Elevator	08/01/14
4	100% CDs / Permit Submission Rev	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

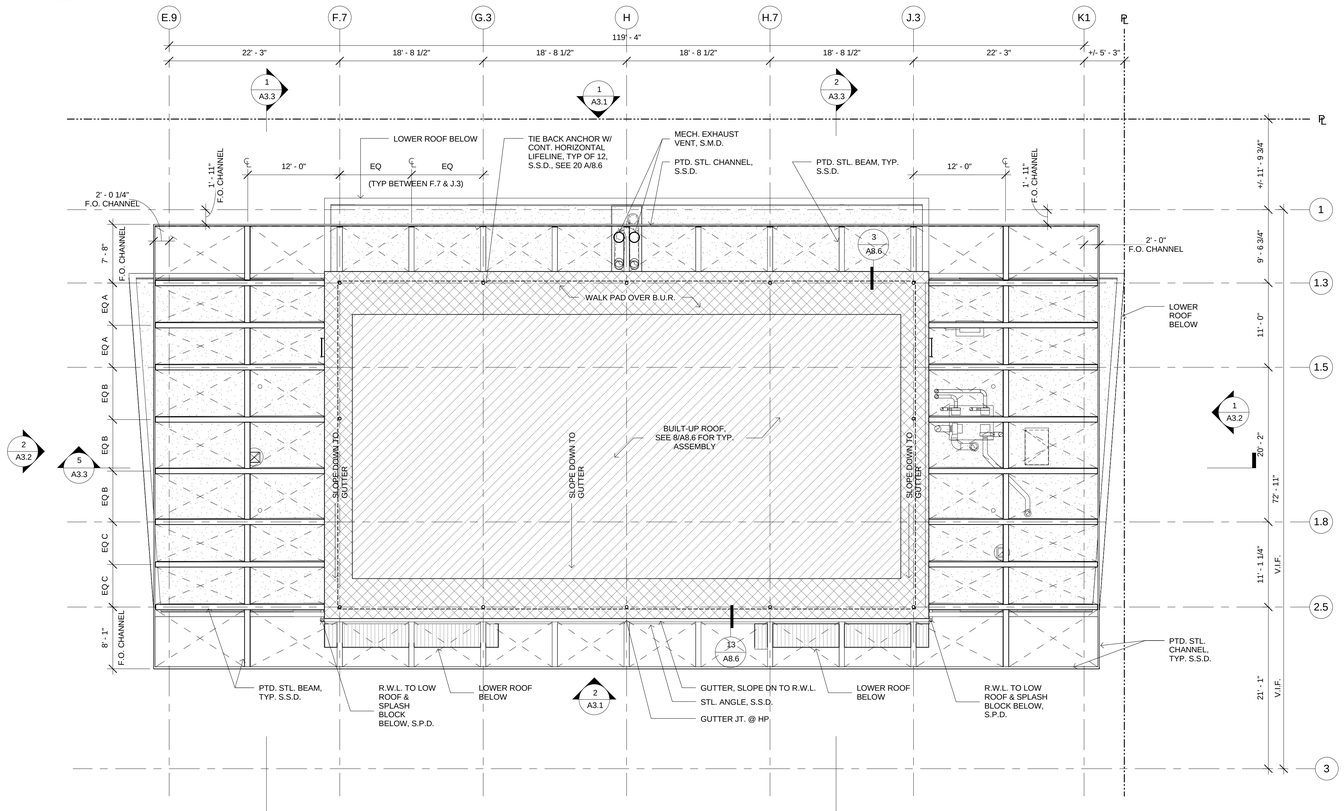
SHEET TITLE
LOWER ROOF PLAN

SHEET No
A2.4



2 A2.5 UPPER ROOF PLAN W/ PHOTOVOLTAIC ARRAY (DEFERRED SUBMITTAL)

SCALE: 1/8" = 1'-0"



1 A2.5 UPPER ROOF PLAN

SCALE: 1/8" = 1'-0"

WALL LEGEND:

- (N) FRAMED WALL
- (N) CONC. WALL, SSD
- (E) WALL TO REMAIN
- (E) WALL TO BE REMOVED
- PROPERTY LINE

SLAB EDGE PLAN LEGEND

- (N) FOUNDATION BELOW, S.S.D.
- CONC. SCORE JOINT, TYP.
- UNDERSLAB DRAINAGE SYSTEM: 4" MIN. SLOT PERF. PVC SCHEDULE 40 PIPE, SLOPE 0.5% TO DRAIN ROUTE BELOW GRADE BEAMS
- FOUNDATION DRAINAGE SYSTEM. PREFAB. DRAINAGE CONDUIT, SEPARATE FROM UNDERSLAB DRAINAGE SYSTEM, CONNECT WITH ETCHEVERRY HALL
- ARCHT'L CONC. WALL, S.S.D. CAST SCORE PATTERN & SANDBLASTED FINISH
- FLOOR DRAIN, SLOPE STRUCT. SLAB TO DRAIN

FINISH LEGEND

A 1 A 1

FLOOR
BASE
WALL
CEILING

FLOOR

A. CARPET TILE
B. SMOOTH TROWEL CONCRETE, SEALED
C. GROUND & SEALED CONCRETE
D. CERAMIC TILE
E. (E) CONCRETE, CLEANED & SEALED

BASE

1. RUBBER
2. CERAMIC TILE
3. (E) TO REMAIN WHERE IN GOOD REPAIR, (N) RUBBER WHERE REQ'D

WALL

A. GYP. BD., PTD.
B. GYP. BD., PTD.; EXT. GLAZING
C. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS
D. GYP. BD., PTD. W/ FRP FINISH TO 8'
E. WR GYP. BD., FULL HT. CERAMIC TILE AT WET WALLS, SEE INT. ELEV.
F. GYP. BD., PTD.; EXT. GLAZING; PERF. PLYWOOD PANELS; CONCRETE
G. (E) WALLS CLEANED & PTD., (N) WALLS GYP. BD PTD.

CEILING

1. SUSPENDED GYP. BD., PTD.
2. SUSPENDED ACOUST. CEILING; PTD EXPOSED BEAMS
3. PERFORATED PLYWOOD ACOUSTICAL CEILING; PTD. MTL. DECK
4. PTD. MTL. DECK
5. PTD. STRUCTURAL CONC. SLAB
6. (E) CONC. CLEANED & PTD.

GENERAL NOTES:

1. SEE A8.6 FOR TYP. ROOFING & FLASHING DTL.S

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	BID # 3A - Elevator	08/01/14
	100% CDs / Permit Submission	08/15/14

DATE: 15 August 2014
JOB No: 1309
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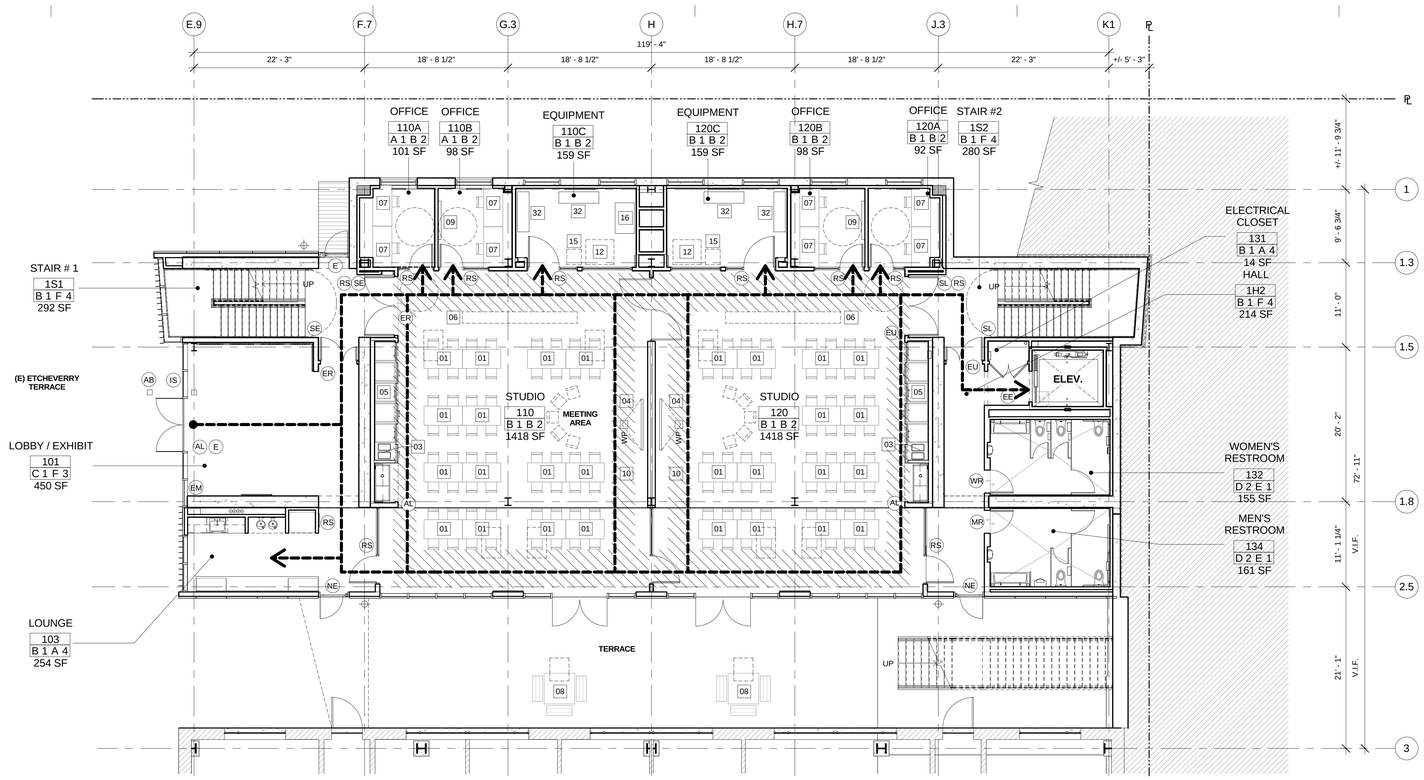
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

SHEET TITLE

UPPER ROOF PLAN

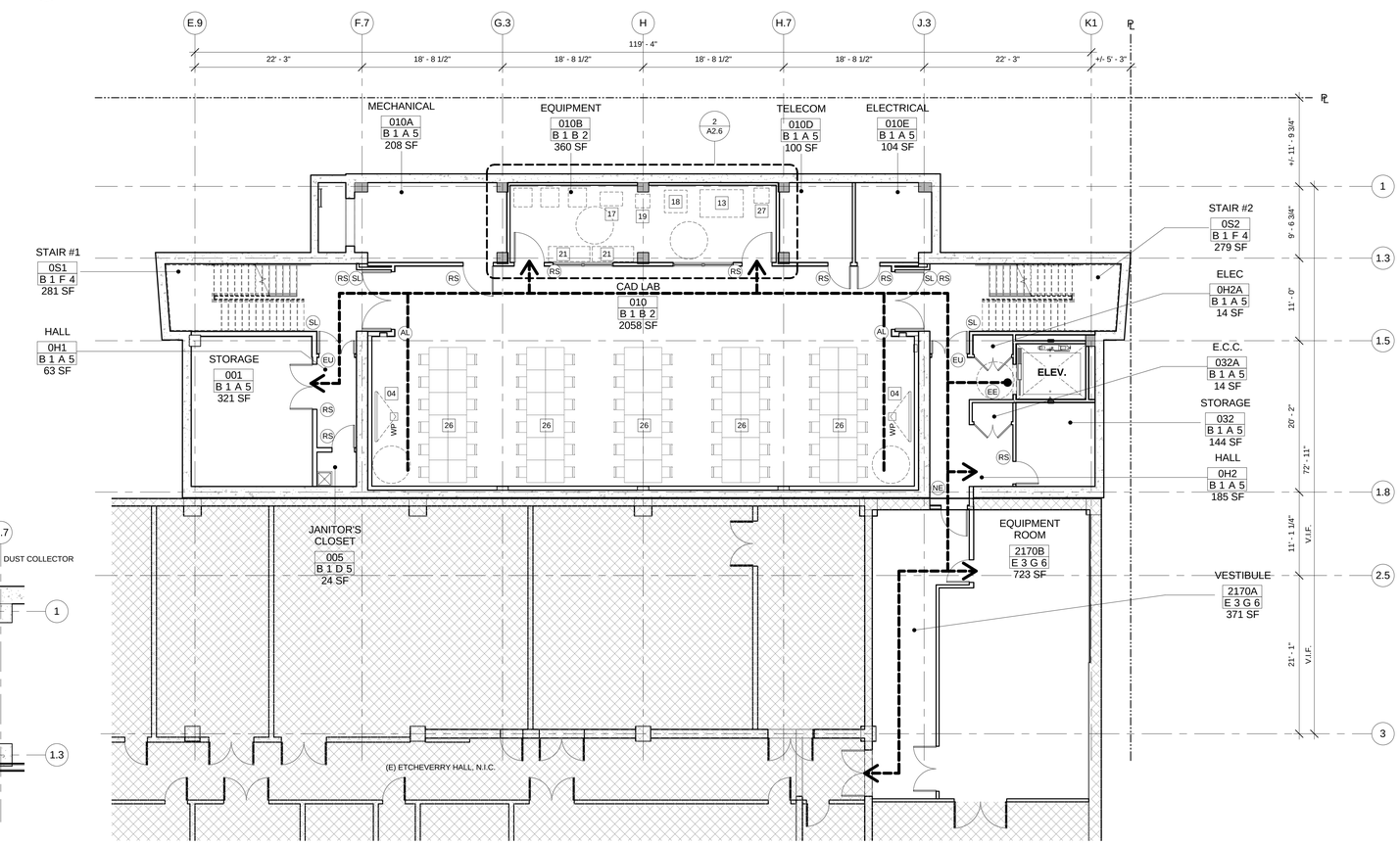
SHEET No

A2.5



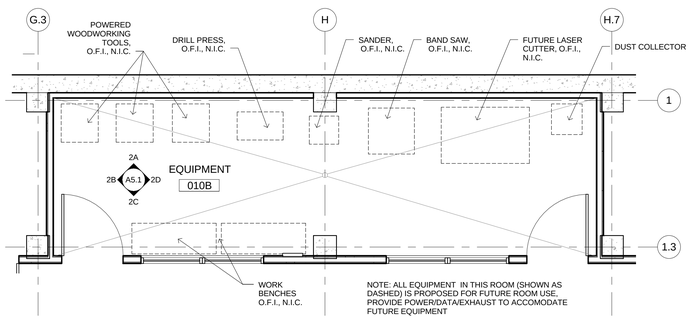
3 A2.6 1ST FLOOR FURNITURE PLAN

SCALE: 1/8" = 1'-0"



1 A2.6 BASEMENT FURNITURE PLAN

SCALE: 1/8" = 1'-0"



2 A2.6 BASEMENT EQUIPMENT ROOM ENLARGED PLAN

SCALE: 1/4" = 1'-0"

EQUIPMENT & FURNITURE KEYNOTES (OFI, NIC)

01	30" x 5' TABLE & STOOLS
02	3' x 6' TABLE & CHAIRS
03	TRASH / RECYCLING / COMPOST BIN
04	SHORT THROW WALL MTD. PROJECTOR, FFE, S.E.D. FOR POWER & AV CONTROL REQUIREMENTS
05	PROJECT STORAGE
06	STORAGE / ROOM DIVIDER
07	INTERIOR FURNITURE
08	EXTERIOR FURNITURE
09	WALL-MTD. LCD DISPLAY, G.C. TO PROVIDE MTL. BACKING PLATE, S.E.D.
10	LOW SHELVING
11	3D PRINTER
12	SMALL LASER CUTTER, S.M.D. FOR EXAUST AIR REQ'TS
13	LARGE LASER CUTTER, S.M.D. FOR EXAUST AIR REQ'TS
14	SNORKEL HOOD
15	COMPUTER STATION
16	SPRAY BOOTH, S.M.D. FOR EXAUST AIR REQ'TS
17	DRILL PRESS, S.M.D. FOR DUST COLLECTION REQ'TS
18	BAND SAW, S.M.D. FOR DUST COLLECTION REQ'TS
19	SANDER, S.M.D. FOR DUST COLLECTION REQ'TS
20	CNC ROUTER, S.M.D. FOR DUST COLLECTION REQ'TS
21	WORK BENCH
22	CLG. MTD. PROJECTOR, F.F.E., S.E.D. FOR POWER & AV CONTROL REQUIREMENTS
23	CLG. MTD. SPEAKERS
24	VENDING MACHINE
25	REFRIGERATOR
26	COMPUTER WORKSTATIONS & CHAIRS
27	DUST COLLECTION SYSTEM, S.M.D.
28	3D PRINTER BATH
29	LARGE FORMAT PRINTER
30	CIRCUIT BOARD PLOTTER
31	3D SCANNER
32	HAND TOOL & EQUIPMENT STORAGE

NOTE: SEE A4.1 FOR ADDITIONAL FURNITURE AND EQUIPMENT

EXIT SIGNAGE

E	TACTILE EXIT SIGN WITH WORD "EXIT", SEE 11B/G0.4
ED	TACTILE EXIT SIGN WITH WORDS "EXIT STAIR DOWN", SEE 12A/G0.4
EU	TACTILE EXIT SIGN WITH WORDS "EXIT STAIR UP", SEE 12A/G0.4
ER	TACTILE EXIT SIGN WITH WORDS "EXIT ROUTE", SEE 11A/G0.4
ML	APPROVED MAX. OCCUPANT LOAD SIGN AT A OCCUPANCIES PER CBC 1004.3
AL	SIGN INDICATING AVAILABLE ASSISTIVE LISTENING DEVICES, SEE 20/G0.4
NE	TACTILE SIGN WITH WORD "NOT AN EXIT"
SL	TACTILE SIGN WITH STAIR LEVEL DESIGNATION, SEE 12C/G0.4
SE	TACTILE SIGN WITH STAIR LEVEL DESIGNATION AT EXIT LEVEL, SEE 12B/G0.4
WR	TACTILE SIGN @ WOMEN'S RESTROOM, SEE 13/G0.4
MR	TACTILE SIGN @ MEN'S RESTROOM, SEE 14/G0.4
UV	"UNAUTHORIZED VEHICLES" SIGN, SEE 19/G0.4
AB	ACCESSIBLE ENTRY BOLLARD, SEE 14/A8.3
EE	"IN CASE OF FIRE" SIGN @ ELEVATORS, SEE 7/G0.4
EM	EVACUATION MAP, SEE 17/G0.4
IS	INTERNATIONAL SYMBOL OF ACCESSIBILITY, SEE 9/G0.4
RS	ROOM SIGN, SEE 21/G0.4

NOTE: COORDINATE SIGNAGE WITH G0.4, TYP.

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	100% CDs / Permit Submission	08/15/14

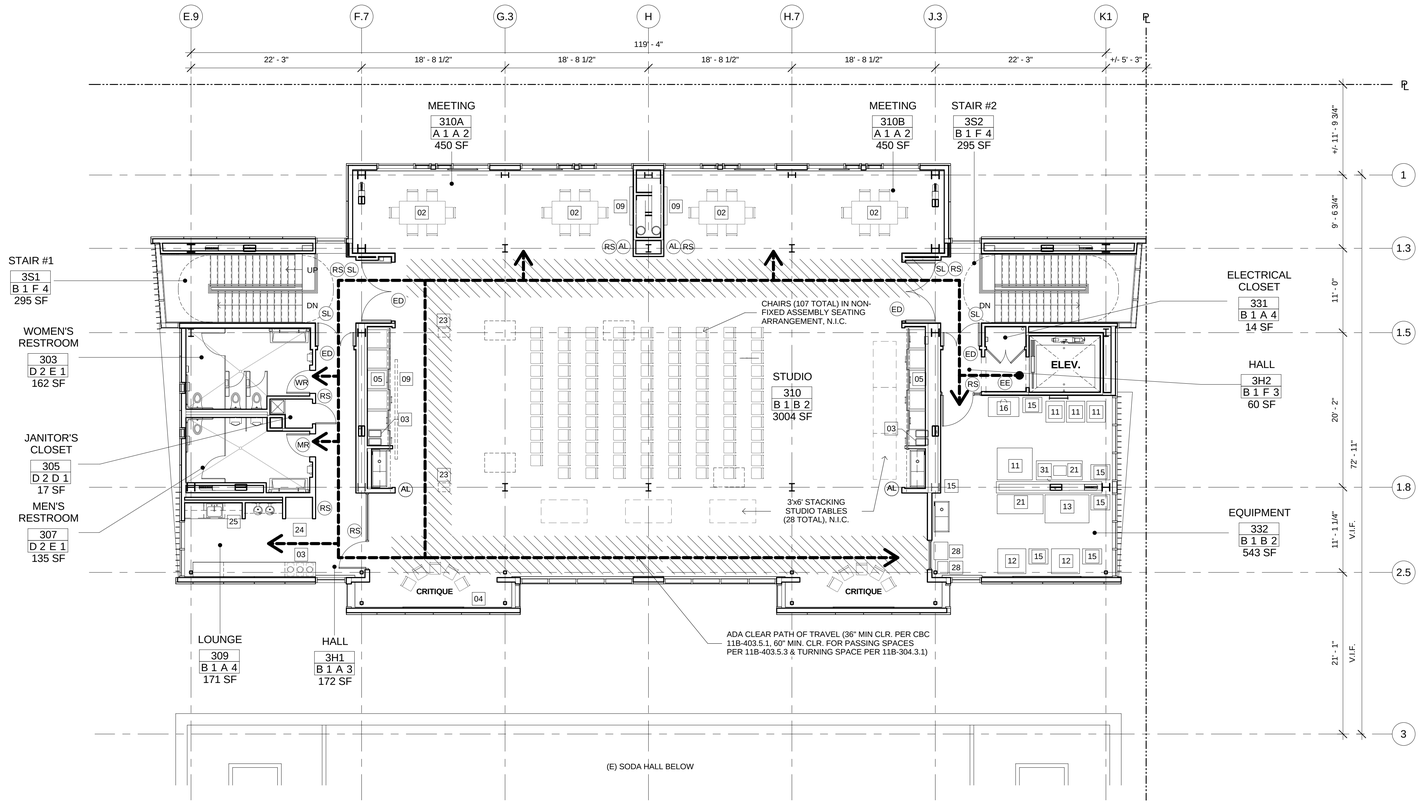
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE

FURNITURE & EQUIPMENT PLANS

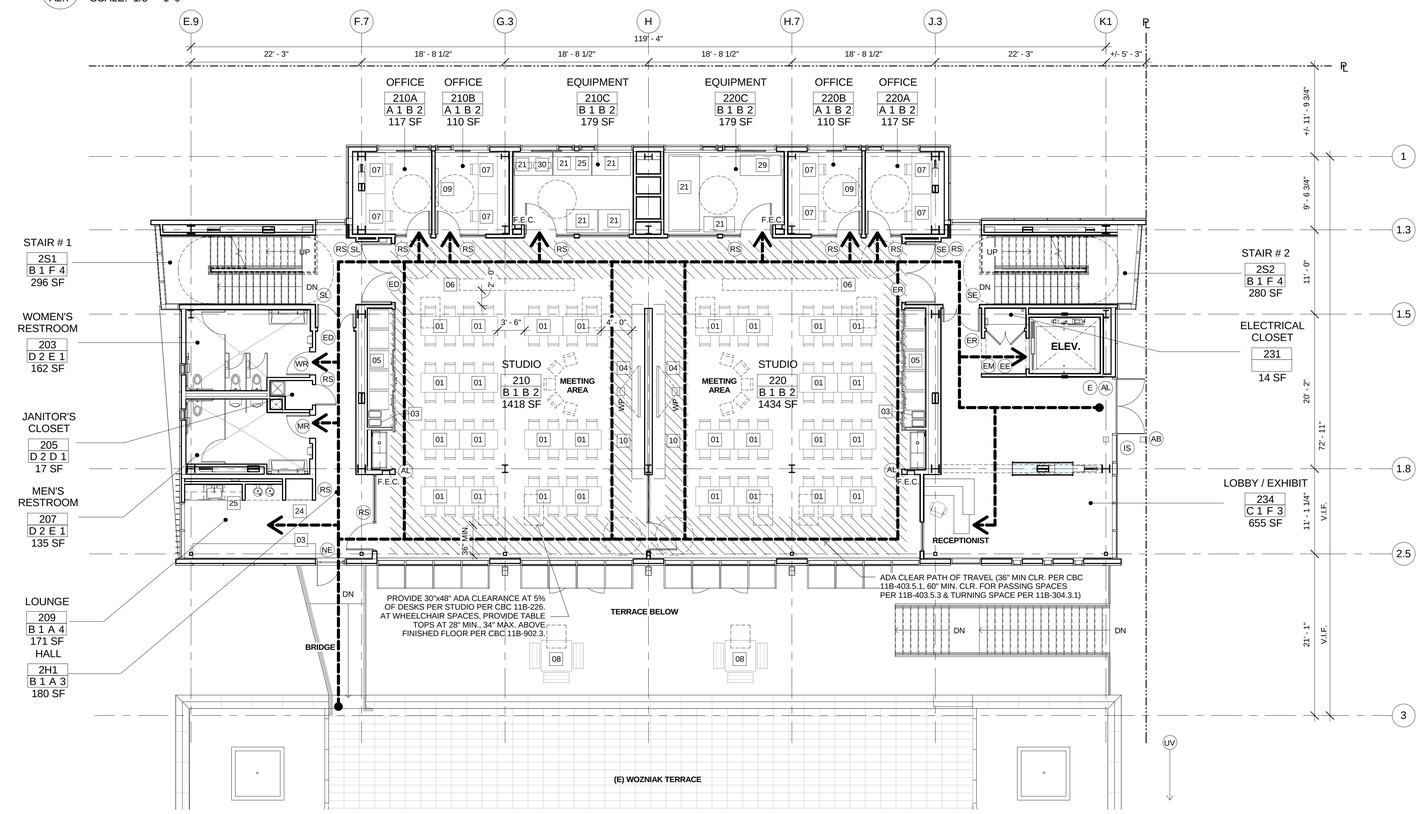
SHEET No

A2.6



2 A2.7 3RD FLOOR FURNITURE PLAN

SCALE: 1/8" = 1'-0"



1 A2.7 2ND FLOOR FURNITURE PLAN

SCALE: 1/8" = 1'-0"

EQUIPMENT & FURNITURE KEYNOTES (OFI, NIC)

01	30" x 5' TABLE & STOOLS
02	3' x 6' TABLE & CHAIRS
03	TRASH / RECYCLING / COMPOST BIN
04	SHORT THROW WALL MTD. PROJECTOR, FFE, S.E.D. FOR POWER & AV CONTROL REQUIREMENTS
05	PROJECT STORAGE
06	STORAGE / ROOM DIVIDER
07	INTERIOR FURNITURE
08	EXTERIOR FURNITURE
09	WALL-MTD. LCD DISPLAY, G.C. TO PROVIDE MTL. BACKING PLATE, S.E.D.
10	LOW SHELVING
11	3D PRINTER
12	SMALL LASER CUTTER, S.M.D. FOR EXAUST AIR REQ'TS
13	LARGE LASER CUTTER, S.M.D. FOR EXAUST AIR REQ'TS
14	SNORKEL HOOD
15	COMPUTER STATION
16	SPRAY BOOTH, S.M.D. FOR EXAUST AIR REQ'TS
17	DRILL PRESS, S.M.D. FOR DUST COLLECTION REQ'TS
18	BAND SAW, S.M.D. FOR DUST COLLECTION REQ'TS
19	SANDER, S.M.D. FOR DUST COLLECTION REQ'TS
20	CNC ROUTER, S.M.D. FOR DUST COLLECTION REQ'TS
21	WORK BENCH
22	CLG. MTD. PROJECTOR, F.F.E., S.E.D. FOR POWER & AV CONTROL REQUIREMENTS
23	CLG. MTD. SPEAKERS
24	VENDING MACHINE
25	REFRIGERATOR
26	COMPUTER WORKSTATIONS & CHAIRS
27	DUST COLLECTION SYSTEM, S.M.D.
28	3D PRINTER BATH
29	LARGE FORMAT PRINTER
30	CIRCUIT BOARD PLOTTER
31	3D SCANNER
32	HAND TOOL & EQUIPMENT STORAGE

NOTE: SEE A4.1 FOR ADDITIONAL FURNITURE AND EQUIPMENT

EXIT SIGNAGE

E	TACTILE EXIT SIGN WITH WORD "EXIT", SEE 11B/G0.4
ED	TACTILE EXIT SIGN WITH WORDS "EXIT STAIR DOWN", SEE 12A/G0.4
EU	TACTILE EXIT SIGN WITH WORDS "EXIT STAIR UP", SEE 12A/G0.4
ER	TACTILE EXIT SIGN WITH WORDS "EXIT ROUTE", SEE 11A/G0.4
ML	APPROVED MAX. OCCUPANT LOAD SIGN AT A OCCUPANCIES PER CBC 1004.3
AL	SIGN INDICATING AVAILABLE ASSISTIVE LISTENING DEVICES, SEE 20/G0.4
NE	TACTILE SIGN WITH WORD "NOT AN EXIT"
SL	TACTILE SIGN WITH STAIR LEVEL DESIGNATION, SEE 12C/G0.4
SE	TACTILE SIGN WITH STAIR LEVEL DESIGNATION AT EXIT LEVEL, SEE 12B/G0.4
WR	TACTILE SIGN @ WOMEN'S RESTROOM, SEE 13/G0.4
MR	TACTILE SIGN @ MEN'S RESTROOM, SEE 14/G0.4
UV	"UNAUTHORIZED VEHICLES" SIGN, SEE 19/G0.4
AB	ACCESSIBLE ENTRY BOLLARD, SEE 14/A8.3
EE	"IN CASE OF FIRE" SIGN @ ELEVATORS, SEE 7/G0.4
EM	EVACUATION MAP, SEE 17/G0.4
IS	INTERNATIONAL SYMBOL OF ACCESSIBILITY, SEE 9/G0.4
RS	ROOM SIGN, SEE 21/G0.4

NOTE: COORDINATE SIGNAGE WITH G0.4, TYP.

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No	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
	100% CDs / Permit Submission	08/15/14

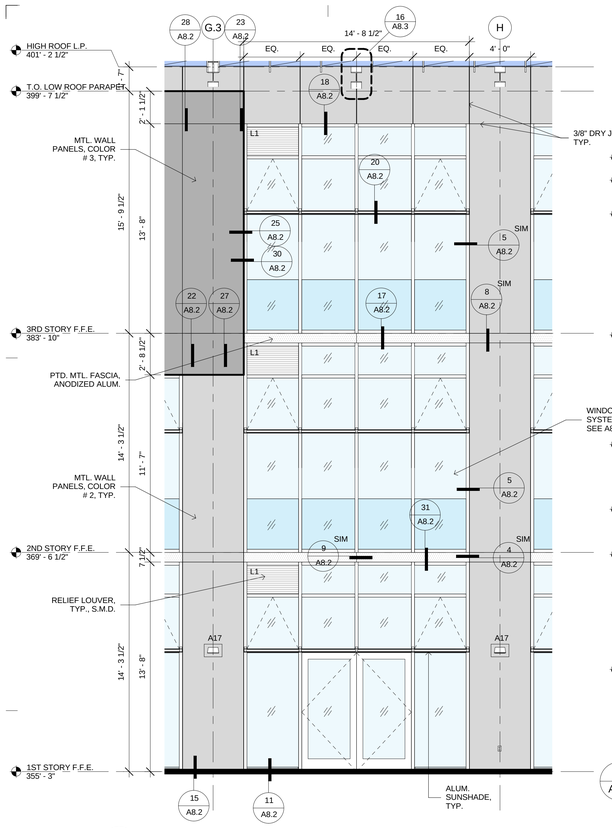
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

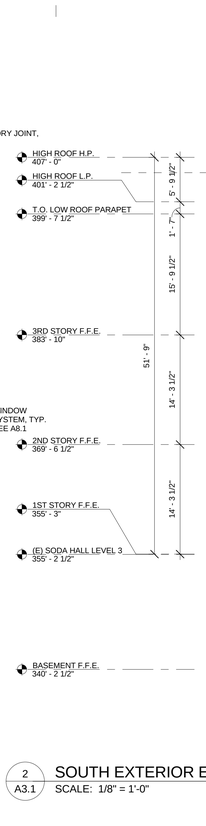
SHEET TITLE

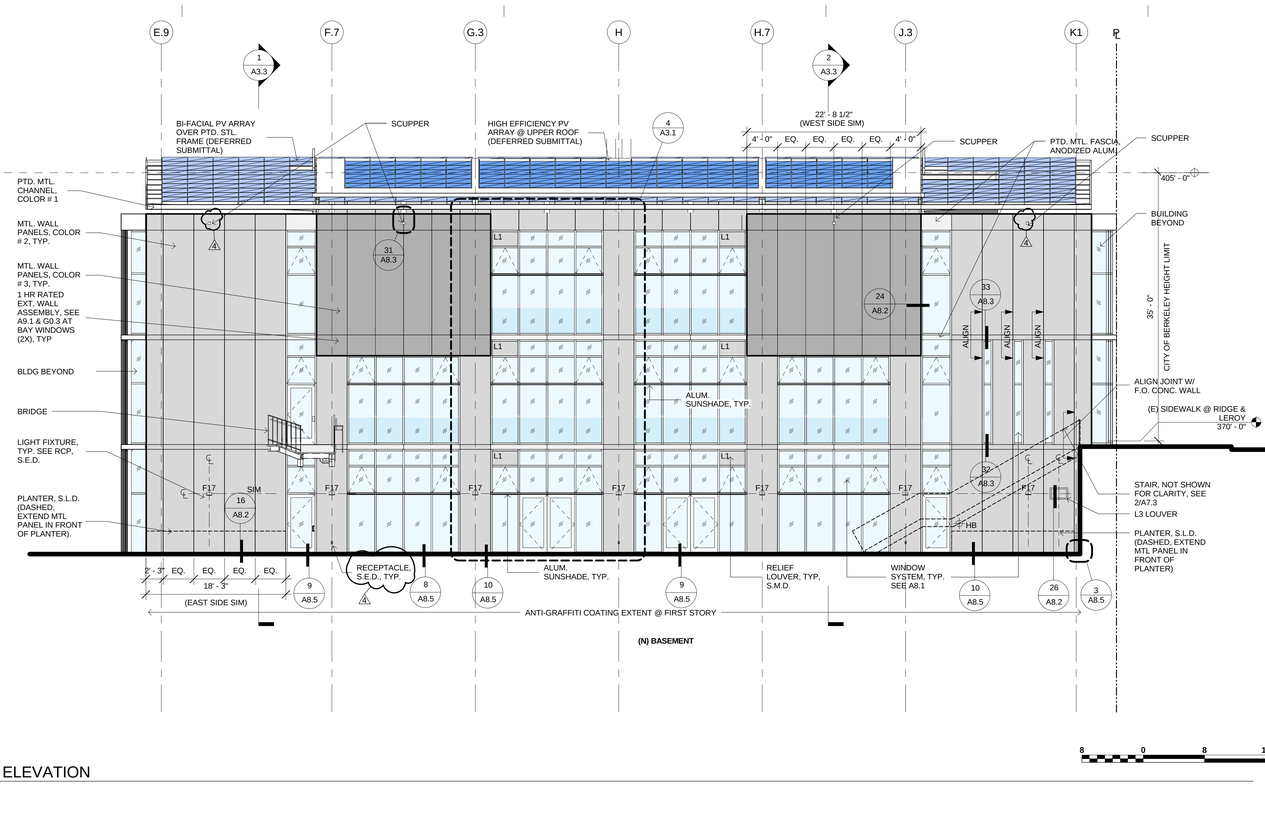
FURNITURE & EQUIPMENT PLANS

SHEET No

A2.7

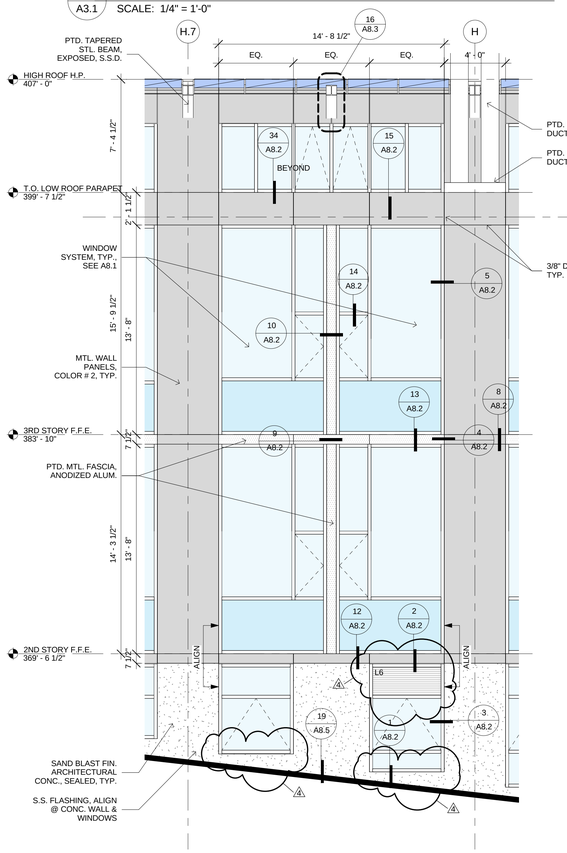


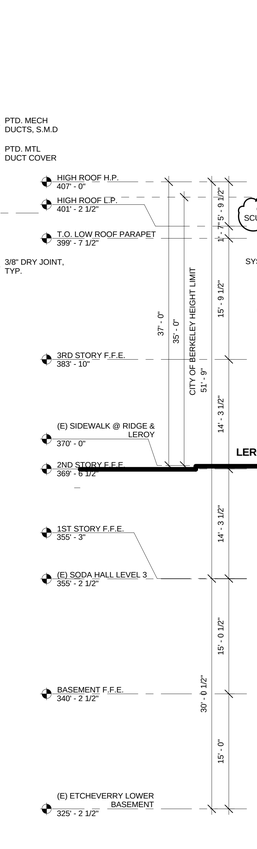


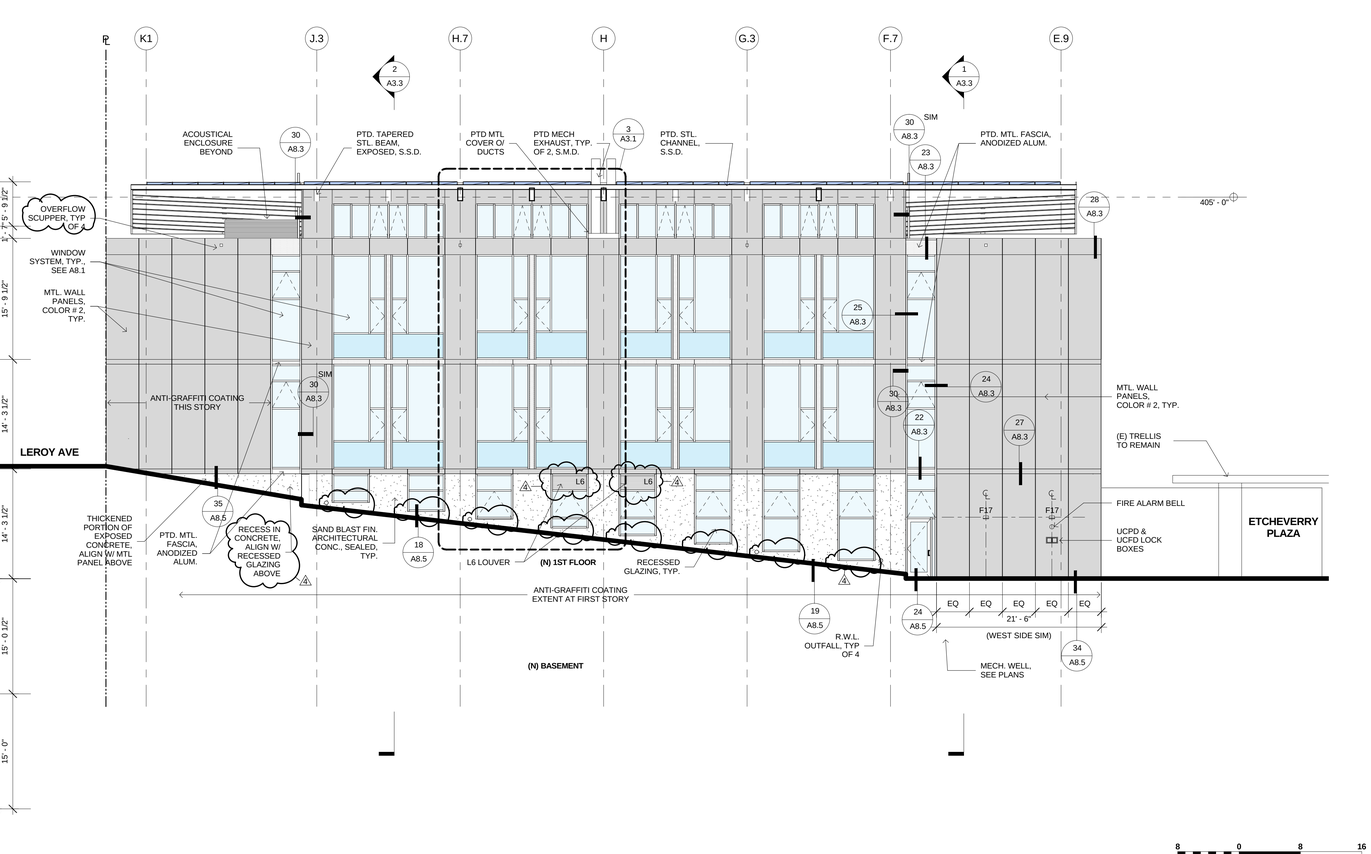


2 A3.1 SOUTH EXTERIOR ELEVATION
SCALE: 1/8" = 1'-0"

4 A3.1 DETAIL SOUTH ELEVATION
SCALE: 1/4" = 1'-0"







3 A3.1 DETAIL NORTH ELEVATION
SCALE: 1/4" = 1'-0"

1 A3.1 NORTH EXTERIOR ELEVATION
SCALE: 1/8" = 1'-0"

EXTERIOR MATERIALS LEGEND:

- CONCRETE
- TRANSPARENT GLASS
- TRANSLUCENT GLASS
- ANODIZED ALUMINUM
- COLOR # 1 (WHITE)
- COLOR # 2 (LIGHT GRAY)
- COLOR# 3 (DARK GRAY)

LOUVER LEGEND

NO.:	SIZE (WIDTH X HEIGHT):	LOCATION:
L1	3'-4 3/8" W x 1'-10 1/2" H	S. C.W.
L2	3'-5 3/8" W x 1'-10 1/2" H	E. ELEV C.W.
L3	2'-0" W X 1'-2" H	1ST STORY RESTRMS
L4	6'-0" W x 5'-4" T	MECH WELL.
L5	6'-0"" W x 2'-8" H	MECH WELL
L6	4'-5 1/2" W x 1'-10 1/2" H	N. ELEV EQUIP RM
		E. ELEV CONCRETE

EXTERIOR SKIN GENERAL NOTES:

NOTES:
2" ARCHT'L BASE BID, 4" ACOUST. A
2" ARCHT'L BASE BID, 4" ACOUST. A
4" ARCHT'L LOUVER
4" ARCHT'L LOUVER, LOW
4" ARCHT'L LOUVER, HIGH
2" ARCHT'L LOUVER
4" ARCHT'L LOUVER

1. ELEVATION DRAWINGS AND COORESPONDING DETAIL DRAWINGS REPRESENT DESIGN INTENT ONLY, ARE NOT COMPREHENSIVE AND ARE NOT INTENDED FOR CONSTRUCTION.

2. THE DESIGN-BUILD SUBCONTRACTOR SHALL BE RESPONSIBLE FOR A COMPLETE EXTERIOR WALL SYSTEM. INCLUDING EXTERIOR SKIN ELEMENTS NOT SHOWN, INCLUDING BUT NOT LIMITED TO FLASHING, JOINT SEALANTS, STRUCTURAL CONNECTIONS, CRUMPLE ZONES, ETC.

3. THE DESIGN-BUILD SUBCONTRACTOR IS RESPONSIBLE FOR ALL ENGINEERING, CODE COMPLIANCE, AND COMPLIANCE WITH APPLICABLE STANDARDS WITH RESPECT TO THE EXTERIOR SKIN; AND SUBMITTAL OF ALL REQUIRED PERMITS TO AUTHORITIES HAVING JURISDICTION.

4. THE DESIGN-BUILD SUBCONTRACTOR SHALL COORDINATE AND COLLABORATE WITH THE DESIGN TEAM DURING THE CONSTRUCTION DOCUMENTS PHASE TO ENSURE CONFORMANCE W/ DESIGN INTENT AND COORDINATION WITH OTHER DISCIPLINES.

5. THE CM / GENERAL CONTRACTOR SHALL BE RESPONSIBLE DELINEATING DESIGN BUILD SCOPE-OF-WORK THAT IS INCLUDED IN THIS BID PACKAGE AND FOR COORDINATION WITH OTHER TRADES (ROOFING, WATERPROOFING, STEEL, ETC.)

6. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

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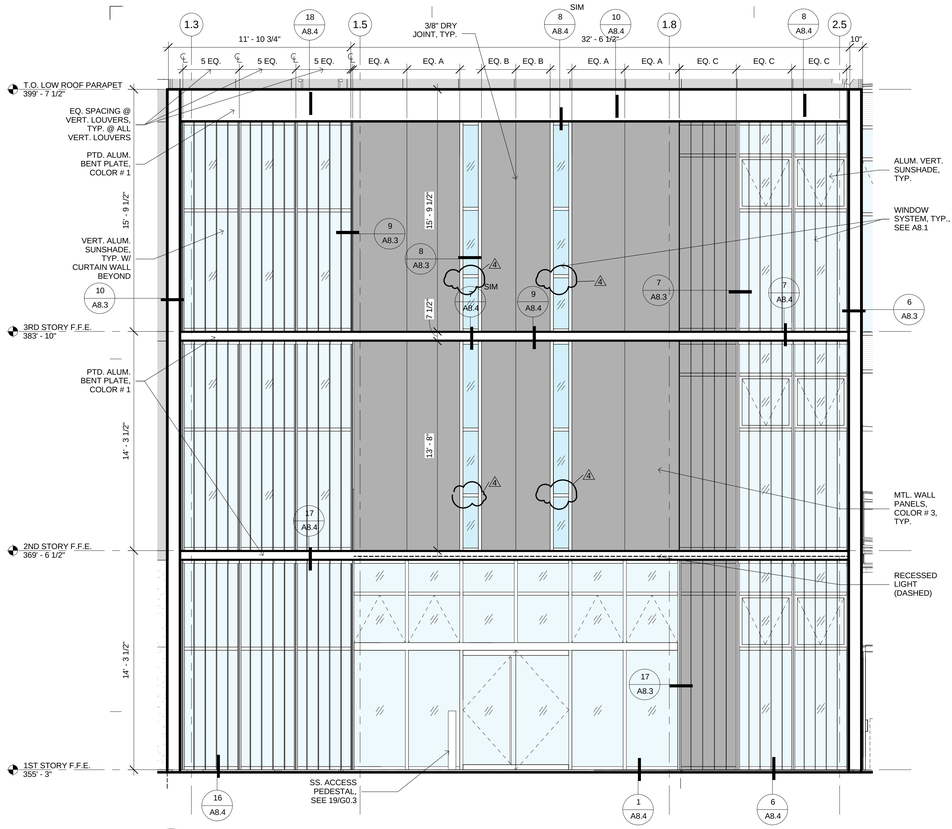
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 2 - Ext. Skin D/B	06/06/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission Rev	08/15/14

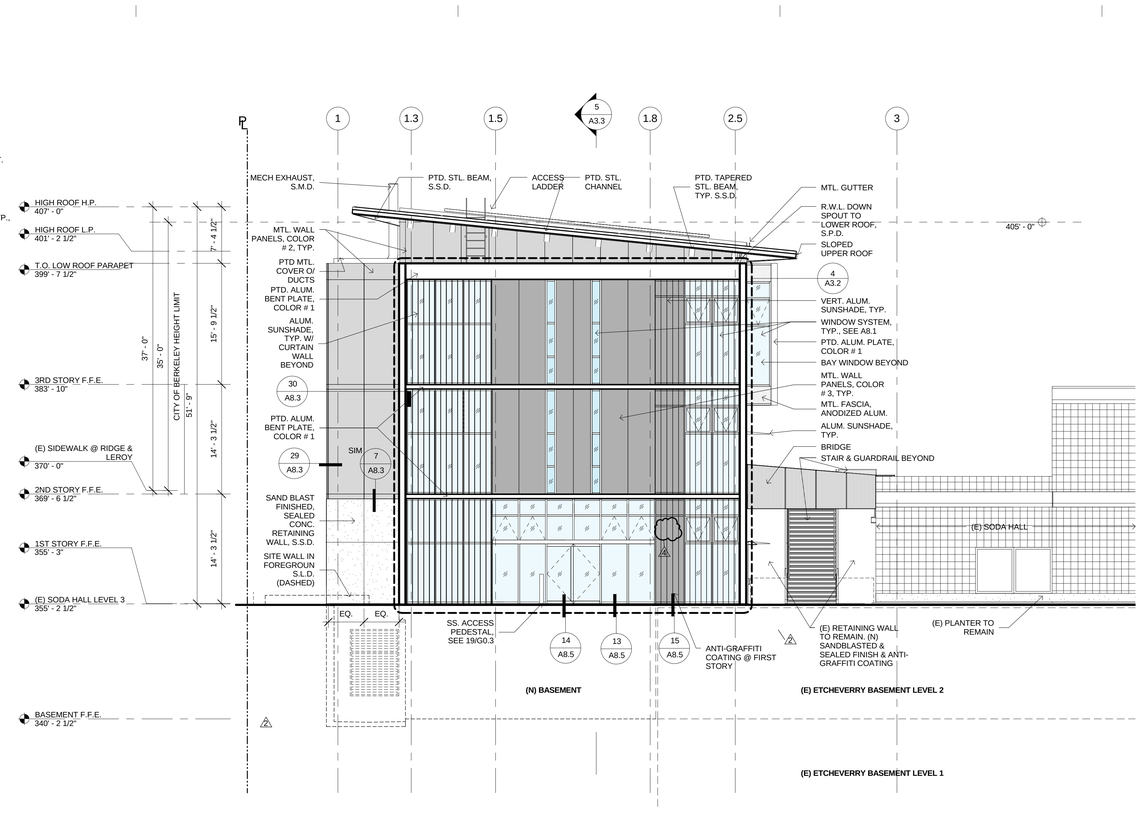
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE
EXTERIOR ELEVATIONS

SHEET No
A3.1



4 A3.2 DETAIL WEST ELEVATION
SCALE: 1/4" = 1'-0"



2 A3.2 WEST EXTERIOR ELEVATION
SCALE: 1/8" = 1'-0"

EXTERIOR MATERIALS LEGEND:

- CONCRETE
- TRANSPARENT GLASS
- TRANSLUCENT GLASS
- ANODIZED ALUMINUM
- COLOR # 1 (WHITE)
- COLOR # 2 (LIGHT GRAY)
- COLOR# 3 (DARK GRAY)

LOUVER LEGEND

NO.:	SIZE (WIDTH X HEIGHT):	LOCATION:	NOTES:
L1	3'-4 3/8" W x 1'-10 1/2" H	S. C.W.	2" ARCHT'L BASE BID, 4" ACOUST. AL
L2	3'-5 3/8" W x 1'-10 1/2" H	E. ELEV C.W.	2" ARCHT'L BASE BID, 4" ACOUST. AL
L3	2'-0" W X 1'-2" H	1ST STORY RESTRMS	4" ARCHT'L LOUVER
L4	6'-0" W x 5'-4" T	MECH WELL	4" ARCHT'L LOUVER, LOW
L5	6'-0"" W x 2'-8" H	MECH WELL	4" ARCHT'L LOUVER, HIGH
L6	4'-5 1/2" W x 1'-10 1/2" H	N. ELEV EQUIP RM	2" ARCHT'L LOUVER
L7	2'-0" W X 1'-6" H	E. ELEV CONCRETE	4" ARCHT'L LOUVER

EXTERIOR SKIN GENERAL NOTES:

1. ELEVATION DRAWINGS AND COORESPONDING DETAIL DRAWINGS REPRESENT DESIGN INTENT ONLY, ARE NOT COMPREHENSIVE AND ARE NOT INTENDED FOR CONSTRUCTION.

2. THE DESIGN-BUILD SUBCONTRACTOR SHALL BE RESPONSIBLE FOR A COMPLETE EXTERIOR WALL SYSTEM. INCLUDING EXTERIOR SKIN ELEMENTS NOT SHOWN, INCLUDING BUT NOT LIMITED TO FLASHING, JOINT SEALANTS, STRUCTURAL CONNECTIONS, CRUMPLE ZONES, ETC.

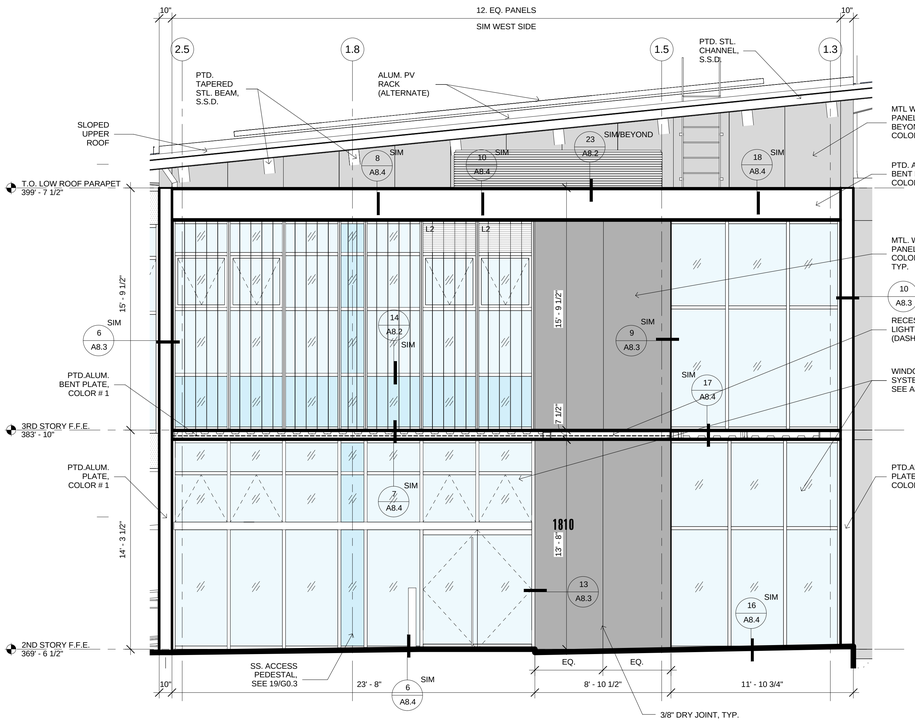
3. THE DESIGN-BUILD SUBCONTRACTOR IS RESPONSIBLE FOR ALL ENGINEERING, CODE COMPLIANCE, AND COMPLIANCE WITH APPLICABLE STANDARDS WITH RESPECT TO THE EXTERIOR SKIN; AND SUBMITTAL OF ALL REQUIRED PERMITS TO AUTHORITIES HAVING JURISDICTION.

4. THE DESIGN-BUILD SUBCONTRACTOR SHALL COORDINATE AND COLLABORATE WITH THE DESIGN TEAM DURING THE CONSTRUCTION DOCUMENTS PHASE TO ENSURE CONFORMANCE W/ DESIGN INTENT AND COORDINATION WITH OTHER DISCIPLINES.

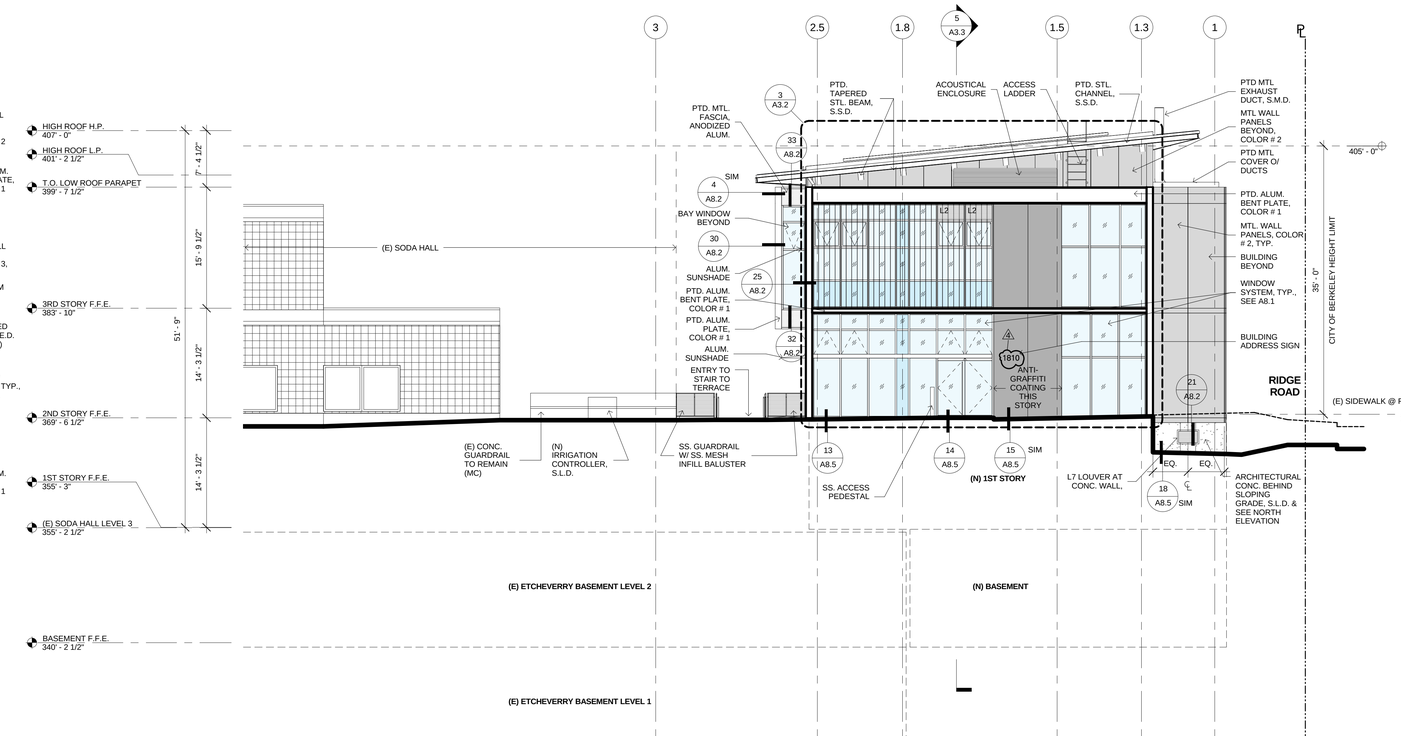
5. THE CM / GENERAL CONTRACTOR SHALL BE RESPONSIBLE DELINEATING DESIGN BUILD SCOPE-OF-WORK THAT IS INCLUDED IN THIS BID PACKAGE AND FOR COORDINATION WITH OTHER TRADES (ROOFING, WATERPROOFING, STEEL, ETC.)

6. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

8 0 8 16



3 A3.2 DETAIL EAST ELEVATION
SCALE: 1/4" = 1'-0"



1 A3.2 EAST EXTERIOR ELEVATION
SCALE: 1/8" = 1'-0"

8 0 8 16

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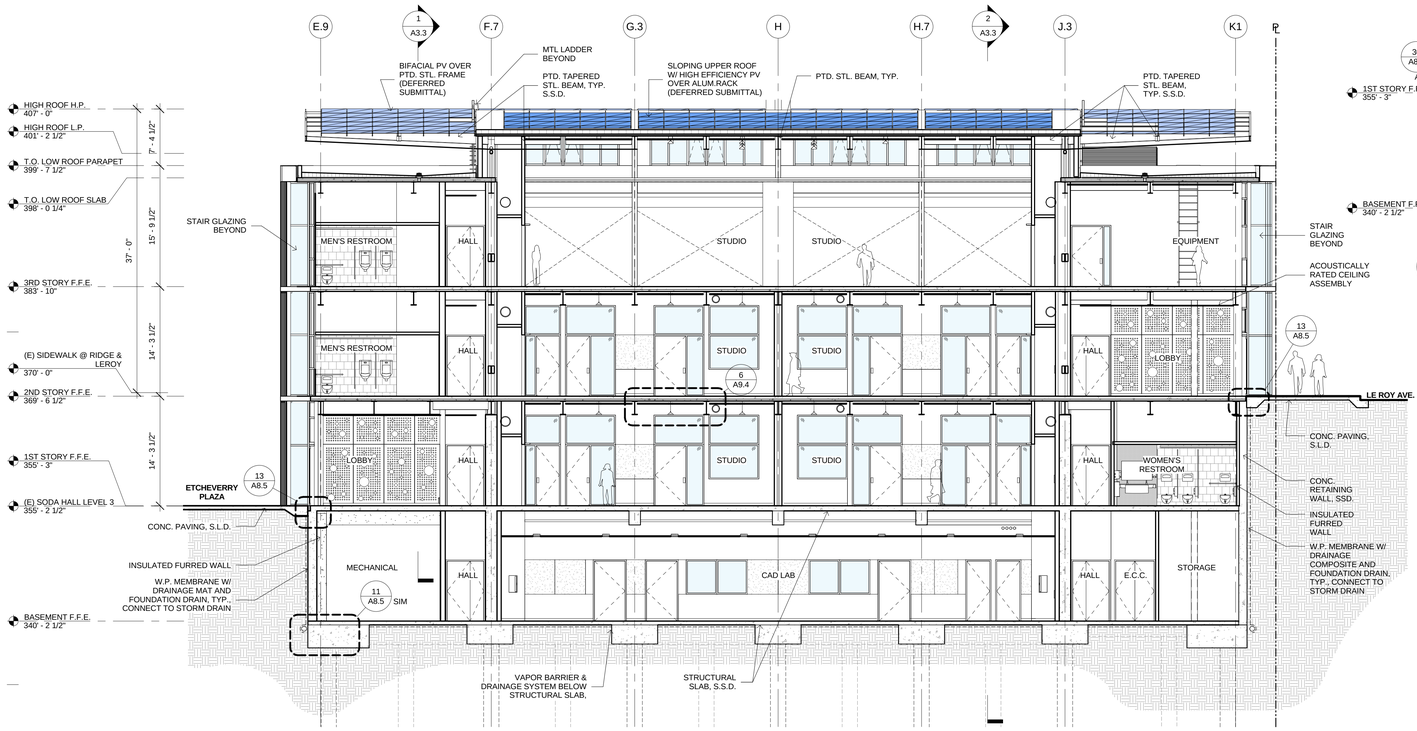
No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 2 - Ext. Skin D/B	06/06/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
2	BID # 2 - Addendum 1	07/22/14
4	100% CDs / Permit Submission Rev	08/15/14

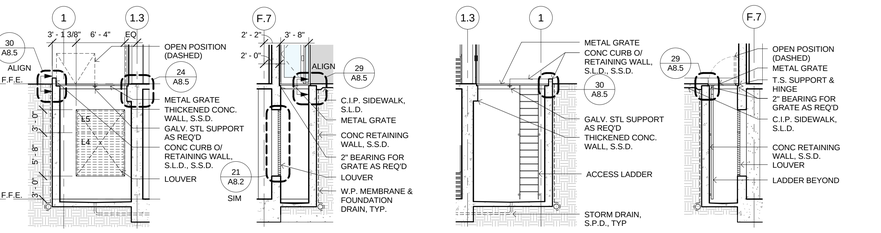
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE
EXTERIOR ELEVATIONS

SHEET No
A3.2



5 A3.3 BUILDING LONGITUDINAL SECTION
SCALE: 1/8" = 1'-0"

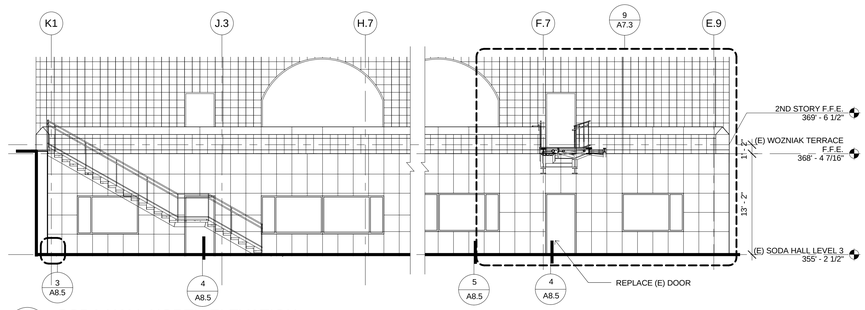


4D A3.3 MECH. WELL EAST
SCALE: 1/8" = 1'-0"

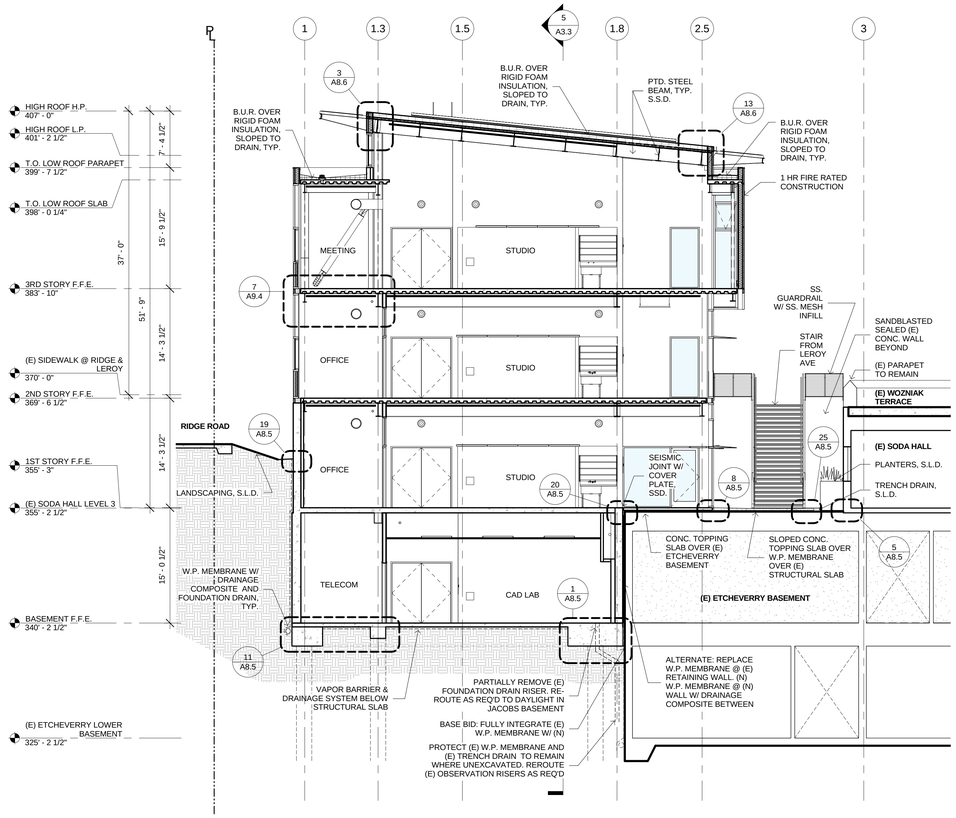
4C A3.3 MECH. WELL SOUTH
SCALE: 1/8" = 1'-0"

4B A3.3 MECH. WELL WEST
SCALE: 1/8" = 1'-0"

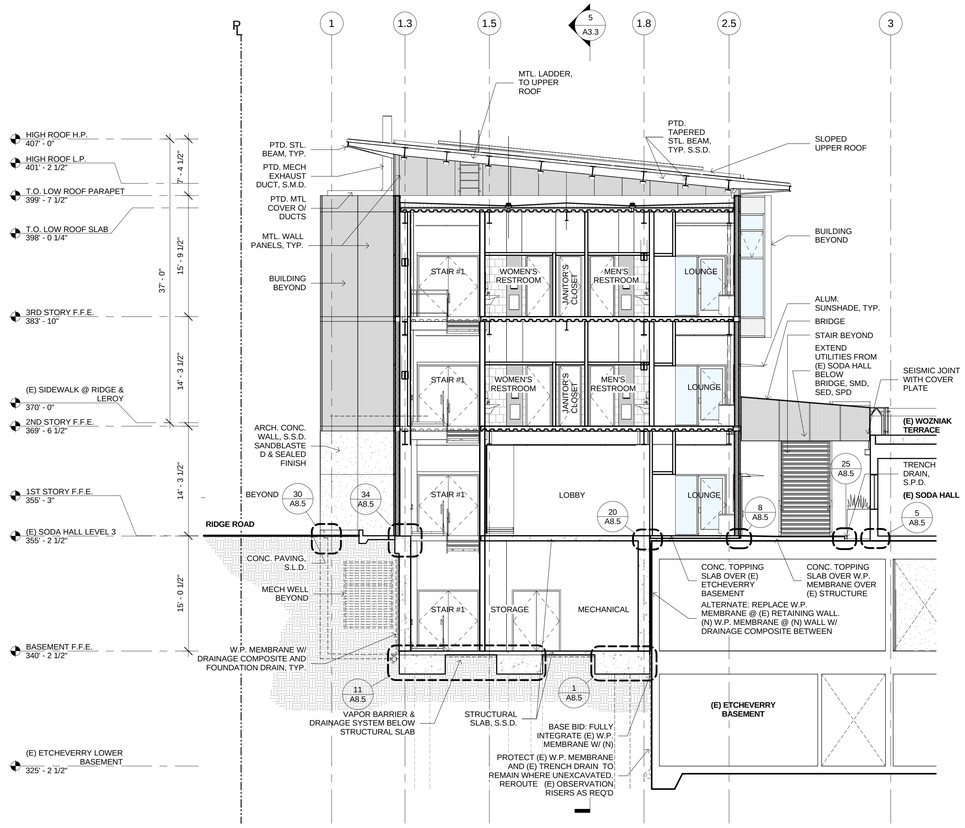
4A A3.3 MECH. WELL NORTH
SCALE: 1/8" = 1'-0"



3 A3.3 SODA HALL NORTH ELEVATION
SCALE: 1/8" = 1'-0"



2 A3.3 BUILDING CROSS SECTION B
SCALE: 1/8" = 1'-0"



1 A3.3 BUILDING CROSS SECTION A
SCALE: 1/8" = 1'-0"

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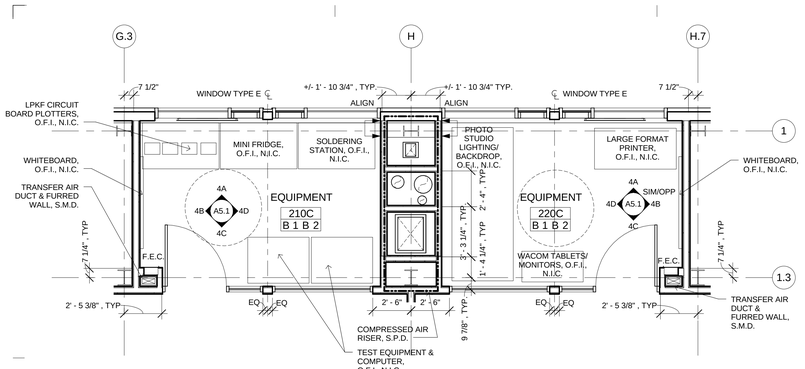
	BID # 2 - Ext. Skin D/B	06/06/14
	BID # 3 - Structure / Site Utilities / W.P.	07/09/14
	BID # 3A - Elevator	08/01/14
	100% CDs / Permit Submission	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

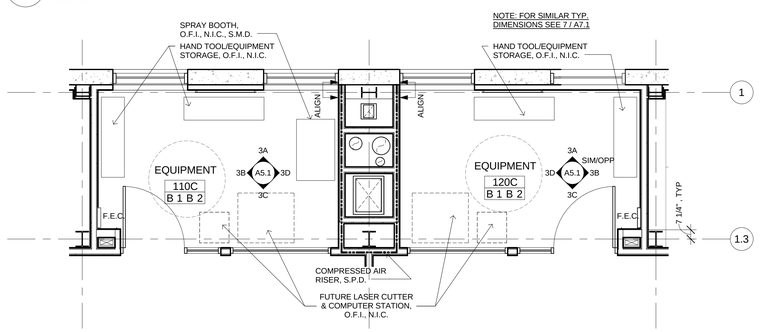
SHEET TITLE
BUILDING SECTIONS

SHEET No
A3.3



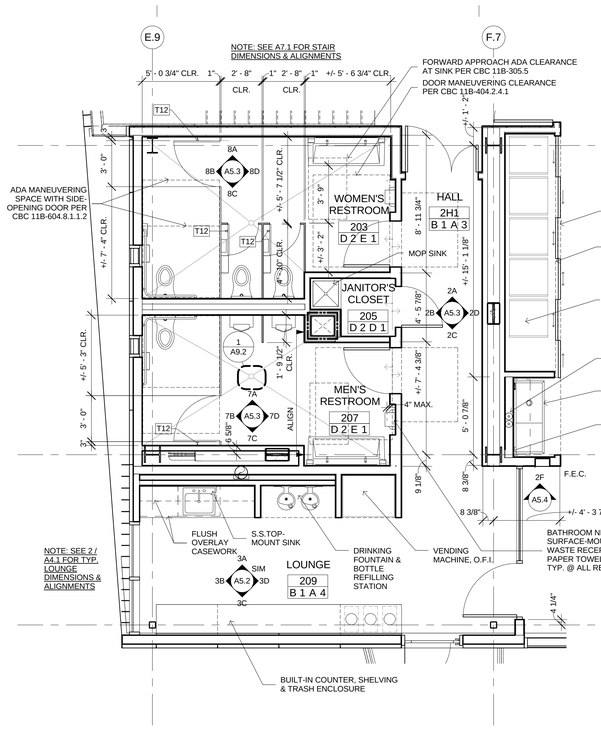
7 A4.1 2ND STORY EQUIPMENT ROOMS ENLARGED PLAN

SCALE: 1/4" = 1'-0"



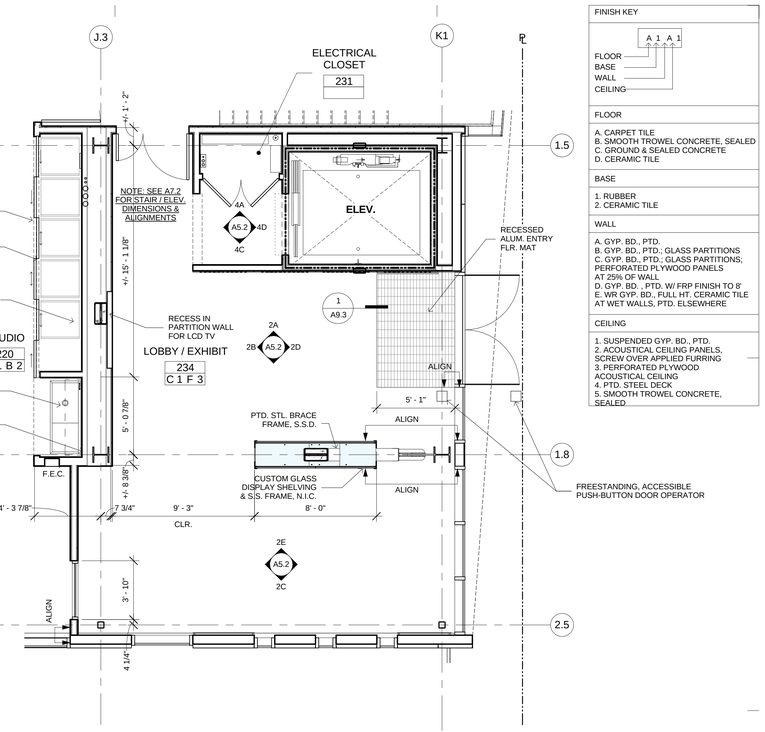
6 A4.1 1ST STORY EQUIPMENT ROOMS ENLARGED PLAN

SCALE: 1/4" = 1'-0"



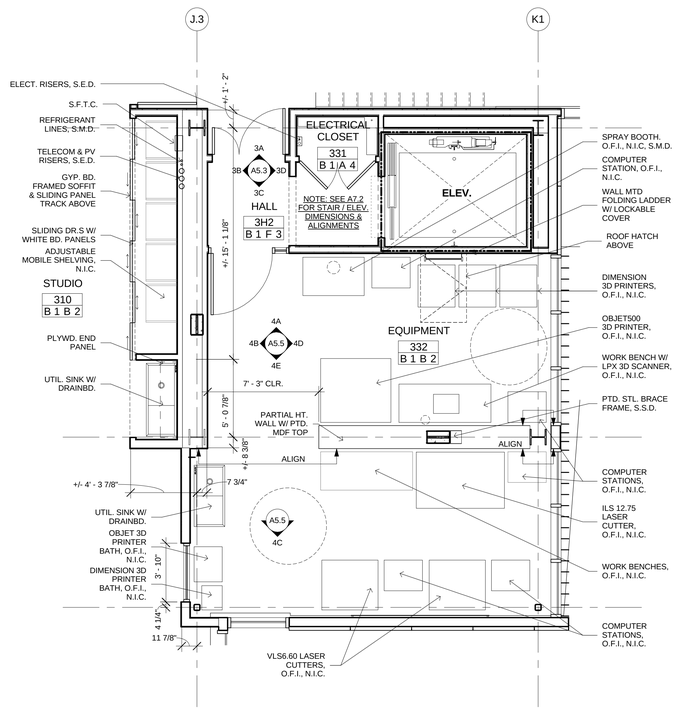
4 A4.1 2ND & 3RD STORY LOUNGE & RESTROOM ENLARGED PLAN

SCALE: 1/4" = 1'-0"



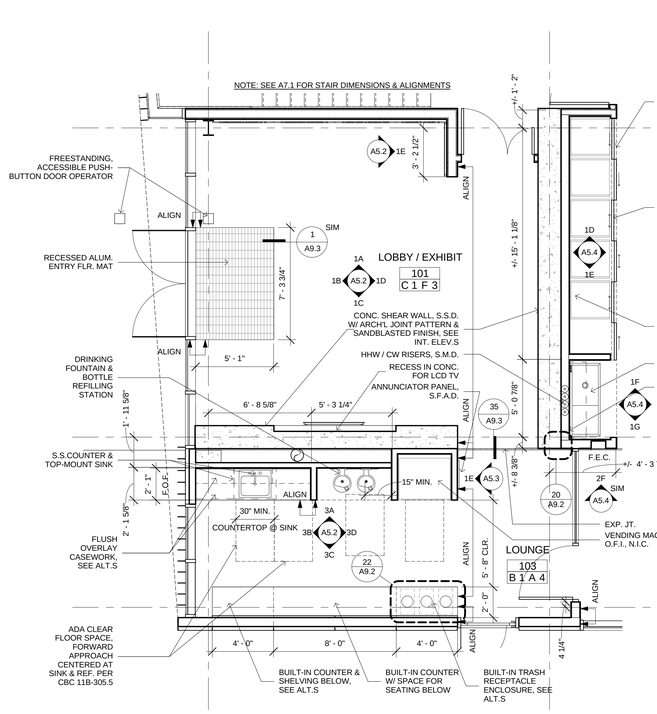
3 A4.1 2ND STORY LOBBY ENLARGED PLAN

SCALE: 1/4" = 1'-0"



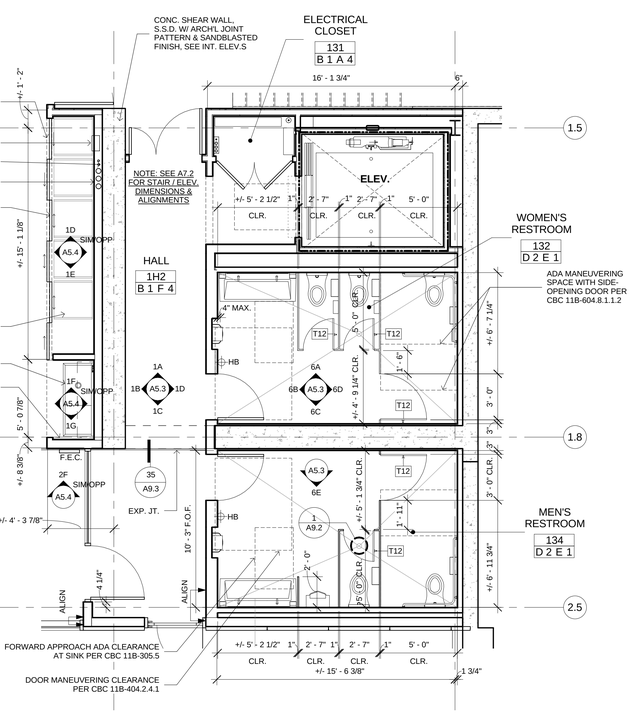
5 A4.1 3RD STORY EQUIPMENT ROOMS ENLARGED PLAN

SCALE: 1/4" = 1'-0"



2 A4.1 1ST STORY LOBBY & LOUNGE ENLARGED PLAN

SCALE: 1/4" = 1'-0"



1 A4.1 1ST STORY RESTROOMS ENLARGED PLAN

SCALE: 1/4" = 1'-0"

FINISH KEY

FLOOR / BASE / WALL / CEILING: A 1 A 1

FLOOR

A. CARPET TILE
B. SMOOTH TROWEL CONCRETE, SEALED
C. GROUND & SEALED CONCRETE
D. CERAMIC TILE

BASE

1. RUBBER
2. CERAMIC TILE

WALL

A. GYP. BD., PTD.
B. GYP. BD., PTD.; GLASS PARTITIONS
C. GYP. BD., PTD.; GLASS PARTITIONS; PERFORATED PLYWOOD PANELS AT 25% OF WALL
D. GYP. BD., PTD. W/ FRP FINISH TO 8'
E. WR GYP. BD., FULL HT. CERAMIC TILE AT WET WALLS, PTD. ELSEWHERE

CEILING

1. SUSPENDED GYP. BD., PTD.
2. ACOUSTICAL CEILING PANELS, SCREW OVER APPLIED FURRING
3. PERFORATED PLYWOOD ACOUSTICAL CEILING
4. PTD. STEEL DECK
5. SMOOTH TROWEL CONCRETE, SEALED

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	100% CDs / Permit Submission	08/15/14

DATE: 15 August 2014
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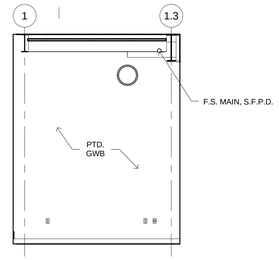
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE

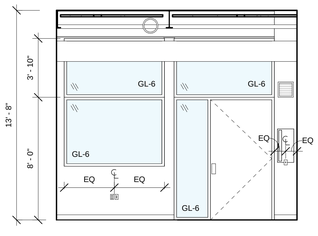
ENLARGED FLOOR PLANS

SHEET No

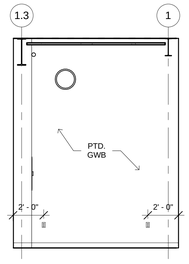
A4.1



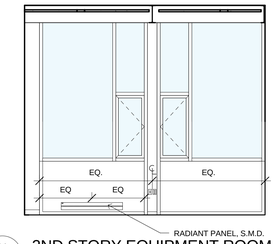
4D A5.1 2ND STORY EQUIPMENT ROOM EAST
SCALE: 1/4" = 1'-0"



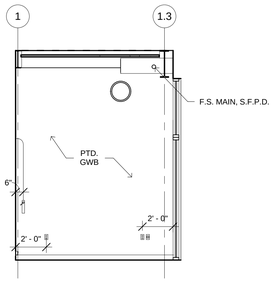
4C A5.1 2ND STORY EQUIPMENT ROOM SOUTH
SCALE: 1/4" = 1'-0"



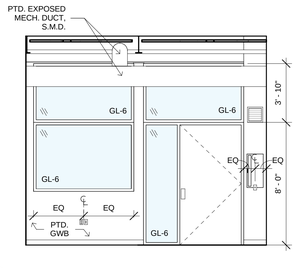
4B A5.1 2ND STORY EQUIPMENT ROOM WEST
SCALE: 1/4" = 1'-0"



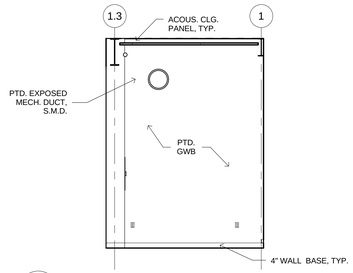
4A A5.1 2ND STORY EQUIPMENT ROOM NORTH
SCALE: 1/4" = 1'-0"



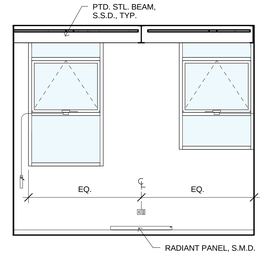
3D A5.1 1ST STORY EQUIPMENT ROOM EAST
SCALE: 1/4" = 1'-0"



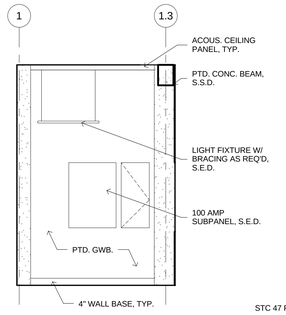
3C A5.1 1ST STORY EQUIPMENT ROOM SOUTH
SCALE: 1/4" = 1'-0"



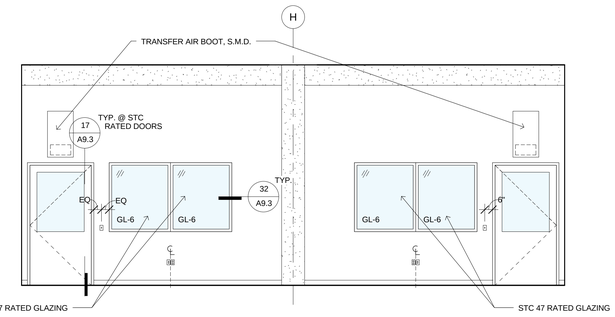
3B A5.1 1ST STORY EQUIPMENT ROOM WEST
SCALE: 1/4" = 1'-0"



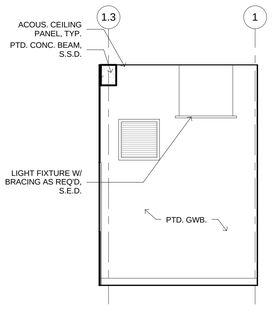
3A A5.1 1ST STORY EQUIPMENT ROOM NORTH
SCALE: 1/4" = 1'-0"



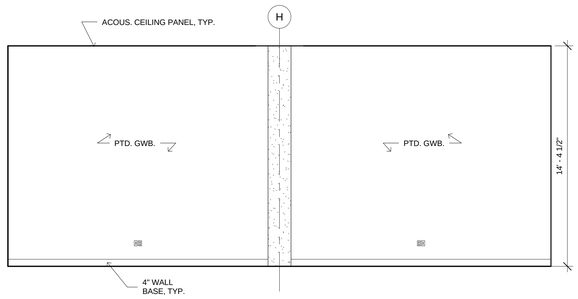
2D A5.1 BASEMENT EQUIP.RM.EAST
SCALE: 1/4" = 1'-0"



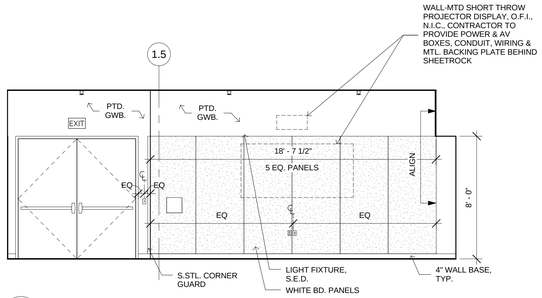
2C A5.1 BASEMENT EQUIPMENT ROOM SOUTH
SCALE: 1/4" = 1'-0"



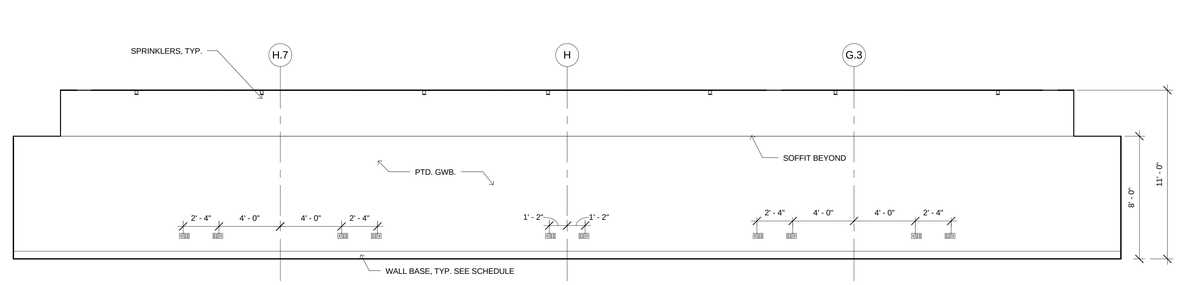
2B A5.1 BASEMENT EQUIP.RM.WEST
SCALE: 1/4" = 1'-0"



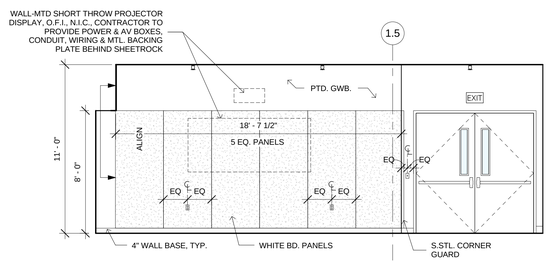
2A A5.1 BASEMENT EQUIPMENT ROOM NORTH
SCALE: 1/4" = 1'-0"



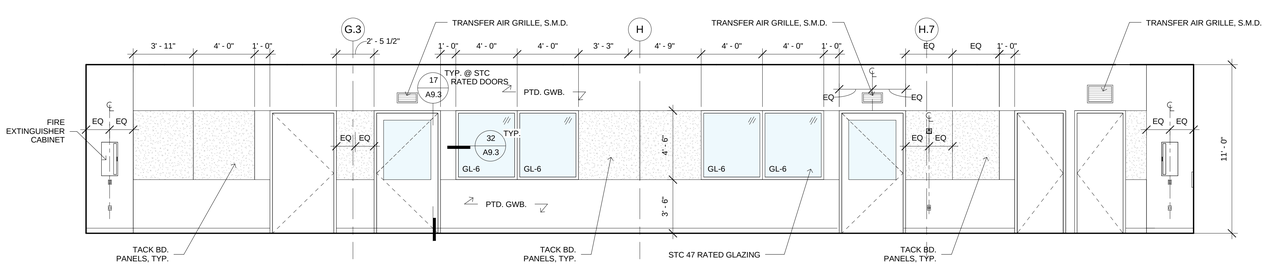
1D A5.1 BASEMENT CAD LAB EAST
SCALE: 1/4" = 1'-0"



1C A5.1 BASEMENT CAD LAB SOUTH
SCALE: 1/4" = 1'-0"



1B A5.1 BASEMENT CAD LAB WEST
SCALE: 1/4" = 1'-0"



1A A5.1 BASEMENT CAD LAB NORTH
SCALE: 1/4" = 1'-0"

ARCHITECTS

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STAMP

CONSULTANTS

PROJECT

MATERIALS LEGEND:

- GYP. BD, PTD.
- CONCRETE, SAND-BLASTED FINISH
- GLASS; PROVIDE IMPACT SAFETY GLAZING
- PERFORATED PLYWOOD PANELS WITH SUPPORT SYSTEM
- TACK BOARD / WHITE BOARD, AS NOTED; ADHERE TO GWB PARTITION
- CERAMIC WALL TILE (12x12)
- CERAMIC WALL TILE (2x2)
- FIBERGLASS REINFORCED PLASTIC

GLASS LEGEND

GL-1*	1" CLR. INSUL. GLASS: SOLARBAN 60
GL-1A	1" CLR. INSUL. GLASS: SOLARBAN 60 W/ TRANSLUCENT LAM. INNER LITE
GL-1B	NOT USED
GL-2*	1" CLR. INSUL. GLASS: SOLARBAN 70 XL
GL-2A	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ TRANSLUCENT LAM. INNER LITE
GL-2B	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ COMBINATION LAM. INNER LITE
GL-3	NOT USED
GL-4	NOT USED
GL-5	NOT USED
GL-6	3/8" CLR LAM. GLASS
GL-7	3/4" CLR MONOLITHIC GLASS
GL-8	1/2" CLR GLASS: 90 MIN FIRE RATED ASSEMBLY
GL-9	2 LAYERS 1/4" LAM GLASS W/ 3" AIR GAP, STC 43

*NOTE: GL-1,1A & 1B AT NORTH AND EAST ELEVATIONS, TYP.; GL-2,2A & 2B AT SOUTH AND WEST ELEVATIONS, TYP.

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY
1810 LEROY AVENUE, BERKELEY, CA 94709

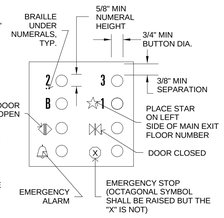
No	REVISION	DATE
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

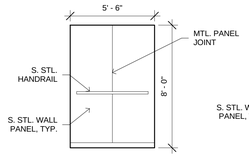
SHEET TITLE
INTERIOR ELEVATIONS

SHEET No
A5.1

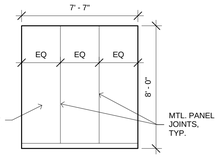
NOTES:
1. CAR CONTROL SHALL COMPLY WITH SECTION 11B-409.4.6
2. BUTTONS SHALL BE RAISED 1/8" ABOVE THE SURROUNDING SURFACE
3. BUTTONS SHALL BE ILLUMINATED
4. CHARACTERS SHALL COMPLY WITH SECTION 11B-703.2 & 11B-703.5. CONTRACT GRADE 2
BRAILLE THAT CONFORMS TO SECTION 11B-703.3 SHALL BE LOCATED IMMEDIATELY BELOW THE NUMERAL, CHARACTER OR SYMBOL
5. THE RAISED CHARACTERS AND SYMBOLS SHALL BE WHITE ON A BLACK BACKGROUND
6. CONTROLS AND EMERGENCY EQUIPMENT IDENTIFIED BY RAISED SYMBOLS SHALL INCLUDE "DOOR OPEN", "DOOR CLOSED", ALARM BELL", "EMERGENCY STOP", AND "TELEPHONE"



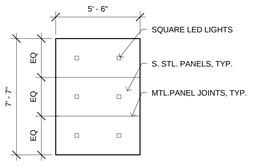
9 A5.2 ELEVATOR CONTROL PANEL
SCALE: 1/4" = 1'-0"



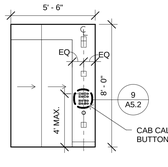
7D A5.2 ELEVATOR CAB EAST
SCALE: 1/4" = 1'-0"



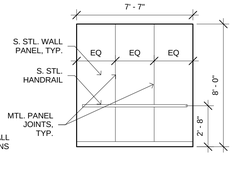
7C A5.2 ELEVATOR CAB SOUTH
SCALE: 1/4" = 1'-0"



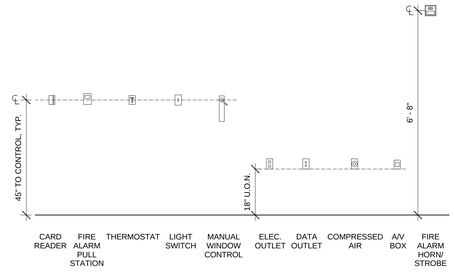
8 A5.2 ELEVATOR CAB RCP
SCALE: 1/4" = 1'-0"



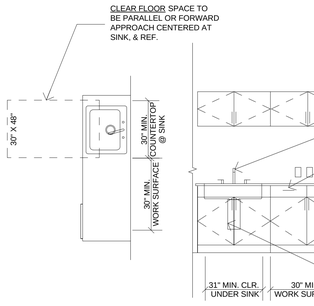
7B A5.2 ELEVATOR CAB WEST
SCALE: 1/4" = 1'-0"



7A A5.2 ELEVATOR CAB NORTH
SCALE: 1/4" = 1'-0"



6 A5.2 TYP. ACCESSORY MOUNTING HEIGHTS
SCALE: 1/2" = 1'-0"

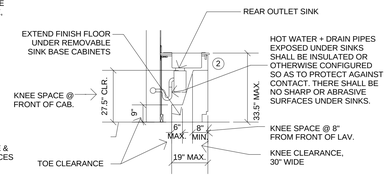


5 A5.2 ADA CLEARANCES @ LOUNGE KITCHENETTE
SCALE: 1/4" = 1'-0"

KITCHEN NOTES:
ALL KITCHENS: (PER CBC 11B-804):

1. FAUCET CONTROLS, DOOR HARDWARE, AND OPERATING MECHANISM SHALL BE OPERABLE WITH ONE HAND AND SHALL NOT REQUIRE TIGHT GRASPING, PINCHING OR TWISTING OF THE WRIST. THE FORCE REQUIRED TO ACTIVATE CONTROLS SHALL BE NO GREATER THAN 5 LBS. LEVER-OPERATED, PUSH-TYPE AND ELECTRONICALLY CONTROLLED MECHANISMS ARE EXAMPLES OF ACCEPTABLE DESIGNS. SELF-CLOSING VALVES ARE ALLOWED IF THE FAUCET REMAINS OPEN FOR AT LEAST 10 SECONDS.

2. DEPTH OF SINK BOWL TO BE 6-1/2" MAX, ONLY ONE BOWL OF A MULTIPLE BOWL SINK NEED COMPLY.



TYPICAL KITCHEN SINK BASE CABINET SECTION

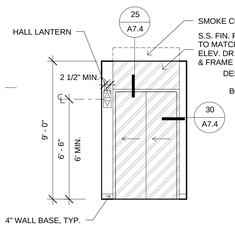
MATERIALS LEGEND:

- GYP. BD, PTD.
- CONCRETE, SAND-BLASTED FINISH
- GLASS; PROVIDE IMPACT SAFETY GLAZING
- PERFORATED PLYWOOD PANELS WITH SUPPORT SYSTEM
- TACK BOARD / WHITE BOARD, AS NOTED; ADHERE TO GWB PARTITION
- CERAMIC WALL TILE (12x12)
- CERAMIC WALL TILE (2x2)
- FIBERGLASS REINFORCED PLASTIC

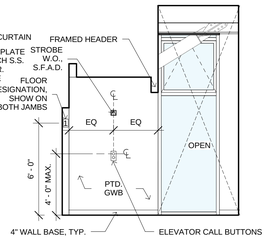
GLASS LEGEND

GL-1*	1" CLR. INSUL. GLASS: SOLARBAN 60
GL-1A	1" CLR. INSUL. GLASS: SOLARBAN 60 W/ TRANSLUCENT LAM. INNER LITE
GL-1B	NOT USED
GL-2*	1" CLR. INSUL. GLASS. SOLARBAN 70 XL
GL-2A	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ TRANSLUCENT LAM. INNER LITE
GL-2B	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ COMBINATION LAM. INNER LITE
GL-3	NOT USED
GL-4	NOT USED
GL-5	NOT USED
GL-6	3/8" CLR LAM. GLASS
GL-7	3/4" CLR MONOLITHIC GLASS
GL-8	1/2" CLR GLASS -90 MIN FIRE RATED ASSEMBLY
GL-9	2 LAYERS 1/4" LAM GLASS W/ 3" AIR GAP, STC 43

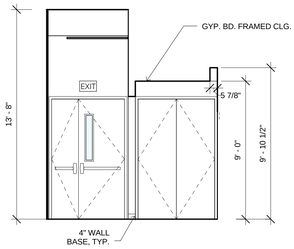
*NOTE: GL-1,1A & 1B AT NORTH AND EAST ELEVATIONS, TYP.; GL-2,2A & 2B AT SOUTH AND WEST ELEVATIONS, TYP.



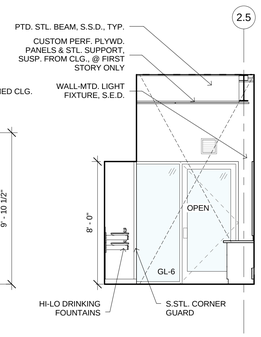
4D A5.2 TYP. ELEV. VEST. EAST
SCALE: 1/4" = 1'-0"



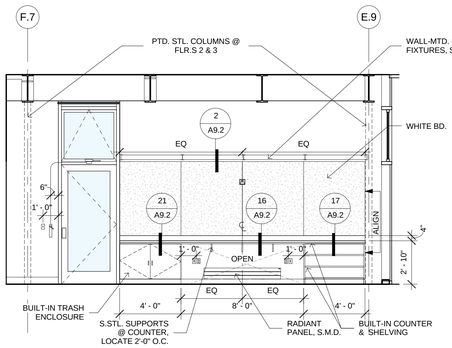
4C A5.2 TYP. ELEV. VEST. SOUTH
SCALE: 1/4" = 1'-0"



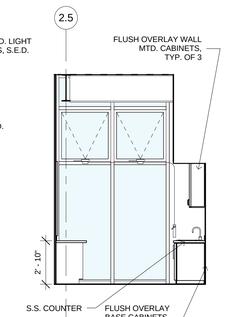
4A A5.2 TYP. ELEV. VEST. NORTH
SCALE: 1/4" = 1'-0"



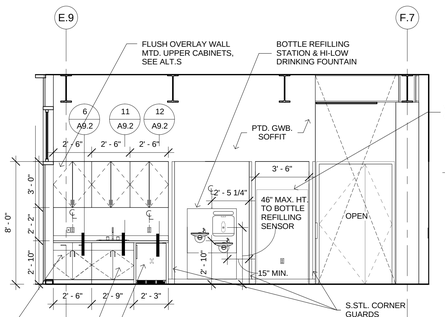
3D A5.2 TYP. LOUNGE EAST
SCALE: 1/4" = 1'-0"



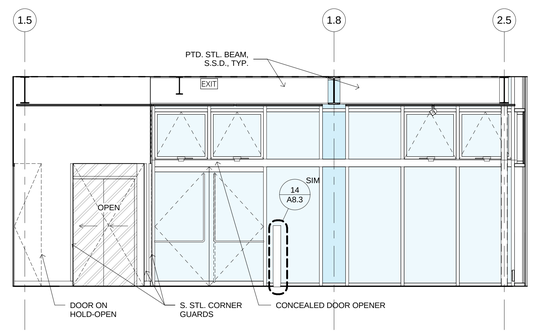
3C A5.2 TYP. LOUNGE SOUTH
SCALE: 1/4" = 1'-0"



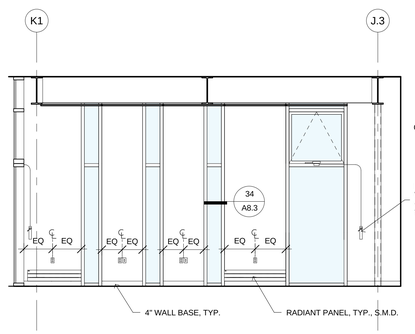
3B A5.2 TYP. LOUNGE WEST
SCALE: 1/4" = 1'-0"



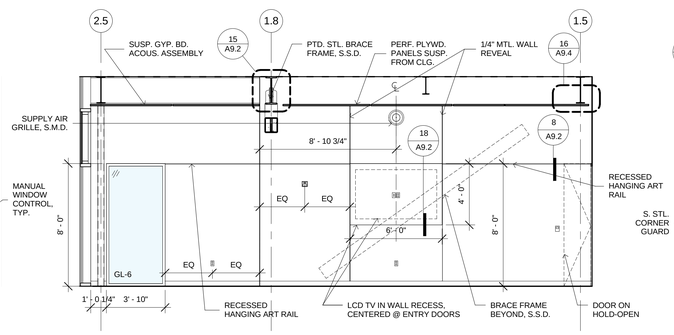
3A A5.2 TYP. LOUNGE NORTH
SCALE: 1/4" = 1'-0"



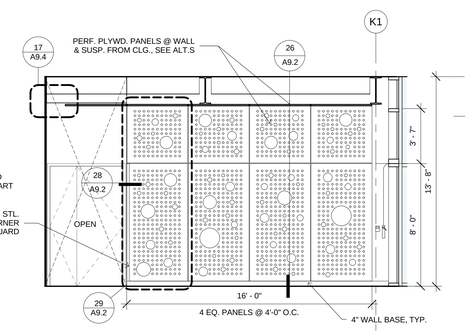
2D A5.2 2ND STORY LOBBY EAST
SCALE: 1/4" = 1'-0"



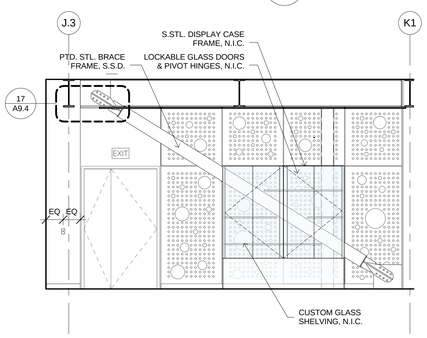
2C A5.2 2ND STORY LOBBY SOUTH
SCALE: 1/4" = 1'-0"



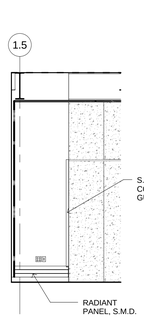
2B A5.2 2ND STORY LOBBY WEST
SCALE: 1/4" = 1'-0"



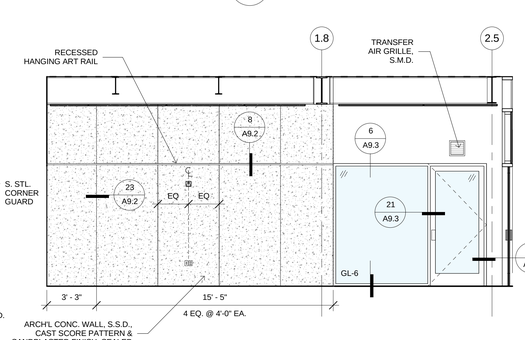
2A A5.2 2ND STORY LOBBY NORTH
SCALE: 1/4" = 1'-0"



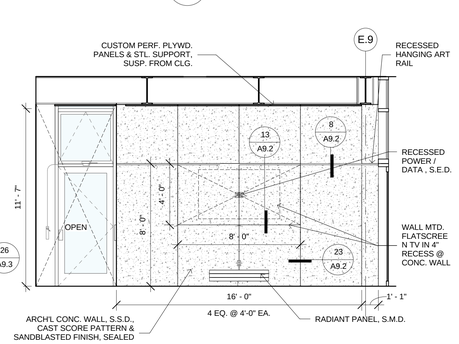
2E A5.2 2ND STORY LOBBY NORTH W/ CASEWORK
SCALE: 1/4" = 1'-0"



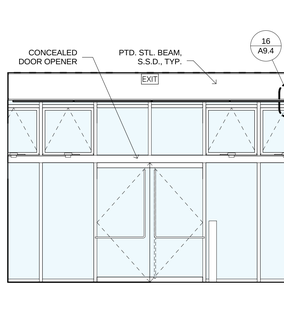
1E A5.2 LOBBY END WALL
SCALE: 1/4" = 1'-0"



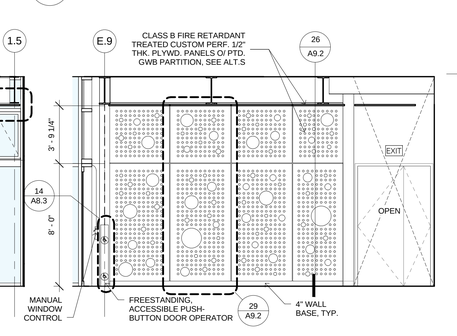
1D A5.2 1ST STORY LOBBY EAST
SCALE: 1/4" = 1'-0"



1C A5.2 1ST STORY LOBBY SOUTH
SCALE: 1/4" = 1'-0"



1B A5.2 1ST STORY LOBBY WEST
SCALE: 1/4" = 1'-0"



1A A5.2 1ST STORY LOBBY NORTH
SCALE: 1/4" = 1'-0"

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PROJECT

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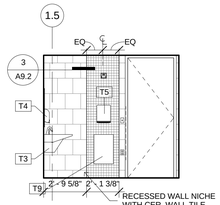
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

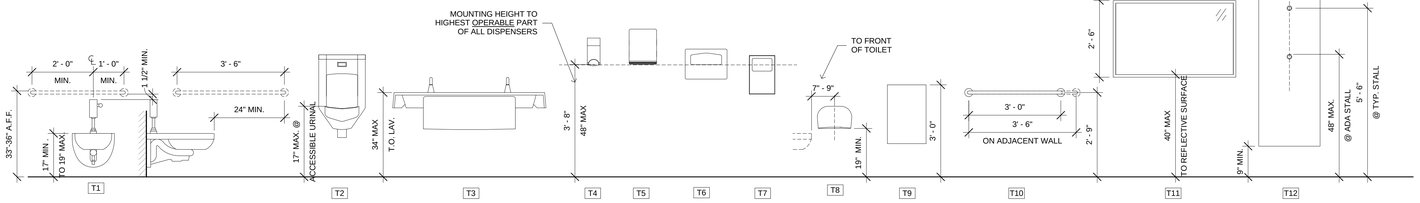
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE
INTERIOR ELEVATIONS

SHEET No
A5.2



8D A5.3 TYP. WOMEN'S RESTROOM EAST
SCALE: 1/4" = 1'-0"



9 A5.3 TOILET ACCESSORY MOUNTING HEIGHTS
SCALE: 1/2" = 1'-0"

RESTROOM LEGEND

NOTE: ALL ITEMS ARE WALL-MTD. U.O.N. SEE 7/A5.1 FOR ACCESSORY MOUNTING HEIGHTS

- T1 TOILET
- T2 URINAL
- T3 SOLID SURFACE COUNTER & BACKSPLASH, UNDERMOUNT SINK & DECK MTD. FAUCET
- T4 SOAP DISPENSER O.F.C.I.
- T5 PAPER TOWEL DISPENSER O.F.C.I.
- T6 SEATCOVER DISPENSER O.F.C.I.
- T7 SANITARY NAPKIN DISPOSAL
- T8 WALL AND PARTITION-MTD. TOILET PAPER DISPENSER. O.F.C.I.
- T9 WASTE RECEPTACLE
- T10 CORNER ADA GRAB BARS
- T11 MIRROR
- T12 PARTITION-MTD. COAT HOOK

RESTROOM NOTES

1. ALL DOORS, FIXTURES AND CONTROLS TO BE ON AN ACCESSIBLE ROUTE.

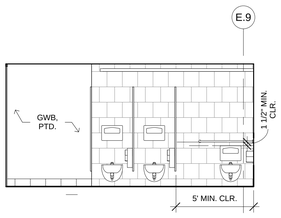
MATERIALS LEGEND:

- GYP. BD, PTD.
- CONCRETE, SAND-BLASTED FINISH
- GLASS; PROVIDE IMPACT SAFETY GLAZING
- PERFORATED PLYWOOD PANELS WITH SUPPORT SYSTEM
- TACK BOARD / WHITE BOARD, AS NOTED; ADHERE TO GWB PARTITION
- CERAMIC WALL TILE (12x12)
- CERAMIC WALL TILE (2x2)
- FIBERGLASS REINFORCED PLASTIC

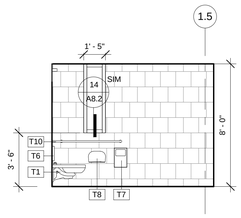
GLASS LEGEND

GL-1*	1" CLR. INSUL. GLASS: SOLARBAN 60
GL-1A	1" CLR. INSUL. GLASS: SOLARBAN 60 W/ TRANSLUCENT LAM. INNER LITE
GL-1B	NOT USED
GL-2*	1" CLR. INSUL. GLASS: SOLARBAN 70 XL
GL-2A	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ TRANSLUCENT LAM. INNER LITE
GL-2B	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ COMBINATION LAM. INNER LITE
GL-3	NOT USED
GL-4	NOT USED
GL-5	NOT USED
GL-6	3/8" CLR LAM. GLASS
GL-7	3/4" CLR MONOLITHIC GLASS
GL-8	1/2" CLR GLASS -90 MIN FIRE RATED ASSEMBLY
GL-9	2 LAYERS 1/4" LAM GLASS W/ 3" AIR GAP, STC 43

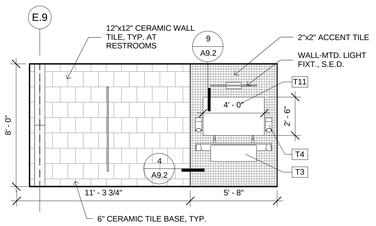
*NOTE: GL-1,1A & 1B AT NORTH AND EAST ELEVATIONS, TYP.; GL-2,2A & 2B AT SOUTH AND WEST ELEVATIONS, TYP.



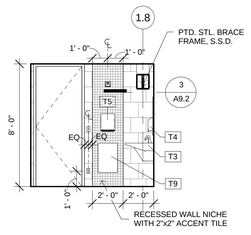
8C A5.3 WOMEN'S RESTRM. SOUTH (FL. 2 & 3)
SCALE: 1/4" = 1'-0"



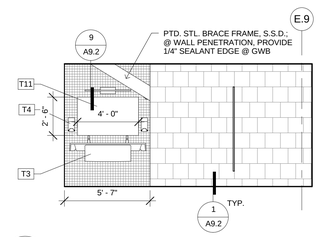
8B A5.3 WOMEN'S RESTRM. WEST (FL. 2 & 3)
SCALE: 1/4" = 1'-0"



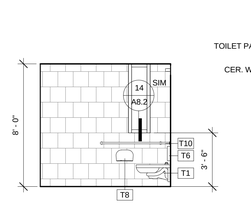
8A A5.3 WOMEN'S RESTRM. NORTH (FL. 2 & 3)
SCALE: 1/4" = 1'-0"



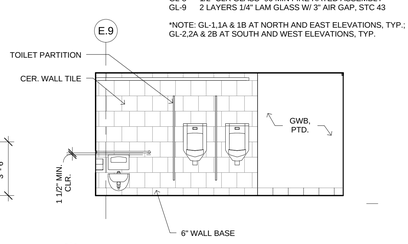
7D A5.3 MEN'S RESTRM. EAST (FL. 2 & 3)
SCALE: 1/4" = 1'-0"



7C A5.3 MEN'S RESTROOM SOUTH (FL. 2 & 3)
SCALE: 1/4" = 1'-0"

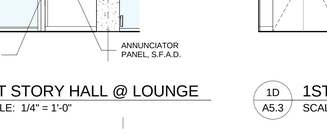


7B A5.3 MEN'S RESTRM. WEST (FL. 2 & 3)
SCALE: 1/4" = 1'-0"

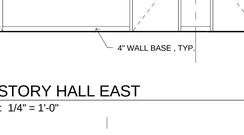


7A A5.3 MEN'S RESTROOM NORTH (FL. 2 & 3)
SCALE: 1/4" = 1'-0"

6F A5.3 TYP. RESTRM. FLOOR TILE LAYOUT
SCALE:

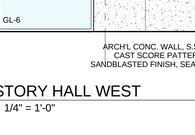


6E A5.3 MEN'S RESTROOM NORTH (1ST FL.)
SCALE: 1/4" = 1'-0"

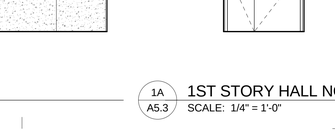


6D A5.3 WOMEN'S RESTRM. EAST (1ST FL.)
SCALE: 1/4" = 1'-0"

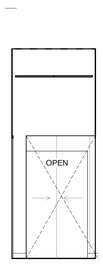
6C A5.3 WOMEN'S RESTROOM SOUTH (1ST FL.)
SCALE: 1/4" = 1'-0"

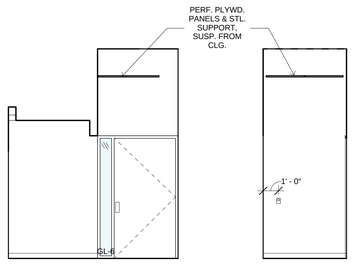


6B A5.3 WOMEN'S RESTRM. WEST (1ST FL.)
SCALE: 1/4" = 1'-0"



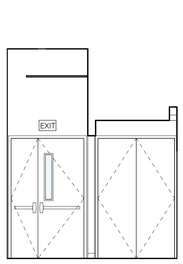
6A A5.3 WOMEN'S RESTROOM NORTH (1ST FL.)
SCALE: 1/4" = 1'-0"





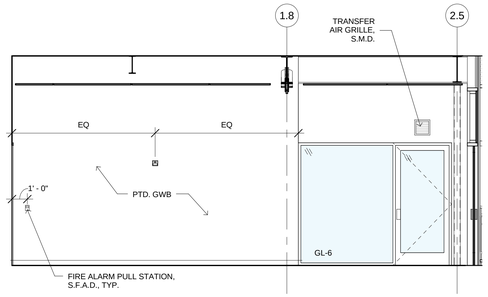
3D A5.3 3RD FL. HALL EAST
SCALE: 1/4" = 1'-0"

3C A5.3 3RD FL. HALL SOUTH
SCALE: 1/4" = 1'-0"

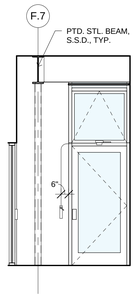


3B A5.3 3RD FL. HALL WEST
SCALE: 1/4" = 1'-0"

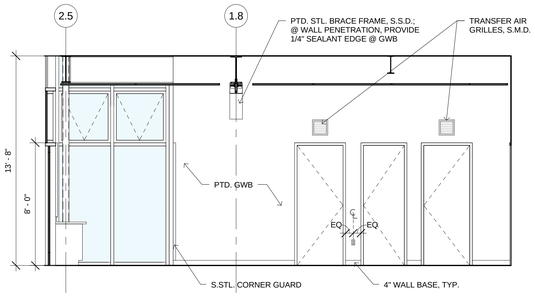
3A A5.3 3RD FL. HALL NORTH
SCALE: 1/4" = 1'-0"



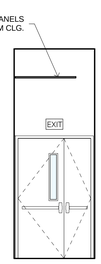
2D A5.3 2ND STORY HALL EAST (3RD STORY SIM)
SCALE: 1/4" = 1'-0"



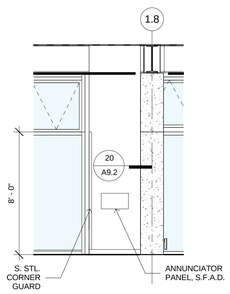
2C A5.3 2ND STORY HALL SOUTH
SCALE: 1/4" = 1'-0" (3RD STORY SIM)



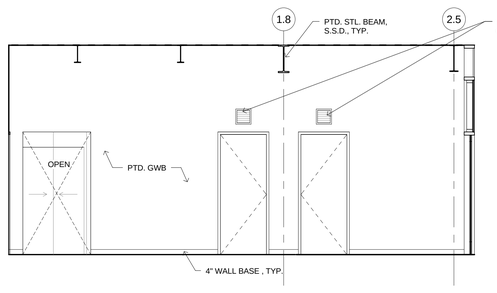
2B A5.3 2ND STORY HALL WEST (3RD STORY SIM)
SCALE: 1/4" = 1'-0"



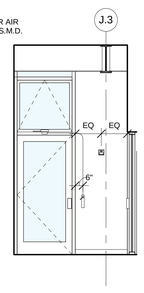
2A A5.3 2ND STORY HALL NORTH
SCALE: 1/4" = 1'-0" (3RD STORY SIM)



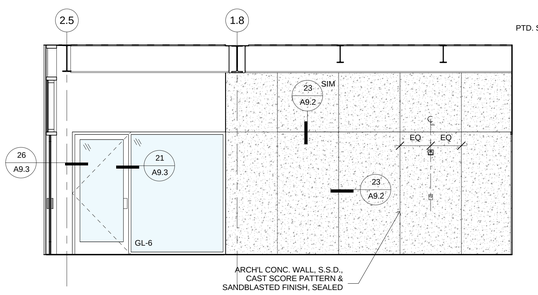
1E A5.3 1ST STORY HALL @ LOUNGE
SCALE: 1/4" = 1'-0"



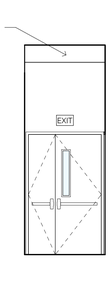
1D A5.3 1ST STORY HALL EAST
SCALE: 1/4" = 1'-0"



1C A5.3 1ST STORY HALL SOUTH
SCALE: 1/4" = 1'-0"



1B A5.3 1ST STORY HALL WEST
SCALE: 1/4" = 1'-0"



1A A5.3 1ST STORY HALL NORTH
SCALE: 1/4" = 1'-0"

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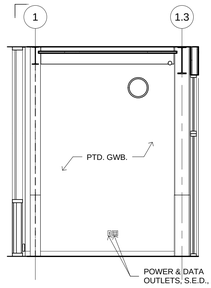
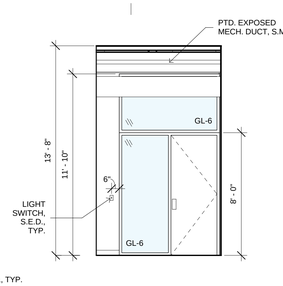
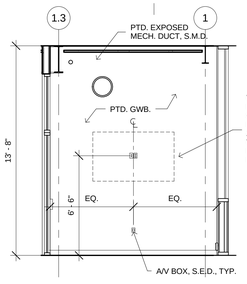


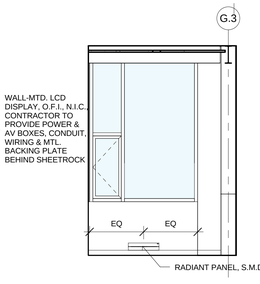
6D A5.4 2ND STORY OFFICE EAST
SCALE: 1/4" = 1'-0"



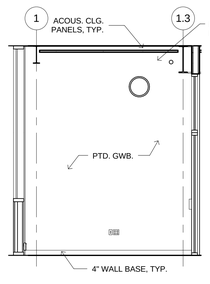
6C A5.4 2ND STORY OFFICE SOUTH
SCALE: 1/4" = 1'-0"



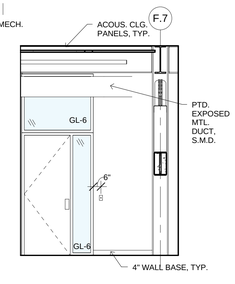
6B A5.4 2ND STORY OFFICE WEST
SCALE: 1/4" = 1'-0"



6A A5.4 2ND STORY OFFICE NORTH
SCALE: 1/4" = 1'-0"



5D A5.4 2ND STORY OFFICE EAST
SCALE: 1/4" = 1'-0"



5C A5.4 2ND STORY OFFICE SOUTH
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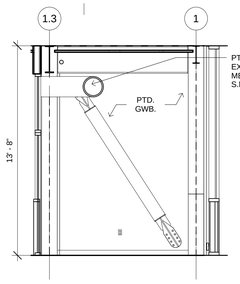
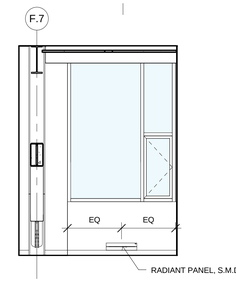


5B A5.4 2ND STORY OFFICE WEST
SCALE: 1/4" = 1'-0"



5A A5.4 2ND STORY OFFICE NORTH
SCALE: 1/4" = 1'-0"

MATERIALS LEGEND:

- GYP. BD, PTD.
- CONCRETE, SAND-BLASTED FINISH
- GLASS; PROVIDE IMPACT SAFETY GLAZING
- PERFORATED PLYWOOD PANELS WITH SUPPORT SYSTEM
- TACK BOARD / WHITE BOARD, AS NOTED; ADHERE TO GWB PARTITION
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- CERAMIC WALL TILE (2x2)
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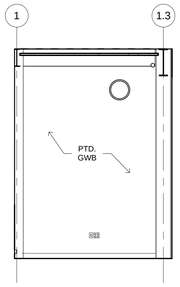
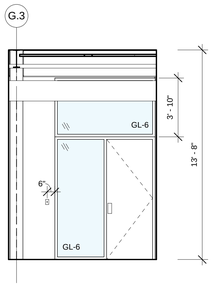
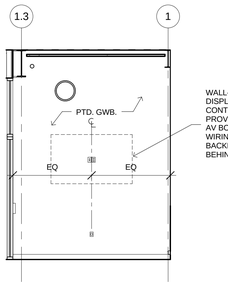


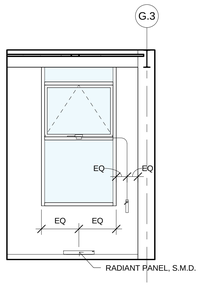
4D A5.4 1ST STORY OFFICE EAST
SCALE: 1/4" = 1'-0"



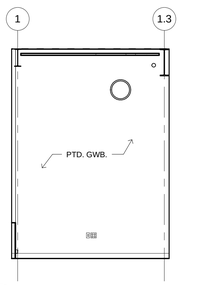
4C A5.4 1ST STORY OFFICE SOUTH
SCALE: 1/4" = 1'-0"



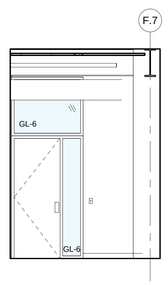
4B A5.4 1ST STORY OFFICE WEST
SCALE: 1/4" = 1'-0"



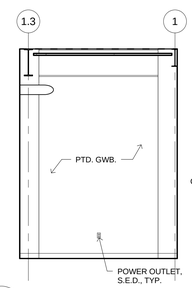
4A A5.4 1ST STORY OFFICE NORTH
SCALE: 1/4" = 1'-0"



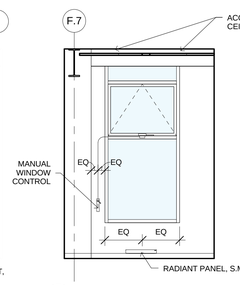
3D A5.4 1ST ST. OFFICE EAST
SCALE: 1/4" = 1'-0"



3C A5.4 1ST ST. OFFICE SOUTH
SCALE: 1/4" = 1'-0"



3B A5.4 1ST ST. OFFICE WEST
SCALE: 1/4" = 1'-0"

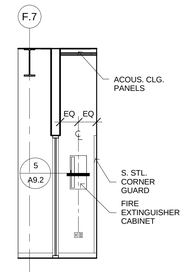


3A A5.4 1ST ST. OFFICE NORTH
SCALE: 1/4" = 1'-0"

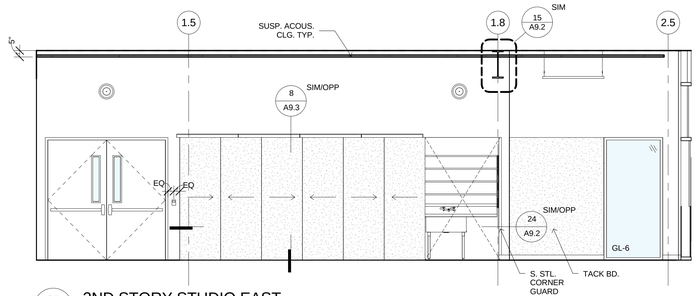
GLASS LEGEND

GL-1*	1" CLR. INSUL. GLASS: SOLARBAN 60
GL-1A	1" CLR. INSUL. GLASS: SOLARBAN 60 W/ TRANSLUCENT LAM. INNER LITE
GL-1B	NOT USED
GL-2*	1" CLR. INSUL. GLASS: SOLARBAN 70 XL
GL-2A	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ TRANSLUCENT LAM. INNER LITE
GL-2B	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ COMBINATION LAM. INNER LITE
GL-3	NOT USED
GL-4	NOT USED
GL-5	NOT USED
GL-6	3/8" CLR LAM. GLASS
GL-7	3/4" CLR MONOLITHIC GLASS
GL-8	1/2" CLR GLASS -90 MIN FIRE RATED ASSEMBLY
GL-9	2 LAYERS 1/4" LAM GLASS W/ 3" AIR GAP, STC 43

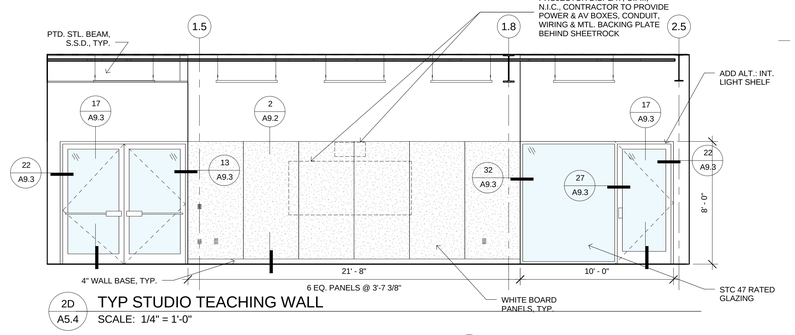
*NOTE: GL-1,1A & 1B AT NORTH AND EAST ELEVATIONS, TYP.; GL-2,2A & 2B AT SOUTH AND WEST ELEVATIONS, TYP.



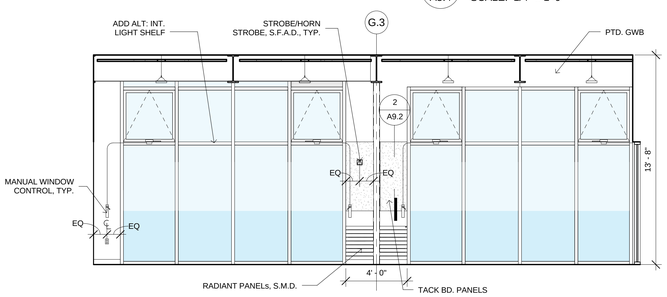
2F A5.4 STUDIO END WALL
SCALE: 1/4" = 1'-0"



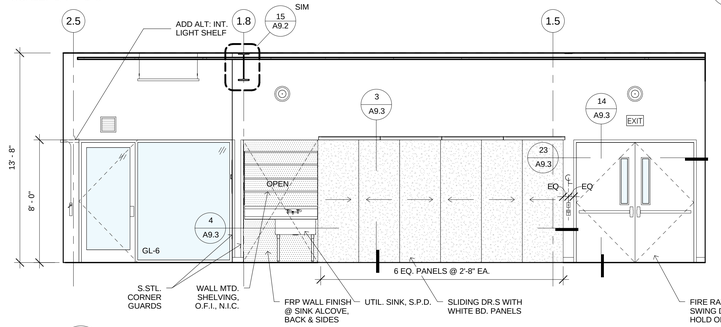
2E A5.4 2ND STORY STUDIO EAST
SCALE: 1/4" = 1'-0"



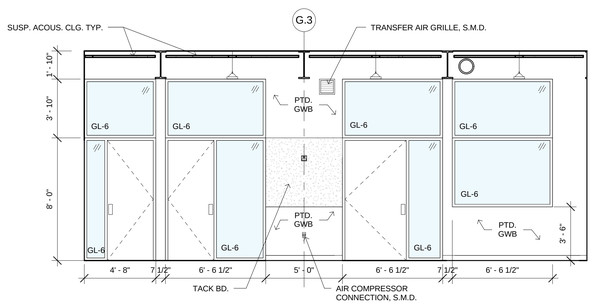
2D A5.4 TYP STUDIO TEACHING WALL
SCALE: 1/4" = 1'-0"



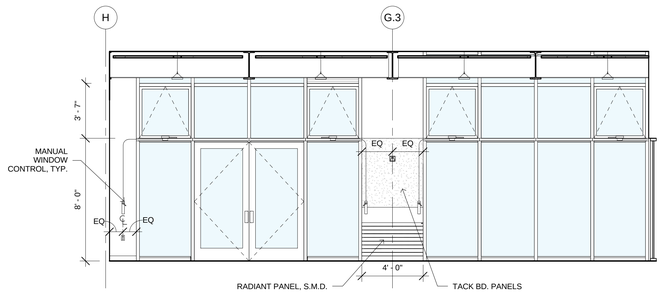
2C A5.4 2ND STORY STUDIO SOUTH
SCALE: 1/4" = 1'-0"



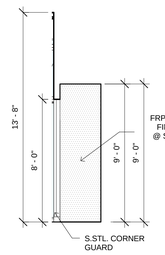
2B A5.4 TYPICAL STUDIO STORAGE WALL
SCALE: 1/4" = 1'-0"



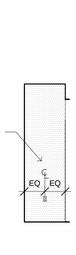
2A A5.4 2ND STORY STUDIO NORTH
SCALE: 1/4" = 1'-0"



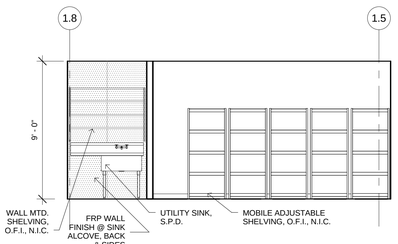
1C A5.4 1ST STORY STUDIO SOUTH
SCALE: 1/4" = 1'-0"



1G A5.4 TYP. SINK AREA SOUTH
SCALE: 1/4" = 1'-0"



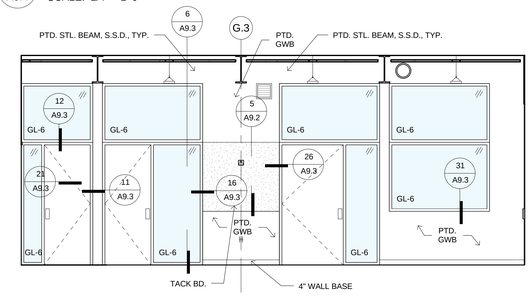
1F A5.4 TYP. SINK AREA NORTH
SCALE: 1/4" = 1'-0"



1B A5.4 TYPICAL STUDIO STORAGE WALL
SCALE: 1/4" = 1'-0"

1E A5.4 TYP. STORAGE AREA SOUTH
SCALE: 1/4" = 1'-0"

1D A5.4 TYP. STORAGE AREA NORTH
SCALE: 1/4" = 1'-0"



1A A5.4 1ST STORY STUDIO NORTH
SCALE: 1/4" = 1'-0"

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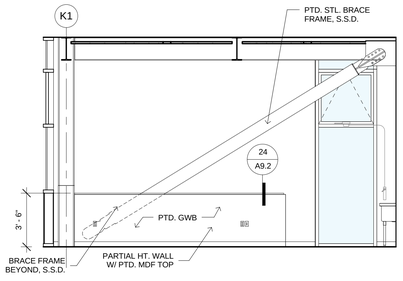
No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

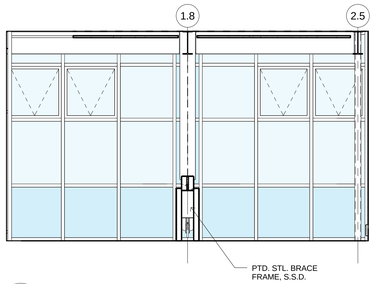
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE
INTERIOR ELEVATIONS

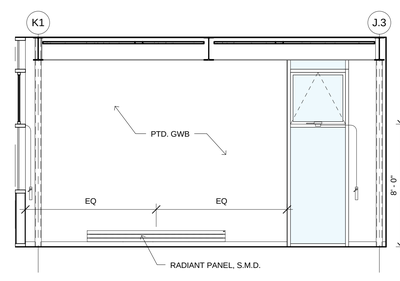
SHEET No
A5.4



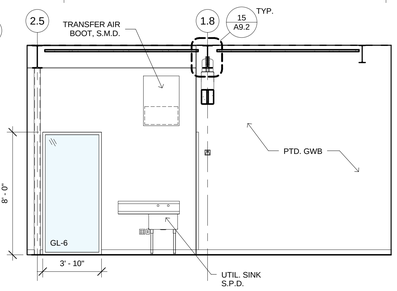
4E A5.5 3RD STORY EQUIPMENT ROOM @ PARTIAL HT. WALL
SCALE: 1/4" = 1'-0"



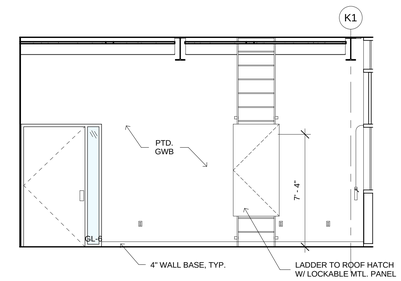
4D A5.5 3RD STORY EQUIPMENT ROOM EAST
SCALE: 1/4" = 1'-0"



4C A5.5 3RD STORY EQUIPMENT ROOM SOUTH
SCALE: 1/4" = 1'-0"



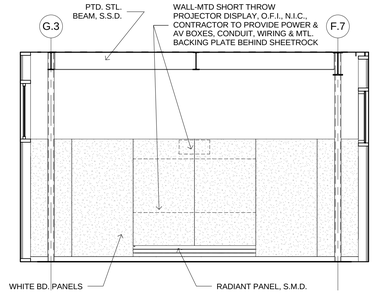
4B A5.5 3RD STORY EQUIPMENT ROOM WEST
SCALE: 1/4" = 1'-0"



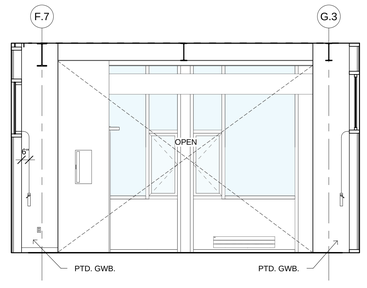
4A A5.5 3RD STORY EQUIPMENT ROOM NORTH
SCALE: 1/4" = 1'-0"

MATERIALS LEGEND:

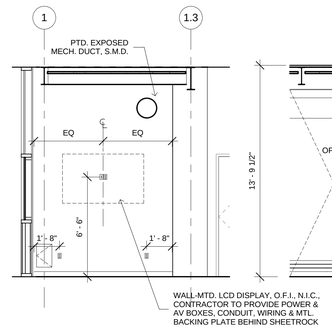
- GYP. BD, PTD.
- CONCRETE, SAND-BLASTED FINISH
- GLASS; PROVIDE IMPACT SAFETY GLAZING
- PERFORATED PLYWOOD PANELS WITH SUPPORT SYSTEM
- TACK BOARD / WHITE BOARD, AS NOTED; ADHERE TO GWB PARTITION
- CERAMIC WALL TILE (12x12)
- CERAMIC WALL TILE (2x2)
- FIBERGLASS REINFORCED PLASTIC



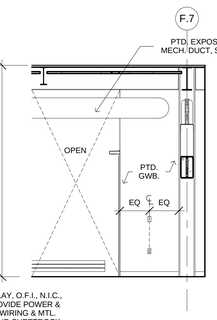
3C A5.5 TYP. CRITIQUE SPACE SOUTH
SCALE: 1/4" = 1'-0"



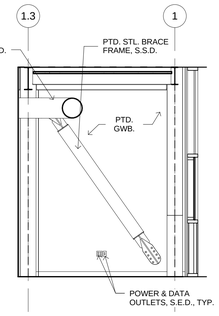
3A A5.5 TYP. CRITIQUE SPACE NORTH
SCALE: 1/4" = 1'-0"



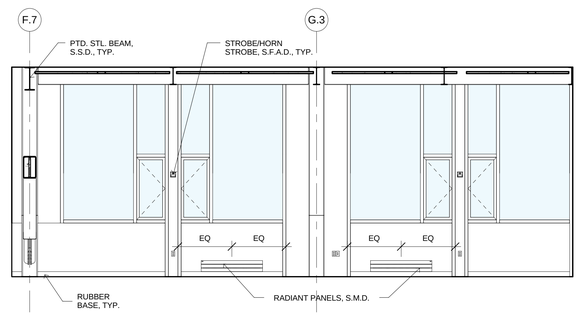
2D A5.5 MEETING EAST
SCALE: 1/4" = 1'-0"



2C A5.5 MEETING SOUTH
SCALE: 1/4" = 1'-0"



2B A5.5 MEETING WEST
SCALE: 1/4" = 1'-0"

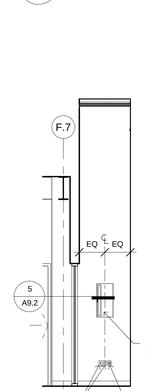


2A A5.5 MEETING NORTH
SCALE: 1/4" = 1'-0"

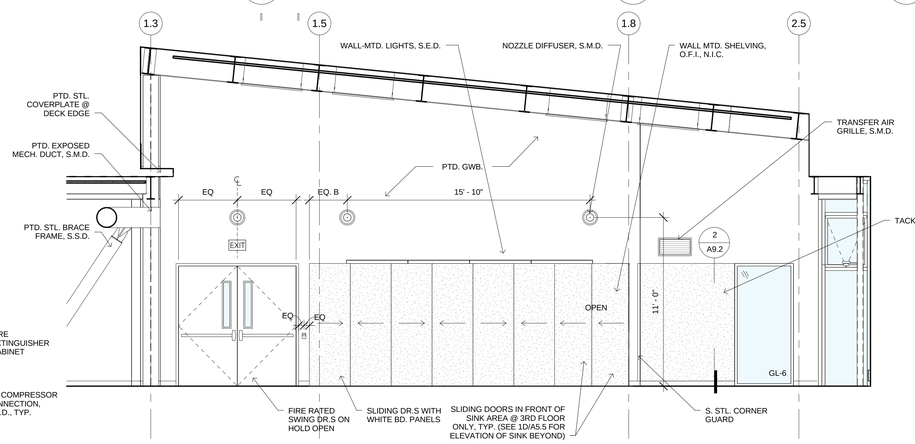
GLASS LEGEND

GL-1*	1" CLR. INSUL. GLASS: SOLARBAN 60
GL-1A	1" CLR. INSUL. GLASS: SOLARBAN 60 W/ TRANSLUCENT LAM. INNER LITE
GL-1B	NOT USED
GL-2*	1" CLR. INSUL. GLASS: SOLARBAN 70 XL
GL-2A	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ TRANSLUCENT LAM. INNER LITE
GL-2B	1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ COMBINATION LAM. INNER LITE
GL-3	NOT USED
GL-4	NOT USED
GL-5	NOT USED
GL-6	3/8" CLR LAM. GLASS
GL-7	3/4" CLR MONOLITHIC GLASS
GL-8	1/2" CLR GLASS -90 MIN FIRE RATED ASSEMBLY
GL-9	2 LAYERS 1/4" LAM GLASS W/ 3" AIR GAP, STC 43

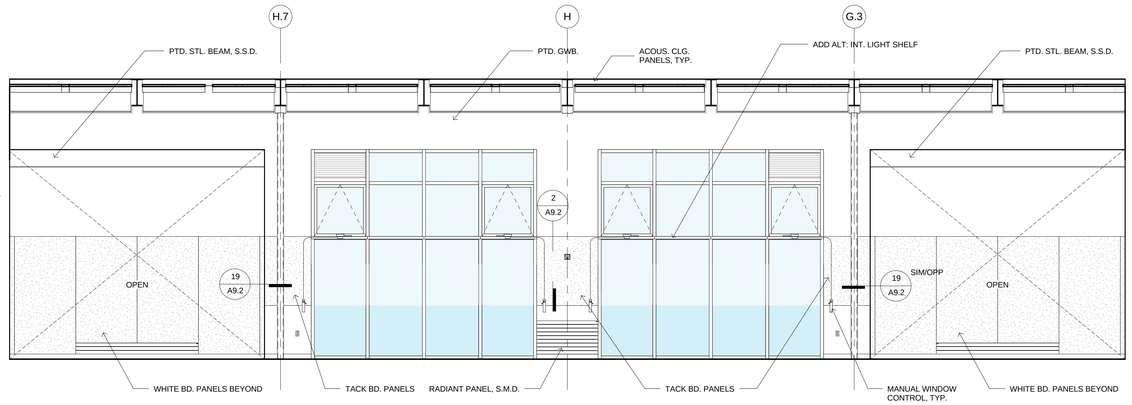
*NOTE: GL-1,1A & 1B AT NORTH AND EAST ELEVATIONS, TYP.; GL-2,2A & 2B AT SOUTH AND WEST ELEVATIONS, TYP.



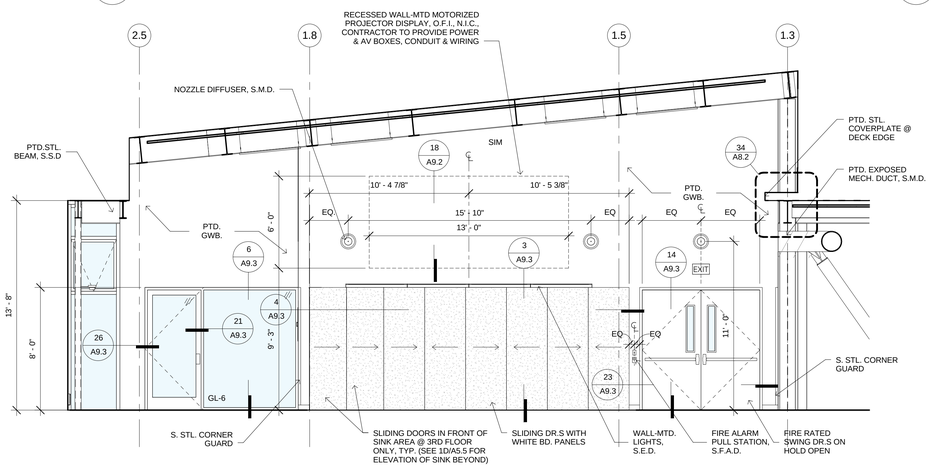
1E A5.5 STUDIO END WALL
SCALE: 1/4" = 1'-0"



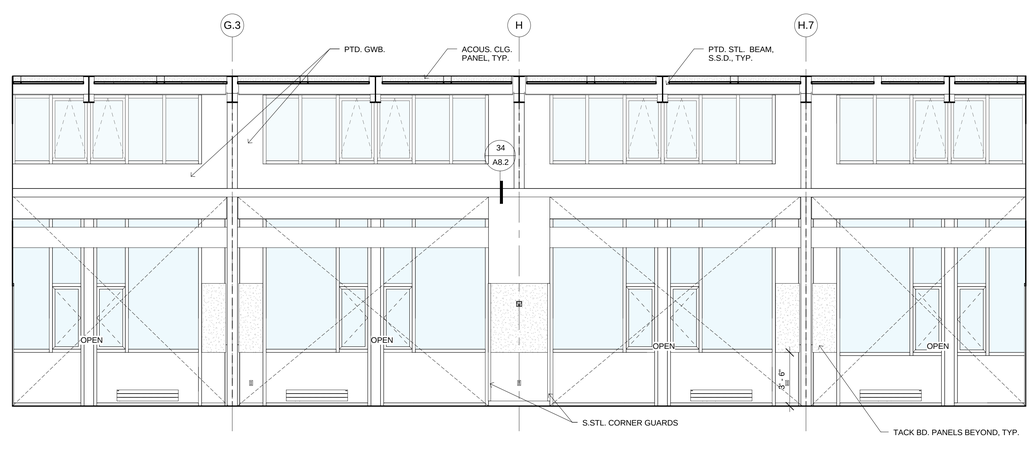
1D A5.5 3RD STORY STUDIO EAST
SCALE: 1/4" = 1'-0"



1C A5.5 3RD STORY STUDIO SOUTH
SCALE: 1/4" = 1'-0"



1B A5.5 3RD STORY STUDIO WEST
SCALE: 1/4" = 1'-0"



1A A5.5 3RD STORY STUDIO NORTH
SCALE: 1/4" = 1'-0"

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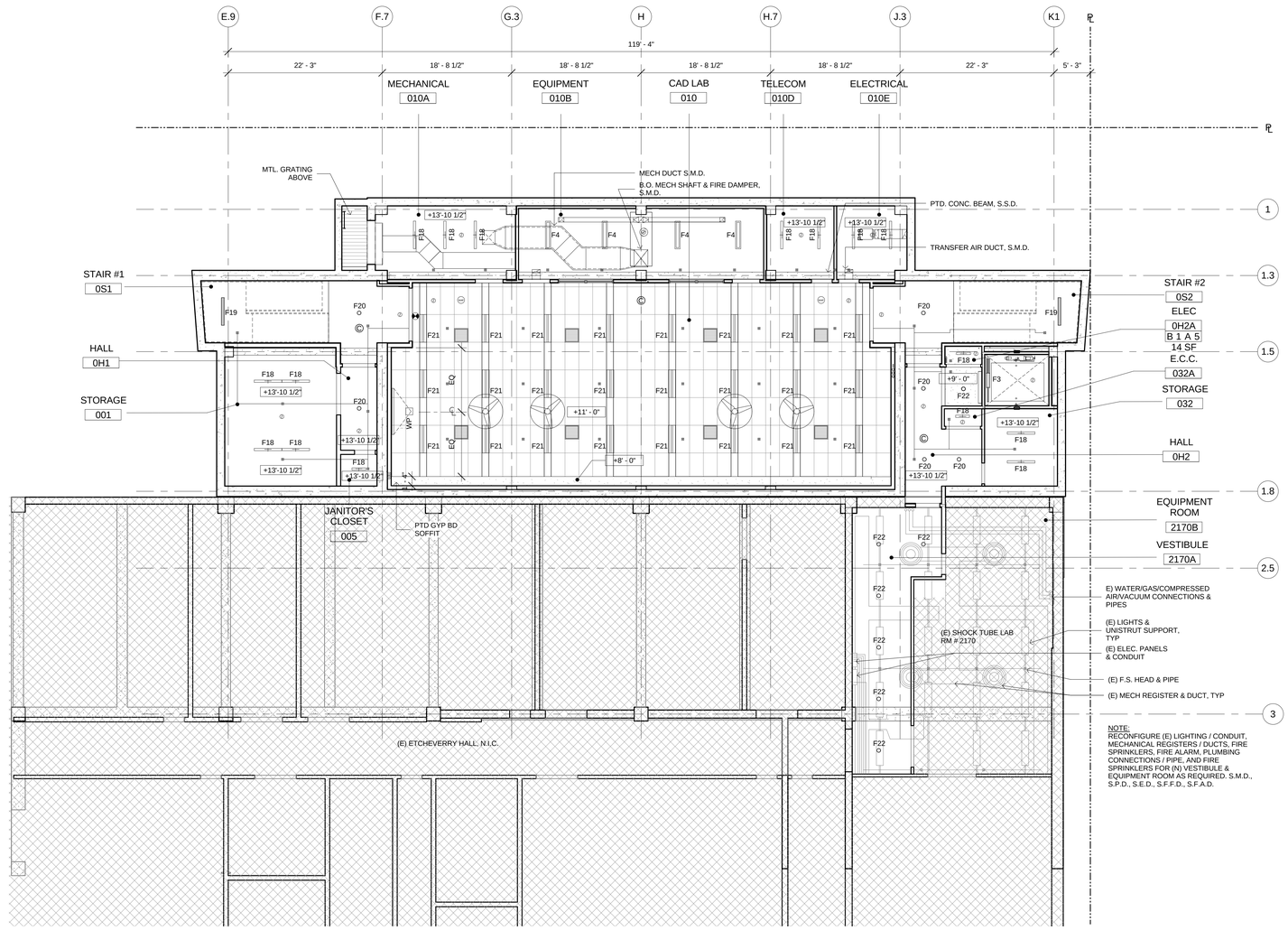
No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE
INTERIOR ELEVATIONS

SHEET No
A5.5



1 A6.0 BASEMENT RCP
SCALE: 1/8" = 1'-0"

CEILING AND LIGHTING LEGEND:

- EXPOSED CEILING (PTD. WHERE IN VIEW)
- GYP. BD., PTD.
- SUSPENDED ACOUSTICAL CEILING BETWEEN BEAMS
- PERFORATED PLYWOOD PANEL, SUSP. FROM CLG., SEE ALT.S
- F1 — CABLE SUSP. UP-DOWN LIGHT @ STUDIOS, ALIGN B.O. FIXT. W/ B.O. BEAM, TYP.
- F2 — WALL-MTD. LINEAR FIXT., ALIGN B.O. FIXT. W/ B.O. SOFFIT, TYP.
- F3 — WALL-MTD. FIXT. @ ELEVATOR PIT
- F4 — CABLE SUSP. UP-DOWN LIGHT @ OFFICES/EQUIP. RM.S
- F5 — 4' DIAM. PENDANT @ STAIR LANDINGS
- F6 — ARM-MTD. LED, 4' MODULES
- F7 — WALL-MTD. LIGHT ABOVE MIRRORS @ RESTROOM SINKS
- F8 — WALL-MTD. LINEAR LIGHT ABOVE TOILETS @ RESTROOMS
- F9 — CLG./WALL MTD. EXIT SIGNS
- F10 — MONOPOINT LED TRACK HEAD
- F11 — UNDER-SHELF LED TASK LIGHT
- A12 — COVE LIGHT @ LEDGE BELOW THIRD FL. CLERESTORY
- F13 — LINEAR LED @ UNDERSIDE OF ENTRY SOFFIT
- F14 — HANDRAIL ASSEMBLY WITH INTEGRAL LED LIGHTING
- F15 — EXT. WALL SCONCE @ SODA HALL, SEE EXT. ELEV.S
- F16 — SURFACE MTD. ACCENT LIGHT UNDER EXT. STAIR
- F17 — EXT. WALL SCONCE, SEE EXT. ELEV.S
- F18 — 2-LAMP WRAPAROUND IN SERVICE SPACES
- F19 — STRIP LIGHT W/ WIREGUARD
- F20 — SURFACE/PENDANT MTD. LED DRUM
- F21 — RECESSED 1x4
- F22 — RECESSED DOWN LIGHT
- SPRINKLER HEAD & PIPE, RUN PIPE THROUGH STL. BEAMS, S.S.D.
- SMOKE DETECTOR, S.F.A.D.
- POWER REEL, MOUNT TO UNDERSIDE OF MTL. DECK BETWEEN ACOUSTICAL PANELS
- CEILING FAN
- VENTILATION AIR REGISTER, NOZZLE TYPE @ STUDIOS, TYP.
- WP — SHORT THROW WALL MTD. PROJECTOR & MOTORIZED SCREEN, O.F.I, S.E.D. FOR POWER & AV CONTROL REQUIREMENTS
- DS — WALL-MTD. TV/DISPLAY SCREEN, S.E.D. FOR POWER & AV CONTROL REQUIREMENTS
- UNISTRUT
- © — SECURITY CAMERA
- SP — CLG. MTD. SPEAKER

GENERAL RCP NOTES:

1. INSTALL ALL CONDUIT BELOW CONC. MTL. DECK OR CONC. SLAB IN STRAIGHT LINES PARALLEL AND PERPENDICULAR TO BUILDING STRUCTURAL LINES; NO DIAGONALS EXCEPT SMALL OFFSETS WHERE CONDUITS CONNECT TO BOXES OR EQUIPMENT.

2. MULTIPLE CONDUITS IN SAME VICINITY TO BE INSTALLED IN PARALLEL CLOSELY SPACE RUNS.

3. WHERE CONDUITS RUN PARALLEL TO FLUTES IN METAL DECK, INSTALL CONDUITS WITHIN THE FLUTES AS TO NOT PENETRATE BEAMS.

4. WHERE CONDUITS RUN PERPENDICULAR TO FLUTES, INSTALL CONDUITS SURFACE-MOUNTED TO UNDERSIDE OF DECK AT CORNERS. MAKE SMOOTH TRANSITIONS IN AND OUT OF FLUTES, USING SWEEPS WITH CODE MINIMUM BEND DIAMETER OR CONDUITS.

5. ORGANIZE VERTICAL AND HORIZONTAL COUNDUITS SO THEY ONLY CROSS NORTH/SOUTH BEAMS. NO CONDUITS CROSSING BELOW BEAMS AND NO CONDUITS ON UNDERSIDE OF BEAMS.

6. RUN CONDUITS WITHIN 2" FURRED SPACE ABOVE ACOUSTIC PANELS.

7. FIRE SPRINKLERS SHOWN FOR DESIGN INTENT ONLY. DESIGN/BUILD ENGINEER TO ASSUME RESPONSIBILITY FOR FULL LAYOUT AND DESIGN DRAWINGS TO BE COORDINATED WITH ARCHITECT.

8. ALIGN FIRE SPRINKLERS IN AN ORGANIZED FASHION WITH LIGHTS AND POWER REELS, STRUCTURE AND ACOUSTIC PANELS AS SHOWN.

9.FIRE SPRINKLER MAIN AND BRANCH LINES ARE INTENDED TO PENETRATE STEEL AND CONCRETE STRUCTURE; COORDINATE WITH ARCHITECT AND STRUCTURAL ENGINEER.

10. INSTALL FIRE SPRINKLER PIPING AS CLOSE TO UNDERSIDE OF METAL DECK AS POSSIBLE. INSTALL IN STRAIGHT LINES PARALLEL AND PERPENDICULAR TO BUILDING STRUCTURAL LINES, NO DIAGONALS.

11. INSTALL LIGHTS AND POWER AS SHOWN ALIGNED WITH OTHER CEILING ELEMENTS BETWEEN BEAMS AND ACOUSTICAL CEILING PANELS.

12. INSTALL PTD. GWB CEILING IN RESTROOMS, ELEVATOR VESTIBULE AND JANITOR'S CLOSET. AT ALL OTHER SPACES NOT COVERED BY ACOUSTICAL PANELS, PAINT CONCRETE METAL DECK.

13. PAINT ALL EXPOSED STEEL BEAMS, COLUMNS AND BRACE FRAMES.

14.INSTALL UNISTRUT WITHIN BEAM DEPTH AT G.L. 1.5 AND BETWEEN G.L. 1.5 - G.L. 1.8 @ +/- 10'-0" O.C.

15. ALIGN CABLE TRAY BELOW F.S. MAIN LINE

16. ALIGN MECH. DUCT BELOW HHW/CW LINES WITH CUSTOM HANGER.

16. ELEC. & TEL. DATA WIRING IS NOT ALLOWED WITHIN CONC. SLAB OR MTL. DECK

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PROJECT

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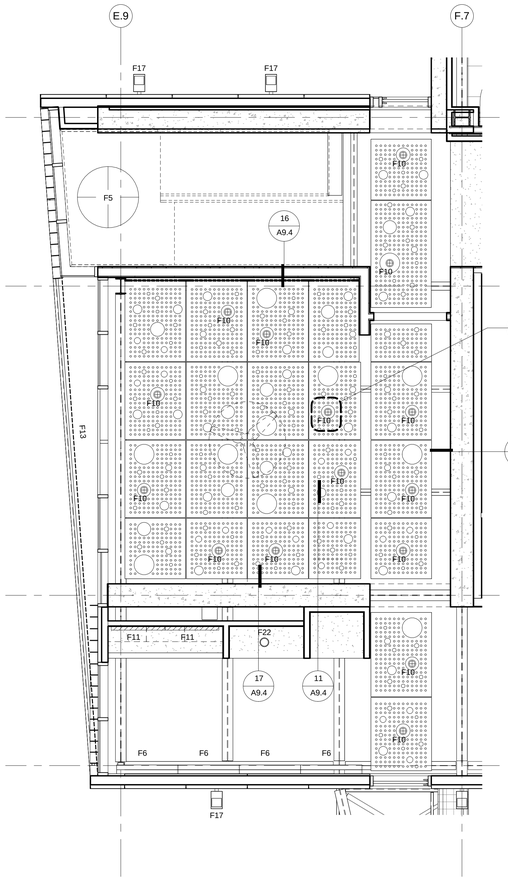
UNIVERSITY OF CALIFORNIA, BERKELEY
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

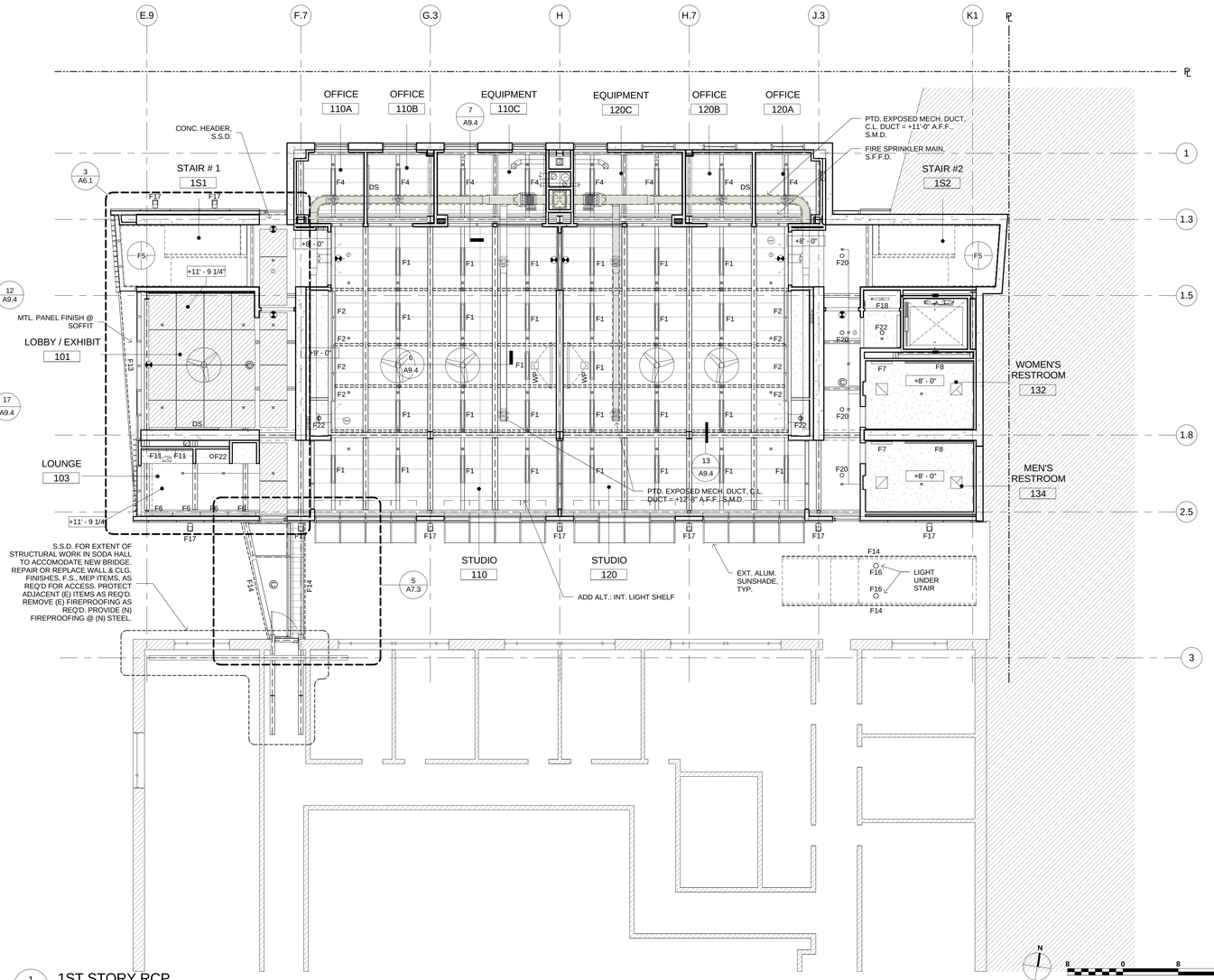
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/8" = 1'-0"

SHEET TITLE
BASEMENT REFLECTED CEILING PLAN

SHEET No
A6.0



3 A6.1 LOBBY & LOUNGE PLYWD. CLG. PATTERN
SCALE: 1/4" = 1'-0"



1 A6.1 1ST STORY RCP
SCALE: 1/8" = 1'-0"

ARCHITECTS

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LEDDY MAYTUM STACY ARCHITECTS
677 HARRISON STREET
SAN FRANCISCO, CA 94107
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STAMP

CONSULTANTS

PROJECT

CEILING AND LIGHTING LEGEND:

- EXPOSED CEILING (PTD. WHERE IN VIEW)
- GYP. BD., PTD.
- SUSPENDED ACOUSTICAL CEILING BETWEEN BEAMS
- PERFORATED PLYWOOD PANEL, SUSP. FROM CLG., SEE ALT.S
- F1 — CABLE SUSP. UP-DOWN LIGHT @ STUDIOS, ALIGN B.O. FIXT. W/ B.O. BEAM, TYP.
- F2 — WALL-MTD. LINEAR FIXT., ALIGN B.O. FIXT. W/ B.O. SOFFIT, TYP.
- F3 — WALL-MTD. FIXT. @ ELEVATOR PIT
- F4 — CABLE SUSP. UP-DOWN LIGHT @ OFFICES/EQUIP. RM.S
- F5 — 4' DIAM. PENDANT @ STAIR LANDINGS
- F6 — ARM-MTD. LED, 4' MODULES
- F7 — WALL-MTD. LIGHT ABOVE MIRRORS @ RESTROOM SINKS
- F8 — WALL-MTD. LINEAR LIGHT ABOVE TOILETS @ RESTROOMS
- F9 — CLG./WALL MTD. EXIT SIGNS
- F10 — MONOPOINT LED TRACK HEAD
- F11 — UNDER-SHELF LED TASK LIGHT
- A12 — COVE LIGHT @ LEDGE BELOW THIRD FL. CLERESTORY
- F13 — LINEAR LED @ UNDERSIDE OF ENTRY SOFFIT
- F14 — HANDRAIL ASSEMBLY WITH INTEGRAL LED LIGHTING
- F15 — EXT. WALL SCONCE @ SODA HALL, SEE EXT. ELEV.S
- F16 — SURFACE MTD. ACCENT LIGHT UNDER EXT. STAIR
- F17 — EXT. WALL SCONCE, SEE EXT. ELEV.S
- F18 — 2-LAMP WRAPAROUND IN SERVICE SPACES
- F19 — STRIP LIGHT W/ WIREGUARD
- F20 — SURFACE/PENDANT MTD. LED DRUM
- F21 — RECESSED 1x4
- F22 — RECESSED DOWN LIGHT
- SPRINKLER HEAD & PIPE, RUN PIPE THROUGH STL. BEAMS, S.S.D.
- SMOKE DETECTOR, S.F.A.D.
- POWER REEL, MOUNT TO UNDERSIDE OF MTL. DECK BETWEEN ACOUSTICAL PANELS
- CEILING FAN
- VENTILATION AIR REGISTER, NOZZLE TYPE @ STUDIOS, TYP.
- WP — SHORT THROW WALL MTD. PROJECTOR & MOTORIZED SCREEN, O.F.I. S.E.D. FOR POWER & AV CONTROL REQUIREMENTS
- DS — WALL-MTD. TV/DISPLAY SCREEN, S.E.D. FOR POWER & AV CONTROL REQUIREMENTS
- UNISTRUT
- © — SECURITY CAMERA
- SP — CLG. MTD. SPEAKER

GENERAL RCP NOTES:

1. INSTALL ALL CONDUIT BELOW CONC. MTL. DECK OR CONC. SLAB IN STRAIGHT LINES PARALLEL AND PERPENDICULAR TO BUILDING STRUCTURAL LINES; NO DIAGONALS EXCEPT SMALL OFFSETS WHERE CONDUITS CONNECT TO BOXES OR EQUIPMENT.

2. MULTIPLE CONDUITS IN SAME VICINITY TO BE INSTALLED IN PARALLEL CLOSELY SPACE RUNS.

3. WHERE CONDUITS RUN PARALLEL TO FLUTES IN METAL DECK, INSTALL CONDUITS WITHIN THE FLUTES AS TO NOT PENETRATE BEAMS.

4. WHERE CONDUITS RUN PERPENDICULAR TO FLUTES, INSTALL CONDUITS SURFACE-MOUNTED TO UNDERSIDE OF DECK AT CORNERS. MAKE SMOOTH TRANSITIONS IN AND OUT OF FLUTES, USING SWEEPS WITH CODE MINIMUM BEND DIAMETER OR CONDUITS.

5. ORGANIZE VERTICAL AND HORIZONTAL COUNDUITS SO THEY ONLY CROSS NORTH/SOUTH BEAMS. NO CONDUITS CROSSING BELOW BEAMS AND NO CONDUITS ON UNDERSIDE OF BEAMS.

6. RUN CONDUITS WITHIN 2" FURRED SPACE ABOVE ACOUSTIC PANELS.

7. FIRE SPRINKLERS SHOWN FOR DESIGN INTENT ONLY. DESIGN/BUILD ENGINEER TO ASSUME RESPONSIBILITY FOR FULL LAYOUT AND DESIGN DRAWINGS TO BE COORDINATED WITH ARCHITECT.

8. ALIGN FIRE SPRINKLERS IN AN ORGANIZED FASHION WITH LIGHTS AND POWER REELS, STRUCTURE AND ACOUSTIC PANELS AS SHOWN.

9.FIRE SPRINKLER MAIN AND BRANCH LINES ARE INTENDED TO PENETRATE STEEL AND CONCRETE STRUCTURE; COORDINATE WITH ARCHITECT AND STRUCTURAL ENGINEER.

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11. INSTALL LIGHTS AND POWER AS SHOWN ALIGNED WITH OTHER CEILING ELEMENTS BETWEEN BEAMS AND ACOUSTICAL CEILING PANELS.

12. INSTALL PTD. GWB CEILING IN RESTROOMS, ELEVATOR VESTIBULE AND JANITOR'S CLOSET. AT ALL OTHER SPACES NOT COVERED BY ACOUSTICAL PANELS, PAINT CONCRETE METAL DECK.

13. PAINT ALL EXPOSED STEEL BEAMS, COLUMNS AND BRACE FRAMES.

14.INSTALL UNISTRUT WITHIN BEAM DEPTH AT G.L. 1.5 AND BETWEEN G.L. 1.5 - G.L. 1.8 @ +/- 10'-0" O.C.

15. ALIGN CABLE TRAY BELOW F.S. MAIN LINE

16. ALIGN MECH. DUCT BELOW HHW/CW LINES WITH CUSTOM HANGER.

16. ELEC. & TEL. DATA WIRING IS NOT ALLOWED WITHIN CONC. SLAB OR MTL. DECK

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SHEET TITLE
1ST STORY REFLECTED CEILING PLAN

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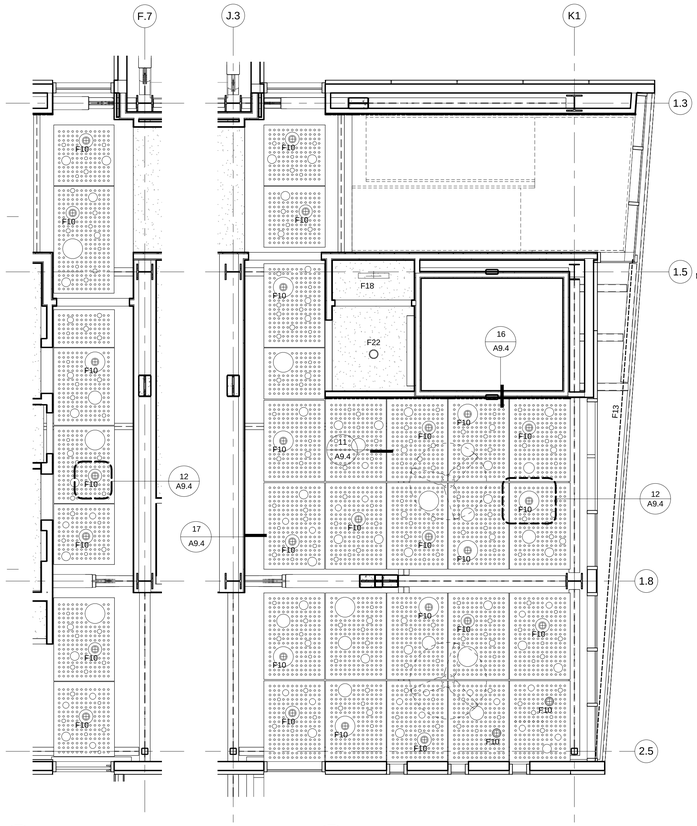
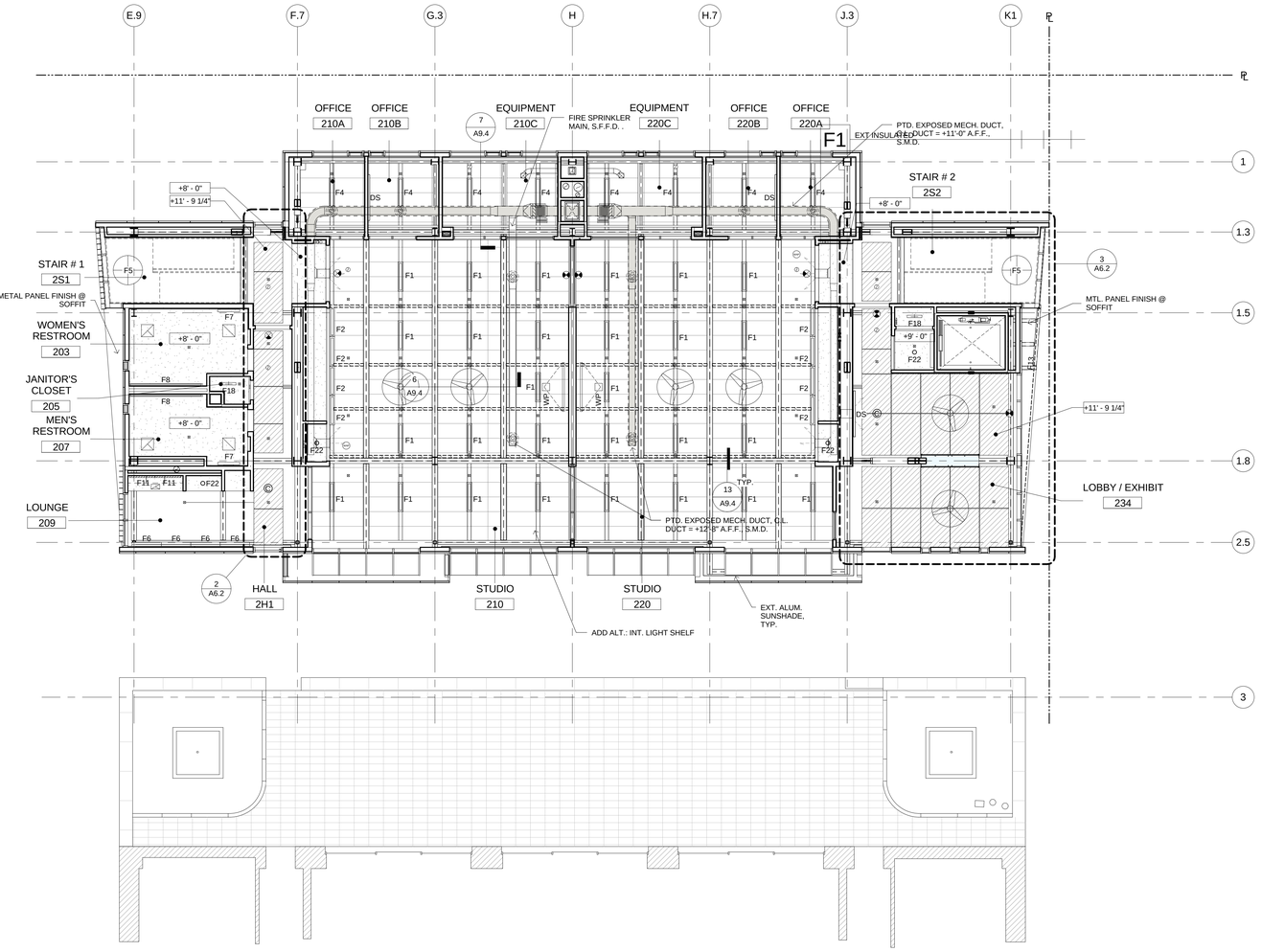


2 A6.2 HALL PLYWD. CLG. PATTERN
SCALE: 1/4" = 1'-0"

3 A6.2 LOBBY PLYWD. CLG. PATTERN
SCALE: 1/4" = 1'-0"



1 A6.2 2ND STORY RCP
SCALE: 1/8" = 1'-0"

N
8 0 8 16

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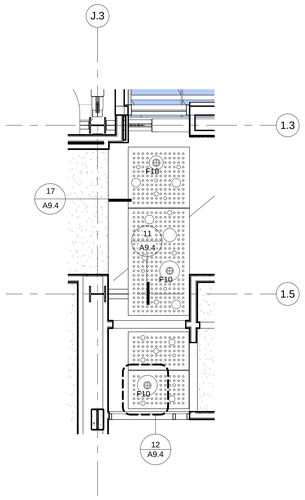
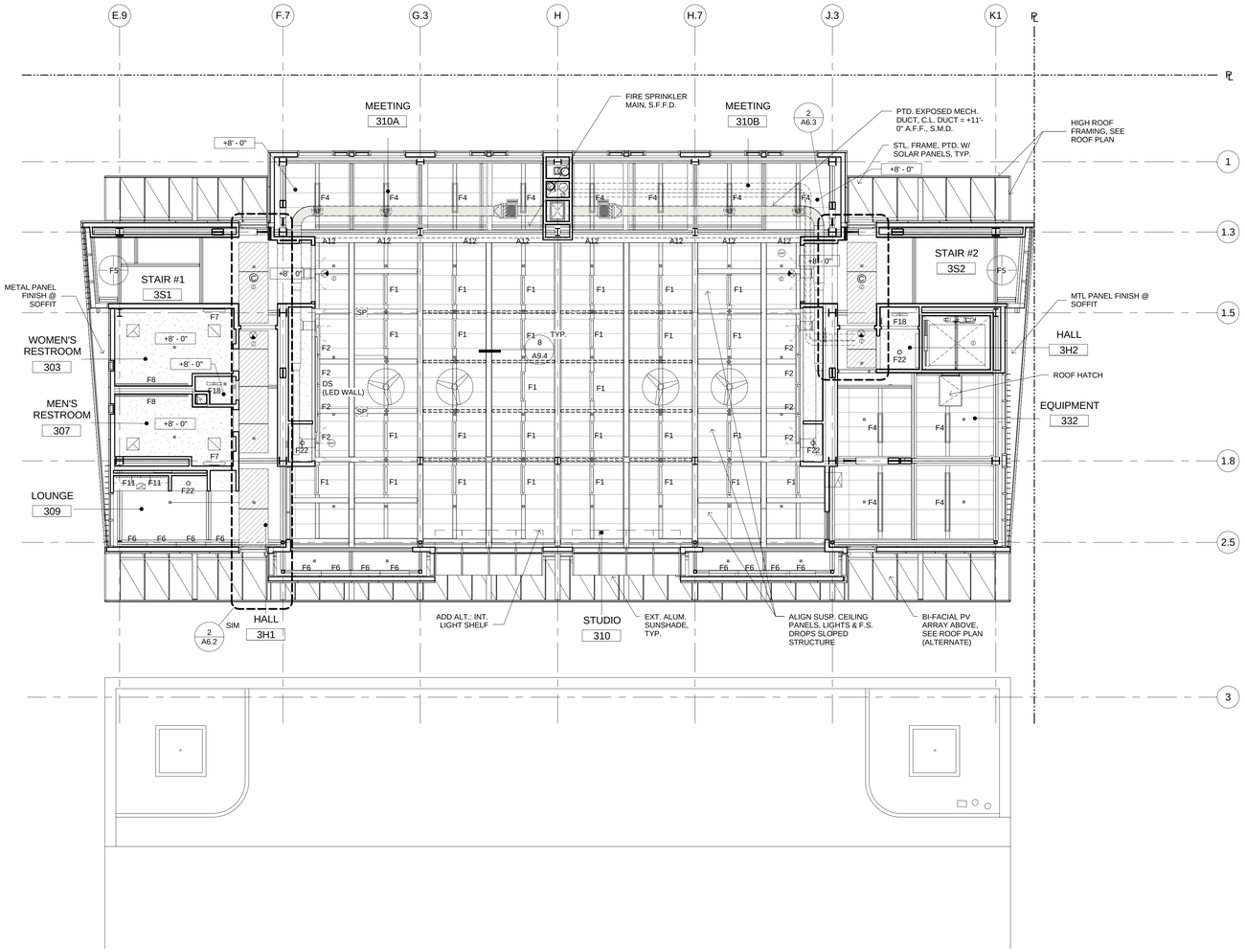


2 A6.3 3RD STORY EAST PLYWD. CLG.
SCALE: 1/4" = 1'-0"



1 A6.3 3RD STORY RCP
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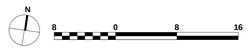

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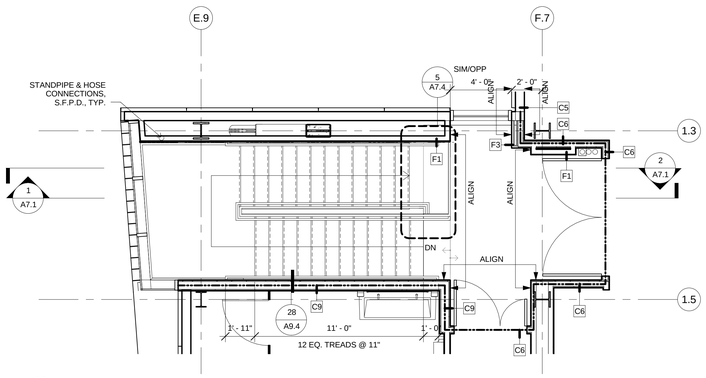
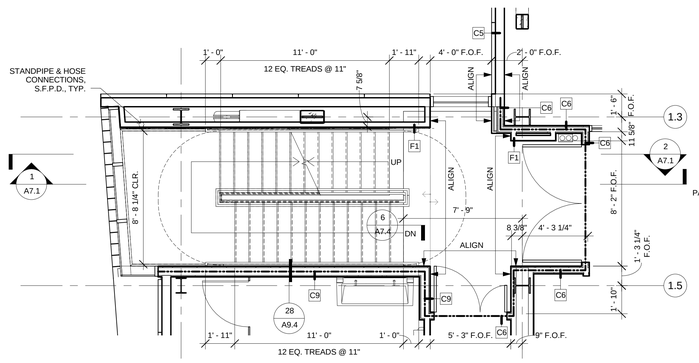


6 A7.1 STAIR #1 3RD STORY ENLARGED PLAN
SCALE: 1/4" = 1'-0"



5 A7.1 STAIR #1 2ND STORY ENLARGED PLAN
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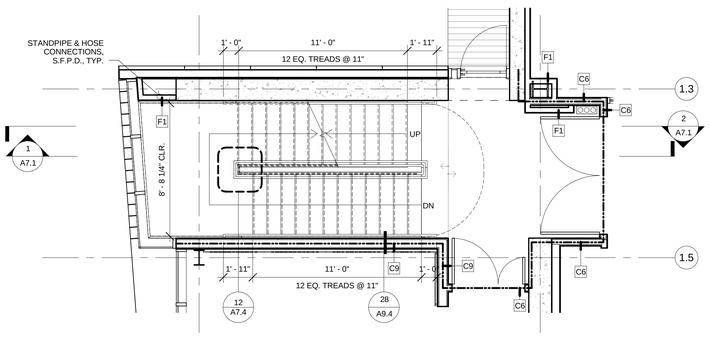

4 A7.1 STAIR #1 1ST STORY ENLARGED PLAN
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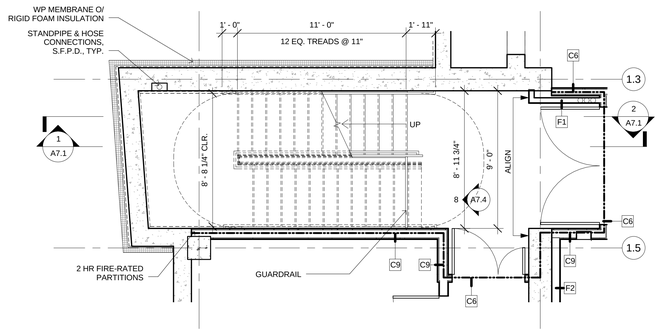
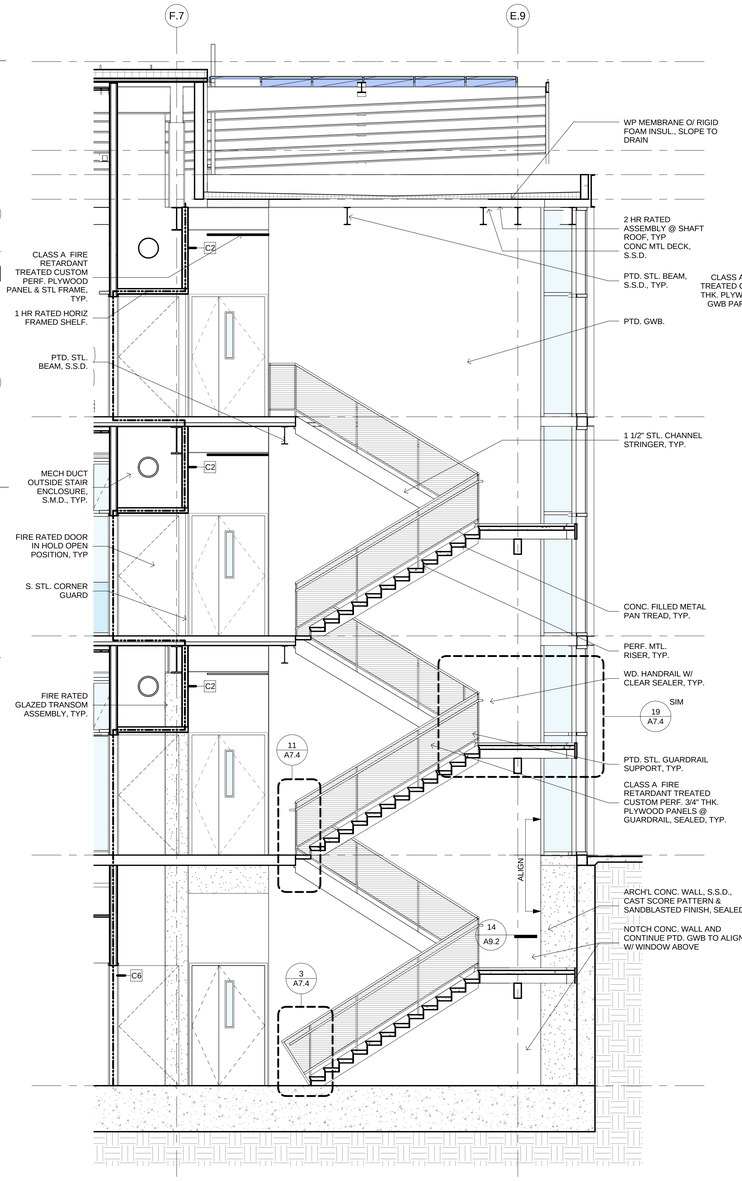
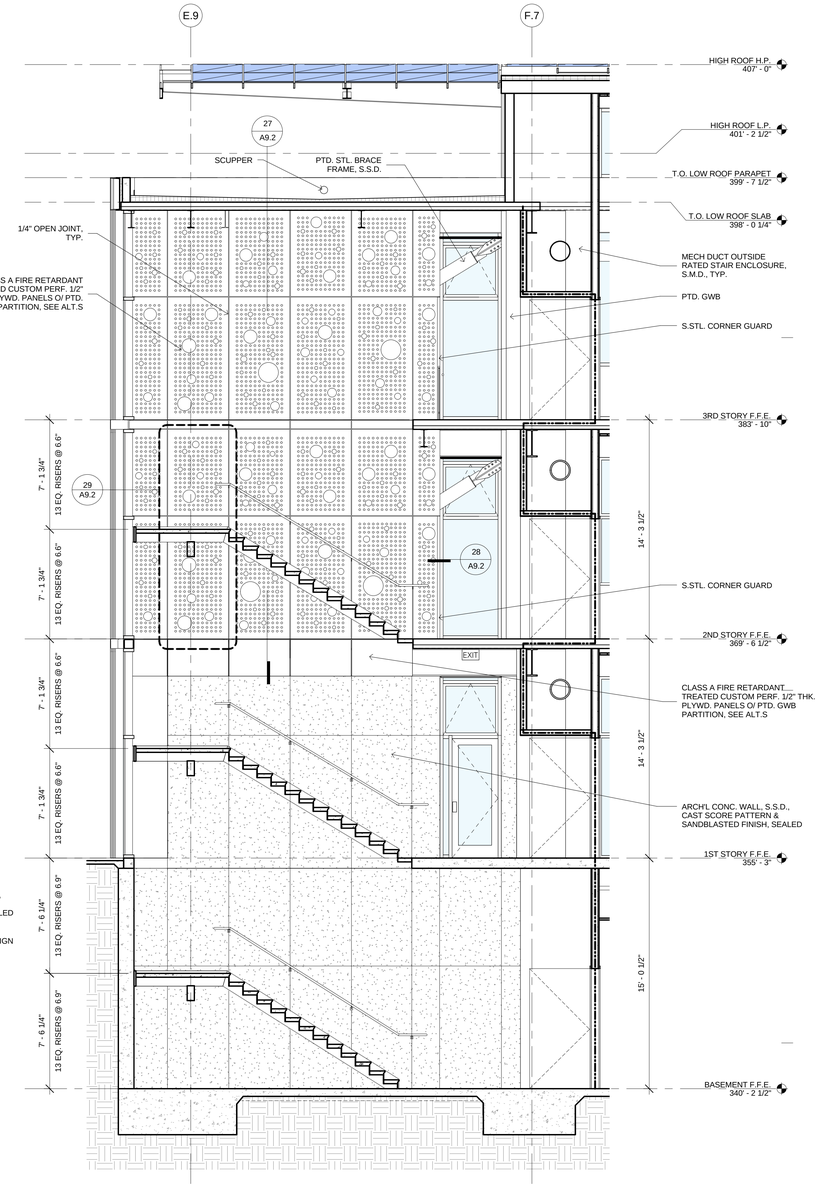


3 A7.1 STAIR #1 BASEMENT ENLARGED PLAN
SCALE: 1/4" = 1'-0"



2 A7.1 STAIR 1 SECTION LOOKING SOUTH
SCALE: 1/4" = 1'-0"



1 A7.1 STAIR 1 SECTION LOOKING NORTH
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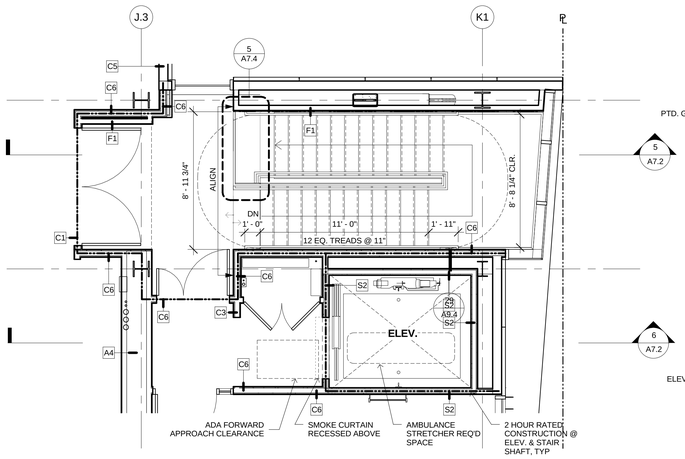
No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

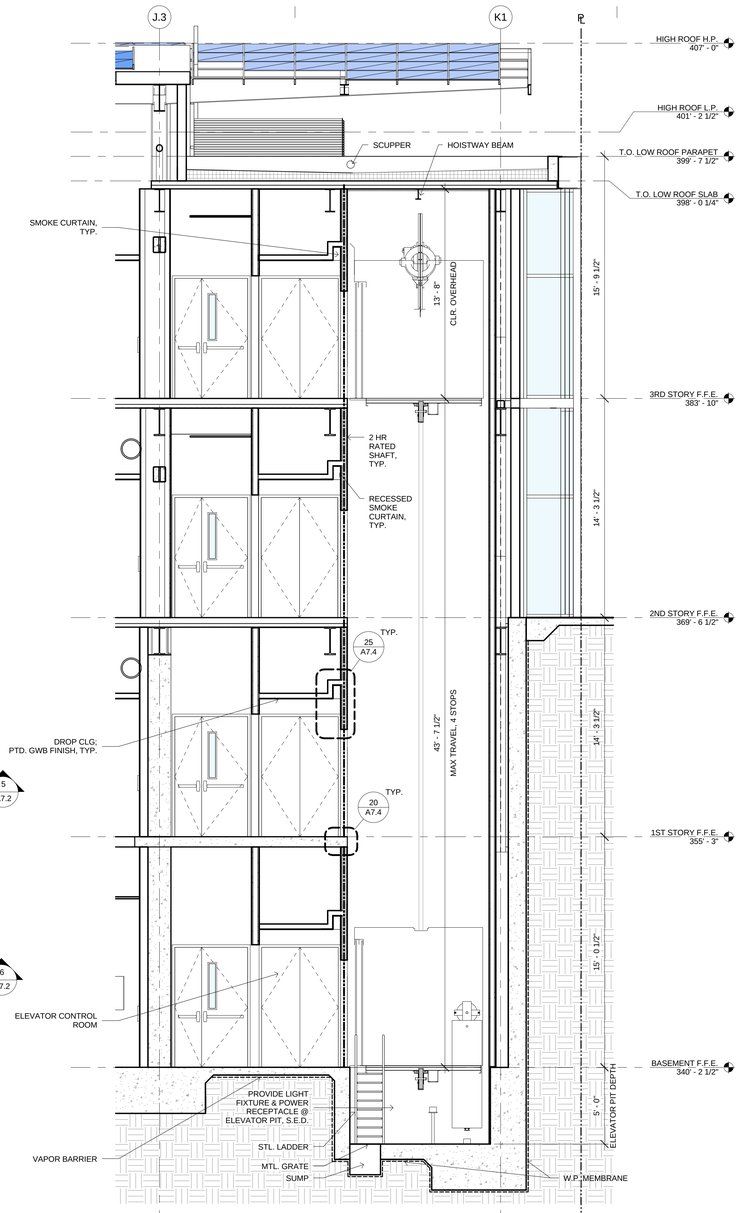
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/4" = 1'-0"

SHEET TITLE
VERTICAL CIRCULATION

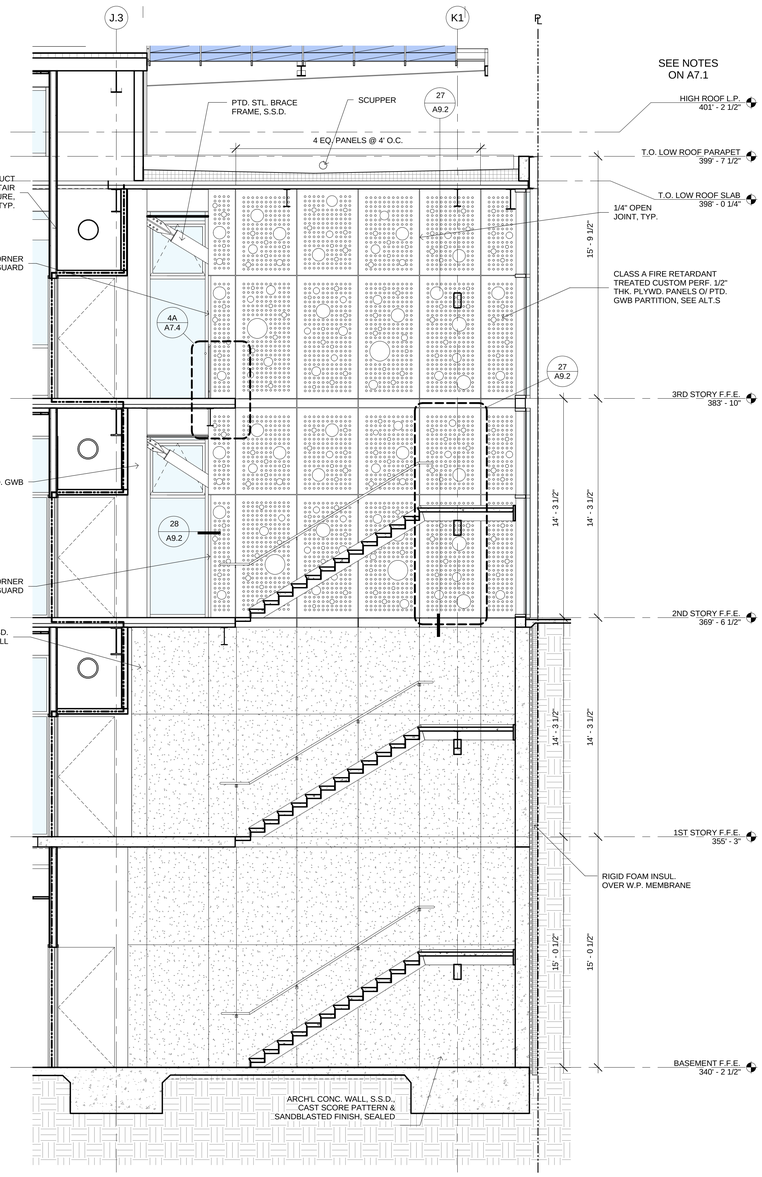
SHEET No
A7.1



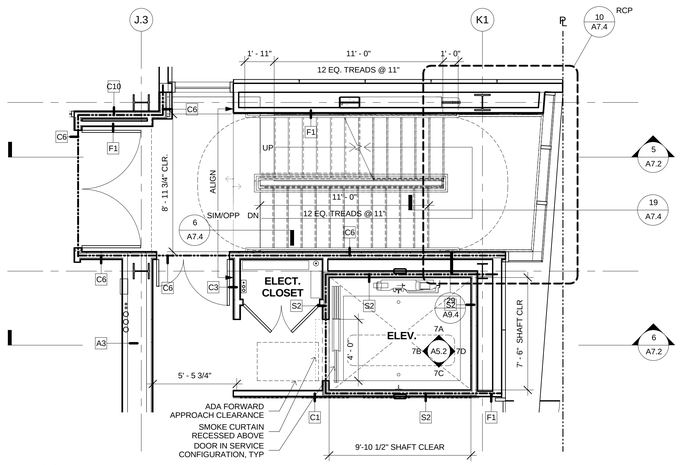
4 A7.2 STAIR #2 3RD STORY ENLARGED PLAN
SCALE: 1/4" = 1'-0"



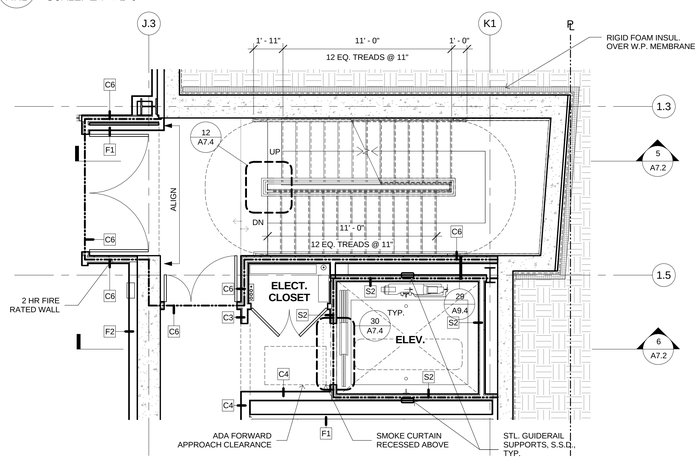
6 A7.2 ELEVATOR SECTION
SCALE: 1/4" = 1'-0"



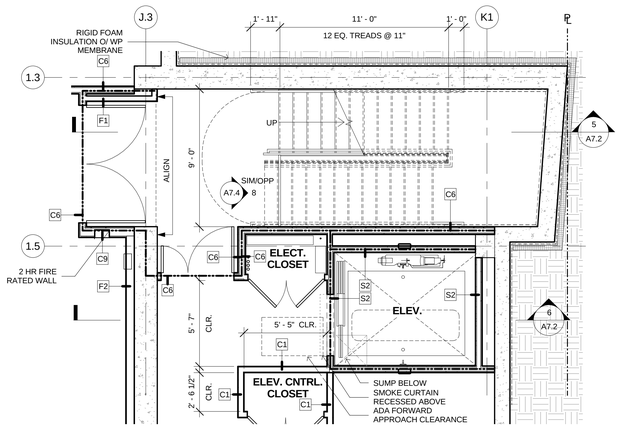
5 A7.2 STAIR 2 SECTION LOOKING NORTH
SCALE: 1/4" = 1'-0"



3 A7.2 STAIR #2 2ND STORY ENLARGED PLAN
SCALE: 1/4" = 1'-0"



2 A7.2 STAIR #2 1ST STORY ENLARGED PLAN
SCALE: 1/4" = 1'-0"



1 A7.2 STAIR # 2 BASEMENT ENLARGED PLAN
SCALE: 1/4" = 1'-0"

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CONSULTANTS

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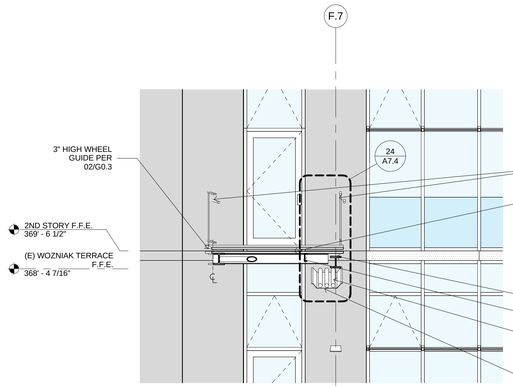
No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 3A - Elevator	08/01/14
	100% CDs / Permit Submission	08/15/14

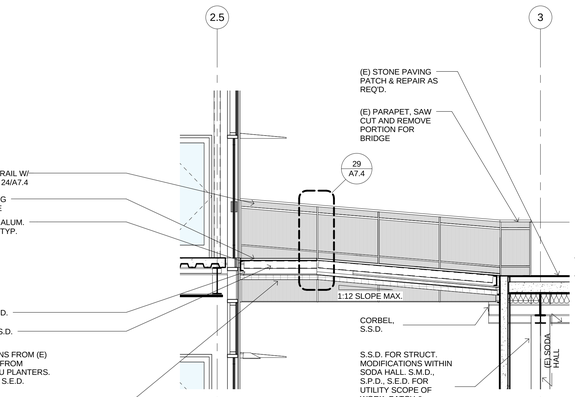
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/4" = 1'-0"

SHEET TITLE
VERTICAL CIRCULATION

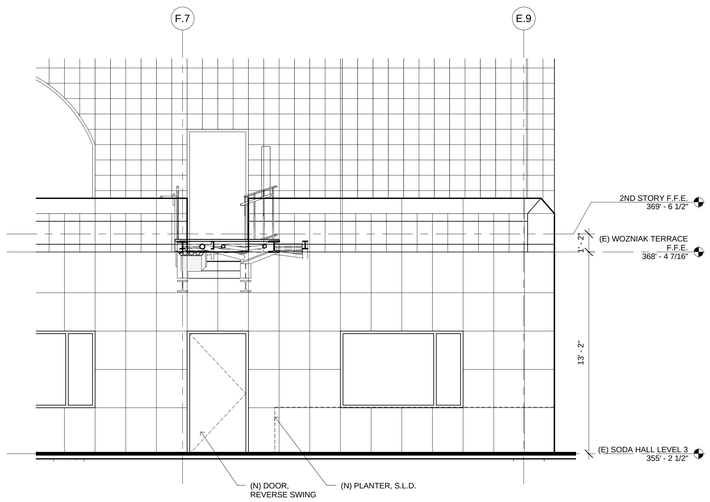
SHEET No
A7.2



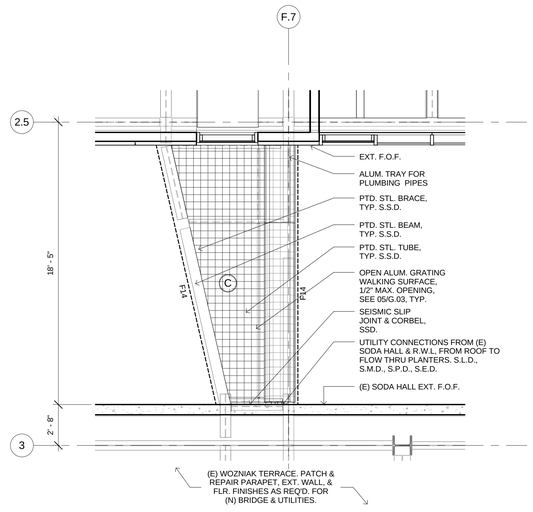
8 A7.3 BRIDGE CROSS SECTION
SCALE: 1/4" = 1'-0"



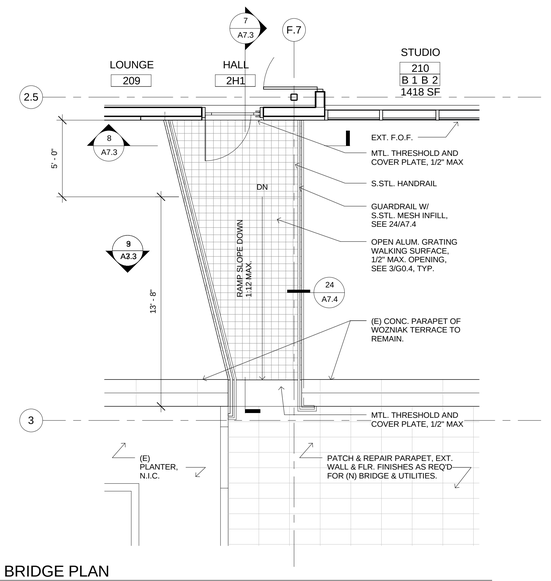
7 A7.3 BRIDGE LONG. SECTION
SCALE: 1/4" = 1'-0"



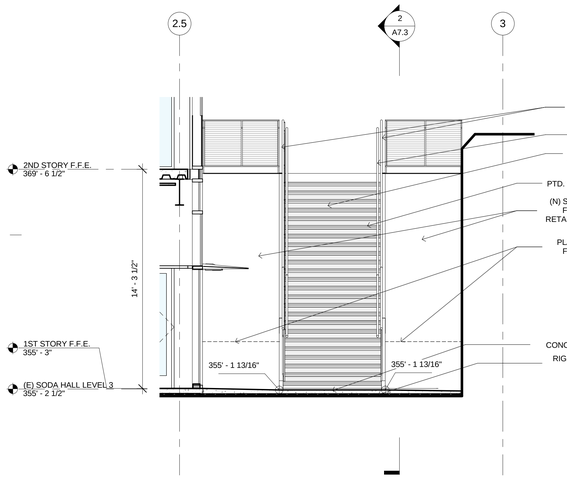
9 A7.3 SODA HALL NORTH ELEVATION @ BRIDGE
SCALE: 1/4" = 1'-0"



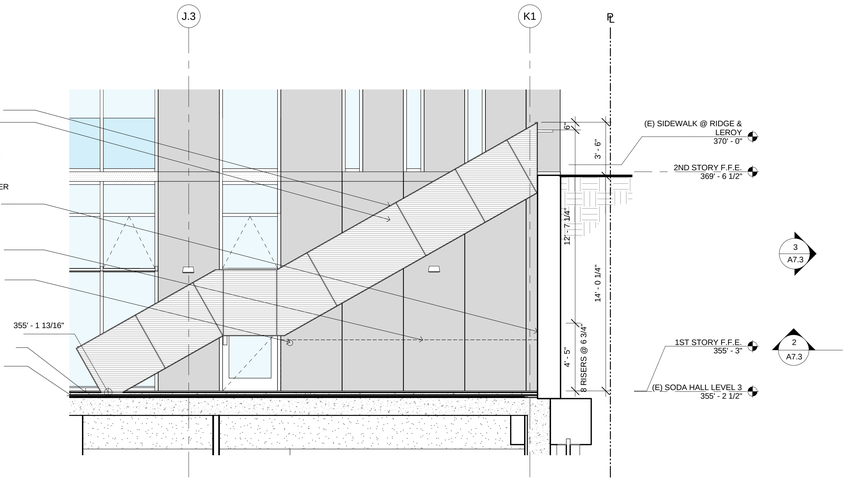
5 A7.3 BRIDGE RCP
SCALE: 1/4" = 1'-0"



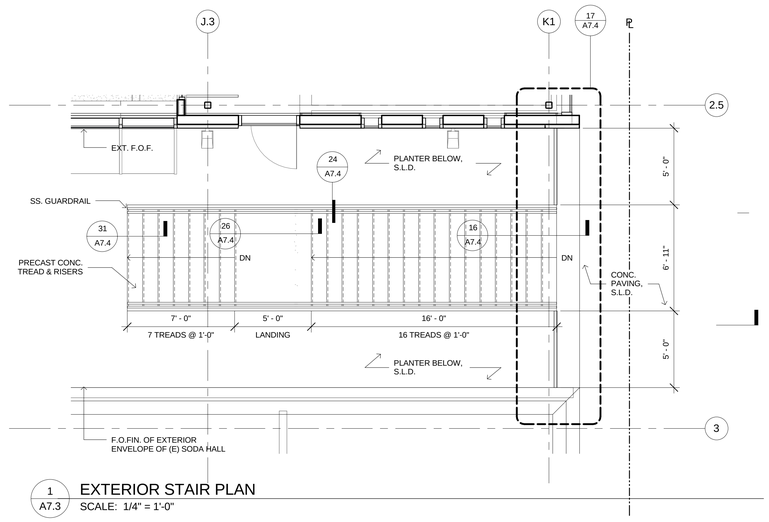
4 A7.3 BRIDGE PLAN
SCALE: 1/4" = 1'-0"



3 A7.3 EXTERIOR STAIR ELEVATION
SCALE: 1/4" = 1'-0"



2 A7.3 EXTERIOR STAIR ELEVATION
SCALE: 1/4" = 1'-0"



1 A7.3 EXTERIOR STAIR PLAN
SCALE: 1/4" = 1'-0"

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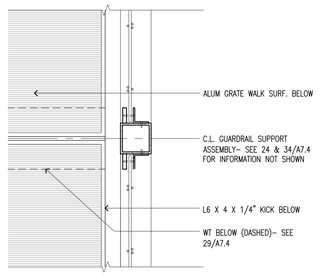
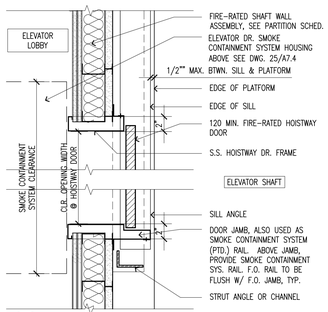
ISSUED FOR: Permit
PERMIT No:
SCALE: 1/4" = 1'-0"

SHEET TITLE
EXTERIOR CIRCULATION

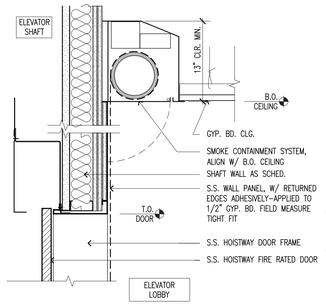
SHEET No
A7.3



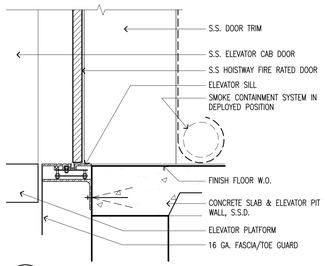
35 A7.4 **GUARDRAIL SUPPORT**
BRIDGE GUARDRAIL 3"=1'–0"



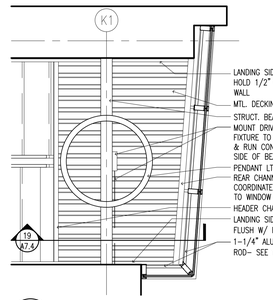
30 A7.4 **TYP. JAMB @ ELEVATOR DOOR**
ELEVATORS 1–1/2"=1'–0"



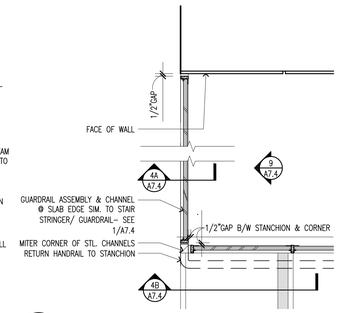
25 A7.4 **TYP. ELEV. HEAD/ SMOKE GUARD**
ELEVATORS 1–1/2"=1'–0"



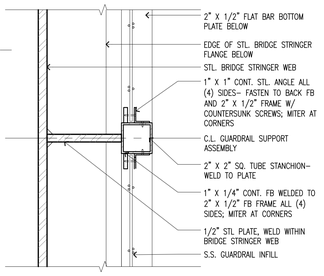
20 A7.4 **TYP SILL DETAIL @ ELEVATOR**
ELEVATORS 1–1/2"=1'–0"



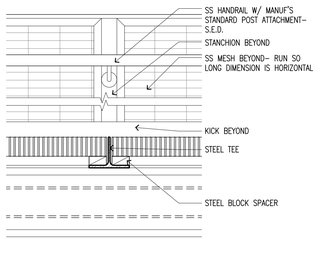
10 A7.4 **RCP AT INTERMEDIATE LANDINGS**
INTERIOR STAIRS 1, 2 3/8"=1'–0"



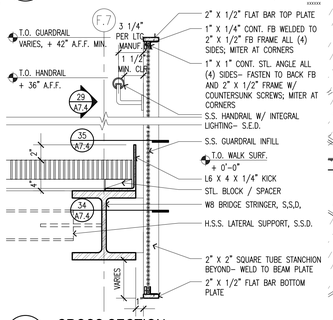
5 A7.4 **PLAN @ TOP OF STAIR**
INTERIOR STAIRS 1, 2 1"=1'–0"



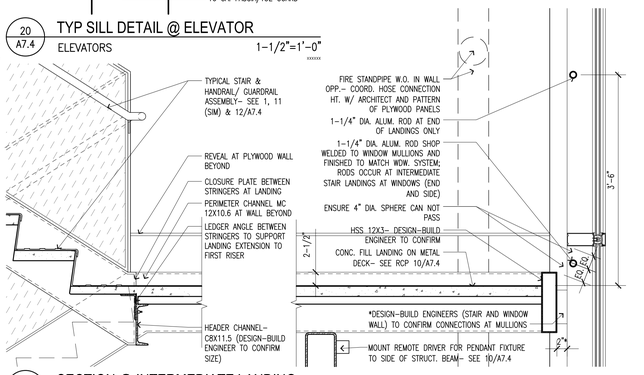
34 A7.4 **GUARDRAIL SUPPORT @ BEAM**
BRIDGE GUARDRAIL 3"=1'–0"



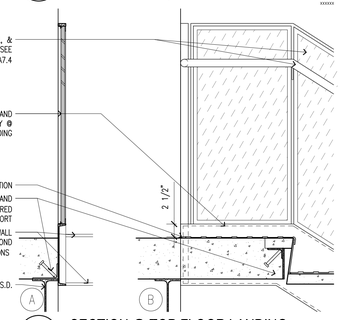
29 A7.4 **METAL GRATING SUPPORT**
BRIDGE 1–1/2"=1'–0"



24 A7.4 **CROSS SECTION**
BRIDGE STRINGER / GUARDRAIL 1–1/2"=1'–0"

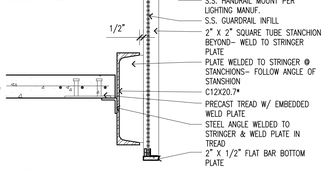


19 A7.4 **SECTION @ INTERMEDIATE LANDING**
INTERIOR STAIRS 1, 2 1"=1'–0"

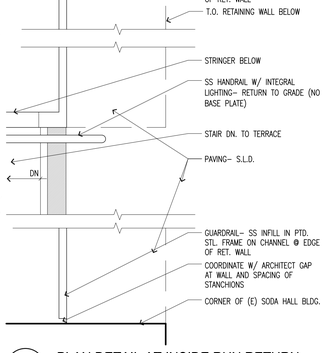


4 A7.4 **SECTION @ TOP FLOOR LANDING**
INTERIOR STAIRS 1, 2 1"=1'–0"

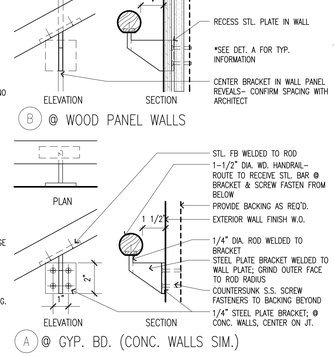
28 A7.4 **GUARDRAIL SECTION**
LE ROY AVE. 1–1/2"=1'–0"



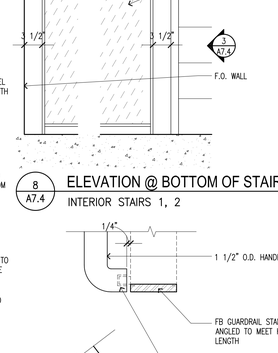
23 A7.4 **CROSS SECTION**
EXTERIOR STAIR 1–1/2"=1'–0"



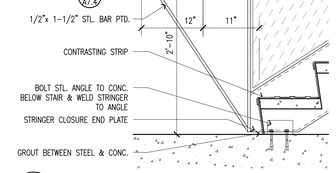
17 A7.4 **PLAN DETAIL AT INSIDE RUN RETURN**
INTERIOR STAIRS 1, 2 1"=1'–0"



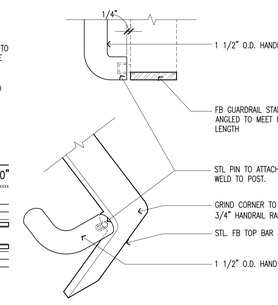
13 A7.4 **HANDRAIL MOUNT**
INTERIOR HANDRAIL LOCATIONS 3"=1'–0"



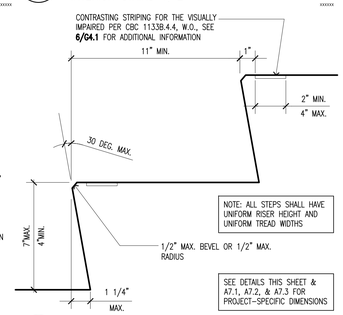
8 A7.4 **ELEVATION @ BOTTOM OF STAIR**
INTERIOR STAIRS 1, 2 1"=1'–0"



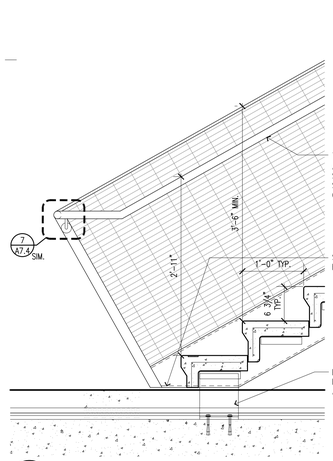
3 A7.4 **SECTION @ BOTTOM OF STAIR**
INTERIOR STAIRS 1, 2 1"=1'–0"



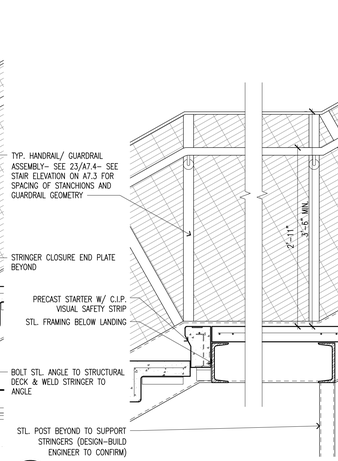
7 A7.4 **HANDRAIL TERMINATION**
STAIRS 3"=1'–0"



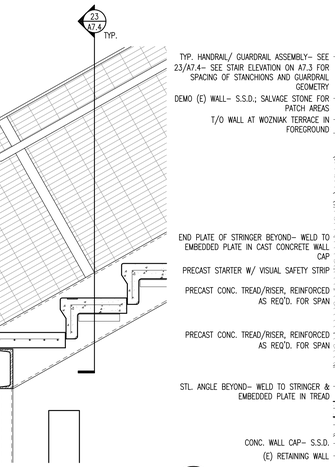
2 A7.4 **TYP. STAIR PROFILE REQUIREMENTS**
PER CBC 1133B.4 3"=1'–0"



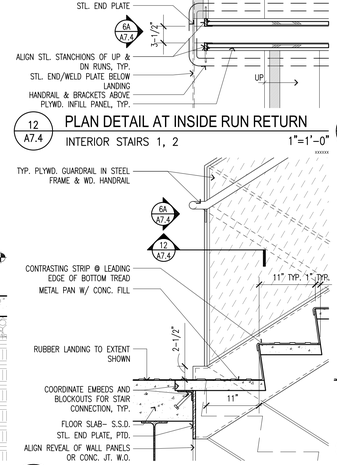
31 A7.4 **SECTION @ BOTTOM**
EXTERIOR STAIR 1"=1'–0"



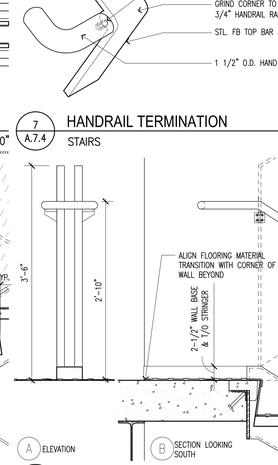
26 A7.4 **SECTION @ INTERMEDIATE LANDING**
EXTERIOR STAIR 1"=1'–0"



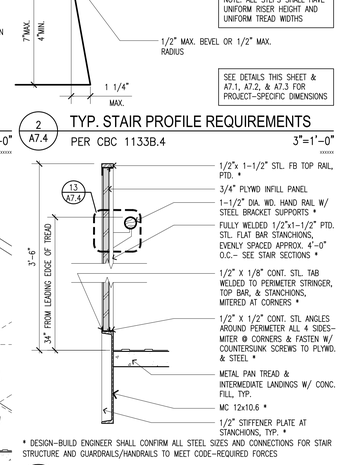
16 A7.4 **SECTION @ TOP**
EXTERIOR STAIR 1"=1'–0"



11 A7.4 **SECTION @ FLOOR LANDING**
INTERIOR STAIRS 1, 2 1"=1'–0"



6 A7.4 **DETAILS @ FLOOR LANDING**
INTERIOR STAIRS 1, 2 1"=1'–0"



1 A7.4 **TYPICAL STAIR/ GUARDRAIL SECTION**
INTERIOR STAIRS 1, 2 1–1/2"=1'–0"

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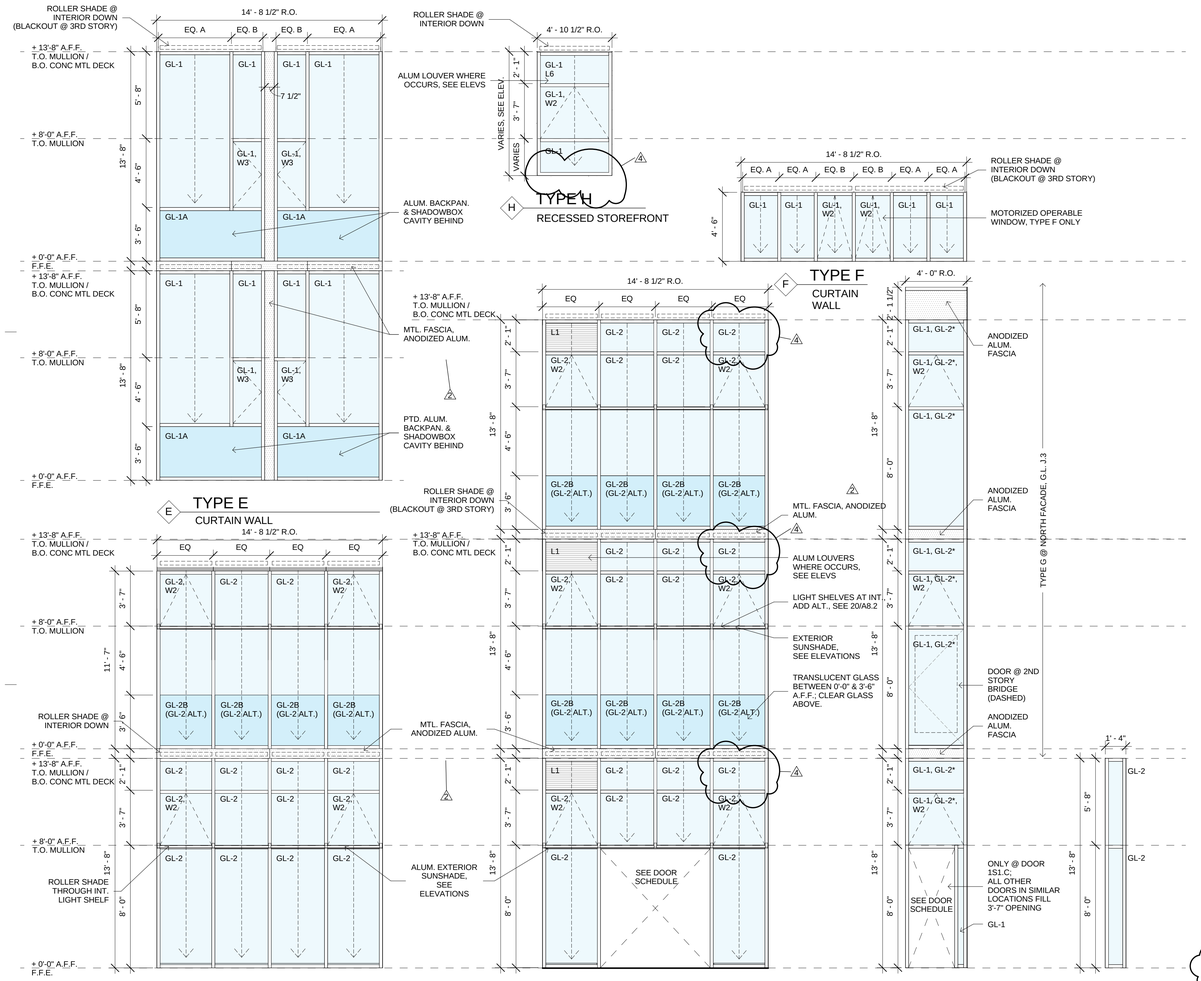
1810 LEROY AVENUE, BERKELEY, CA 94709

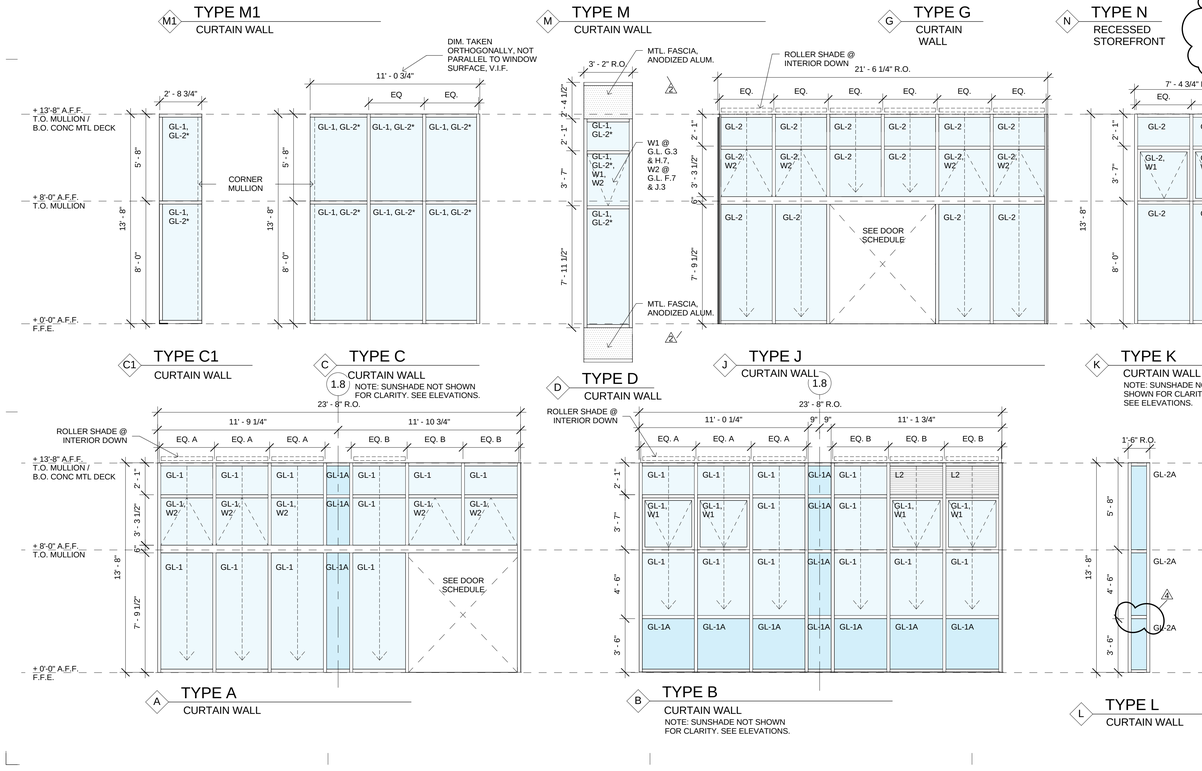
No	REVISION	DATE
	Bid #3: Structure / Site Utilities / W.P.	06/23/14
	BID # 3A - Elevator	08/01/14
	100% CDs / Permit Submission	08/15/14

DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : As Indicated

SHEET TITLE
STAIR, ELEVATOR & BRIDGE DETAILS

SHEET No
A7.4





DOOR GENERAL NOTES:

1. ALL DOOR OPENINGS, DOORS, FRAMES AND HARDWARE SHALL COMPLY WITH ALL APPLICABLE CODES AND U.L. & A.N.S.I. SPECIFICATIONS.

2. SEE EXTERIOR AND INTERIOR ELEVATIONS FOR ADJOINING SIDELIGHTS & TRANSOMS.

3. COORDINATE ALL DOORS AND DOOR DETAILS TO PROVIDE ADEQUATE CLEARANCE AND FRAME REINFORCEMENT FOR HARDWARE TYPES. SEE SPECIFICATIONS FOR HARDWARE MOUNTING HEIGHTS.

4. ALL UNDERCUT DOORS SHALL BE VERIFIED AND PROPERLY COORDINATED FOR VARYING CARPET THICKNESS, RUBBER FLOORING, ETC. THE MAXIMUM SWING DOOR CLEARANCE TO FRAME/SILL SHALL BE 1/8" MAX AT JAMBS, HEAD AND SILL (U.O.N.).

5. ALL HOLLOW METAL DOORS AND DOOR FRAMES TO BE PAINTED BOTH SIDES.

6. REFER TO SPECIFICATIONS FOR FULL DESCRIPTION OF GLAZING TYPES.

7. ALL GLASS, ACOUSTIC AND WEATHER SEAL SURFACES SHALL BE PREFINISHED.

8. ALL FIRE RATED DOORS TO RECEIVE LABELED CLOSING DEVICES, FRAMES AND AUTOMATIC LATCHES.

9. TYPICAL DOOR BEVEL TO BE 1/8" IN 2" U.O.N. BY HARDWARE TEMPLATE REQUIREMENTS.

10. ALL FLOOR PIVOTS AND CLOSURE PLATES ARE TO BE INSTALLED FLUSH TO SLAB BELOW FINISH FLOORING. PROVIDE ADJUSTMENT ACCESS AS REQUIRED.

11. EXIT DOORS ARE OPERABLE FROM THE INSIDE WITHOUT THE USE OF A KEY OR ANY SPECIAL KNOWLEDGE OR EFFORT.

12. MAXIMUM EFFORT TO OPERATE DOORS SHALL NOT EXCEED 5 POUNDS FOR EXTERIOR AND INTERIOR DOORS, SUCH PULL OR PUSH EFFORT BEING APPLIED AT RIGHT ANGLES TO HINGED DOORS AND AT THE CENTER PLANE OF SLIDING OR FOLDING DOORS.

13. MAXIMUM EFFORT TO OPERATE FIRE DOORS SHALL NOT EXCEED 15 POUNDS.

14. VERIFY ALL H.M. FRAME THROAT WIDTHS WITH SPECIFIC WALL WIDTHS AT EACH LOCATION.

15. CHANGES IN LEVEL AT THRESHOLDS SHALL NOT EXCEED 1/2" BEVELED AT A 1:2 GRADIENT (1/4" VERTICAL IS ALLOWABLE).

16. ALL DOORS TO SWING IN DIRECTION OF EGRESS WHEN OCCUPANCY LOAD IS 50 OR MORE.

17. ALL DOORS SERVING GROUP A AND E OCCUPANCIES SHALL NOT BE PROVIDED WITH A LATCH OR LOCK UNLESS IT IS PANIC HARDWARE OR FIRE EXIT HARDWARE (CBC 1008.1.10).

18. SEE EXTERIOR WINDOW SCHEDULE & INTERIOR ELEVATIONS FOR ADJOINING SIDELIGHTS & TRANSOMS

19. FOR ELEVATOR DOORS SEE ELEVATOR SPECIFICATIONS.

20. FOR STC-RATED ACOUSTICAL DOORS (AD) SEE ACOUSTICAL REPORT. DOORS NOTED AS "SOUND RATED" SHALL HAVE A MINIMUM STC RATING AS INDICATED.

21. PROVIDE PANIC HARDWARE AS REQUIRED BY CODE.

22. REFER TO SPECIFICATIONS FOR FULL DESCRIPTION OF GLAZING TYPES.

23. PROVIDE SAFETY GLAZING PER CBC 2406.4

24. SEE INTERIOR ELEVATIONS FOR INTERIOR GLAZING/ SIDELITE / TRANSOM SCHEDULE

GLASS LEGEND

GL-1* 1" CLR. INSUL. GLASS: SOLARBAN 60
GL-1A 1" CLR. INSUL. GLASS: SOLARBAN 60 W/ TRANSLUCENT LAM. INNER LITE
GL-1B NOT USED
GL-2* 1" CLR. INSUL. GLASS: SOLARBAN 70 XL
GL-2A 1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ TRANSLUCENT LAM. INNER LITE
GL-2B 1" CLR. INSUL. GLASS: SOLARBAN 70 XL W/ COMBINATION LAM. INNER LITE
GL-3 NOT USED
GL-4 NOT USED
GL-5 NOT USED
GL-6 3/8" CLR LAM. GLASS
GL-7 3/4" CLR MONOLITHIC GLASS
GL-8 1/2" CLR GLASS -90 MIN FIRE RATED ASSEMBLY
GL-9 2 LAYERS 1/4" LAM GLASS W/ 3" AIR GAP, STC 43

*NOTE: GL-1,1A & 1B AT NORTH AND EAST ELEVATIONS, TYP.; GL-2,2A & 2B AT SOUTH AND WEST ELEVATIONS, TYP.

LOUVER LEGEND

NO.:	SIZE (WIDTH X HEIGHT):
L1	3'-4 3/8" W X 1'-10 1/2" H
L2	3'-5 3/8" W X 1'-10 1/2" H
L3	2'-0" W X 1'-2" H
L4	6'-0" W x 5'-4" T
L5	6'-0"" W x 2'-8" H
L6	4'-5 1/2" W x 1'-10 1/2" H
L7	2'-0"W X 1'-4" H

LOCATION:
S. C.W.
E. ELEV C.W.
1ST STORY RESTRMS
MECH WELL
MECH WELL
N. ELEV EQUIP RM
E. ELEV CONCRETE

NOTES:
2" ARCHT'L BASE BID, 4" ACOUST. ALT.
2" ARCHT'L BASE BID, 4" ACOUST. ALT.
4" ARCHT'L LOUVER
4" ARCHT'L LOUVER, LOW
4" ARCHT'L LOUVER, HIGH
2" ARCHT'L LOUVER
4" ARCHT'L LOUVER

DOOR SCHEDULE

DOOR NUMBER	LOCATION	DOOR TYPE	DOOR THK	SIZE WIDTH	SIZE HEIGHT	MATERIALS DOOR	MATERIALS DR. FIN.	MATERIALS GLAZ.	MATERIALS FM.	MATERIALS FM. FIN.	FIRE RATING (MIN.)	DETAILS HEAD	DETAILS JAMB	DETAILS SILL	HRDWR GROUP	REMARKS
BASEMENT F.F.E.																
0H2.A	ELEC	B1	1 3/4"	5' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				07	
0H2.B	HALL	A	1 3/4"	3' - 6"	7' - 10"	HM	PTD	-	HM	PTD	3 HR				08	CR, FIRE WALL BET. BLDG, NOT AN EXIT
0S1.A	STAIR #1	C	1 3/4"	4' - 9"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				09	FR, HO
0S1.B	STAIR #1	B	1 3/4"	7' - 8"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				10	CR, FR, HO, PH
0S2.A	STAIR #2	C	1 3/4"	4' - 9"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				09	FR, HO
0S2.B	STAIR #2	B	1 3/4"	7' - 8"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				10	CR, FR, HO, PH
001	STORAGE	B1	1 3/4"	6' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				07	
005	JANITOR'S CLOSET	A	1 3/4"	3' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				14	UC
010.A	MECHANICAL	A	1 3/4"	4' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				15	STC 47
010.B	EQUIPMENT	A	1 3/4"	4' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				16	STC 47 DOOR & SIDELITE
010.C	EQUIPMENT	A	1 3/4"	4' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				16	CR, STC 47 DOOR & SIDELITE
010.D	TELECOM	A	1 3/4"	3' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				21	CR, SG
010.E	ELECTRICAL	A	1 3/4"	3' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				17	SG, PH
032	STORAGE	A	1 3/4"	3' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				14	
032.A	E.C.C.	B1	1 3/4"	5' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				07	
2170.B	EQUIPMENT ROOM	A	1 3/4"	3' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR				22	CR
2170.C	EQUIPMENT ROOM	B1	1 3/4"	6' - 0"	7' - 10"	HM	PTD	-	HM	PTD	O HR					
2170.D	VESTIBULE	A	1 3/4"	6' - 2"	7' - 10"	HM	PTD	-	HM	PTD	20 MIN				23	(E) DOOR: (E) CR TO REMAIN
1ST STORY F.F.E.																
1H1.B	HALL	G	1 3/4"	3' - 7"	7' - 9 1/2"	ALUM	AN	GL-2	ALUM	AN	O HR				01	
1H2.A	ELECTRICAL CLOSET	B1	1 3/4"	5' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				07	
1S1.A	STAIR # 1	C	1 3/4"	4' - 9"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				11	FR, HO, PH
1S1.B	STAIR # 1	B	1 3/4"	7' - 8"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				10	CR, FR, HO, PH
1S1.C	STAIR # 1	G	1 3/4"	3' - 0"	7' - 9 1/2"	ALUM	AN	GL-1	ALUM	AN	O HR				05	PH
1S2.A	STAIR #2	C	1 3/4"	4' - 9"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				09	FR, HO
1S2.B	STAIR #2	B	1 3/4"	7' - 8"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				10	CR, FR, HO, PH
032.B	STUDIO	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				26	SG
101	LOBBY / EXHIBIT	I	1/2"	6' - 10 3/4"	7' - 9 1/2"	S.STL.	S.STL.	GL-7	ALUM	AN	O HR				02	CR, DO
102	LOUNGE	G	1 3/4"	3' - 7"	7' - 9 1/2"	ALUM	AN	GL-2	ALUM	AN	O HR				03	CR
110.B	OFFICE	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				26	SG
110.C	EQUIPMENT	A	1 3/4"	4' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				27	CR, SG, DB
110.D	STUDIO	E	1 3/4"	3' - 6"	7' - 10"	ALUM	PTD	GL-6	ALUM	PTD	O HR				28	DB, SG
110.E	STUDIO	H	1 3/4"	7' - 1 3/4"	7' - 9 1/2"	ALUM	AN	GL-2	ALUM	AN	O HR				06	PH
110.F	STUDIO	D	1 3/4"	8' - 0"	7' - 10"	HM	PTD	GL-6	HM	PTD	O HR				29	PH, STC 47
120.A	OFFICE	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				26	SG
120.B	OFFICE	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				26	SG
120.C	EQUIPMENT	A	1 3/4"	4' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				27	CR, SG, DB
120.D	STUDIO	E	1 3/4"	3' - 6"	7' - 10"	ALUM	PTD	GL-6	ALUM	PTD	O HR				28	DB, SG
120.E	STUDIO	H	1 3/4"	7' - 1 3/4"	7' - 9 1/2"	ALUM	AN	GL-2	ALUM	AN	O HR				06	PH
120.F	STUDIO	E	1 3/4"	3' - 6"	7' - 10"	HM	PTD	GL-6	HM	PTD	O HR				30	STC 47 DOOR (ALT.) & SIDELITE
132	WOMEN'S RESTROOM	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				24	
134	MEN'S RESTROOM	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				24	
2ND STORY F.F.E.																
2H2.A	ELECTRICAL CLOSET	B1	1 3/4"	5' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				07	
2S1.A	STAIR # 1	C	1 3/4"	4' - 9"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				11	FR, HO, PH
2S1.B	STAIR # 1	B	1 3/4"	7' - 8"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				10	CR, FR, HO, PH
2S2.A	STAIR # 2	C	1 3/4"	4' - 9"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				12	FR, HO, PH
2S2.B	STAIR # 2	B	1 3/4"	7' - 8"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				10	CR, FR, HO, PH
201	LOBBY / EXHIBIT	I	1/2"	7' - 1"	7' - 9 1/2"	S.STL.	S.STL.	GL-7	ALUM	AN	O HR				02	CR, DO, PH
202	HALL	G	1 3/4"	3' - 7"	7' - 9 1/2"	ALUM	AN	GL-2	ALUM	AN	O HR				04	CR
203	WOMEN'S RESTROOM	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				24	
205	JANITOR'S CLOSET	A	1 3/4"	2' - 8"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				25	UC
207	MEN'S RESTROOM	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				24	
210.A	OFFICE	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				26	SG
210.B	OFFICE	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				26	SG
210.C	EQUIPMENT	A	1 3/4"	4' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				27	CR, DB, SG
210.D	STUDIO	E	1 3/4"	3' - 6"	7' - 10"	ALUM	AN	GL-6	ALUM	PTD	O HR				28	DB, SG
210.F	STUDIO	D	1 3/4"	8' - 0"	7' - 10"	HM	PTD	GL-6	HM	PTD	O HR				29	PH, STC 47
220.A	OFFICE	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				26	SG
220.B	OFFICE	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				26	SG
220.C	EQUIPMENT	A	1 3/4"	4' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				27	CR, SG, DB
220.F	STUDIO	E	1 3/4"	3' - 6"	7' - 10"	HM	PTD	GL-6	HM	PTD	O HR				30	STC 47 DOOR (ALT.) & SIDELITE
3RD STORY F.F.E.																
3H2.A	ELECTRICAL CLOSET	B1	1 3/4"	5' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				07	
3S1.A	STAIR #1	C	1 3/4"	4' - 9"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				11	FR, HO, PH
3S1.B	STAIR #1	B	1 3/4"	7' - 8"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				10	CR, FR, HO, PH
3S2.A	STAIR #2	C	1 3/4"	4' - 9"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				09	FR, HO
3S2.B	STAIR #2	B	1 3/4"	7' - 8"	7' - 10"	HM	PTD	GL-8	HM	PTD	90 MIN				10	CR, FR, HO, PH
303	WOMEN'S RESTROOM	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				24	
305	JANITOR'S CLOSET	A	1 3/4"	2' - 8"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				25	UC
306.A	EQUIPMENT	A	1 3/4"	4' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				31	CR. SG
307	MEN'S RESTROOM	A	1 3/4"	3' - 0"	7' - 10"	WD	PTD	-	ALUM	PTD	O HR				24	
310.D	STUDIO	E	1 3/4"	3' - 6"	7' - 10"	ALUM	PTD	GL-6	ALUM	PTD	O HR				28	DB, SG

DOOR NOTES LEGEND

CR	CARD READER
FR	FIRE RATED
HO	HOLD OPEN
PH	PANIC HARDWARE
DB	DROP BOTTOM
DO	AUTO DOOR OPERATOR
SG	SOUND GASKETED
STC XX	REQ'D STC RATING
UC	UNDERCUT

DOOR MATERIAL LEGEND

HM	HOLLOW METAL
HMA	HOLLOW METAL W/ ALUMINUM COVER
WD	WOOD
ALUM	ALUMINUM
S. STL.	STAINLESS STEEL
GL	MONOLITHIC GLASS

DOOR/ FRAME FINISH LEGEND

PTD	PAINTED
FF	FACTORY FINISH
AN	ANODIZED

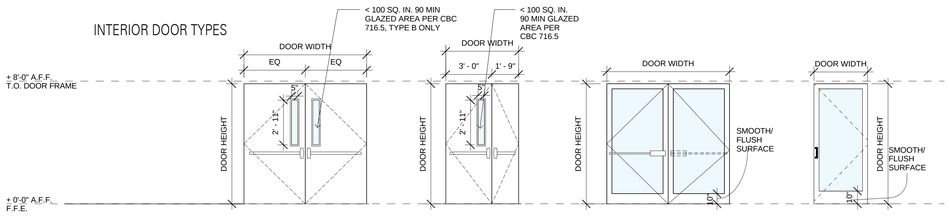
FRAME MATERIAL LEGEND

WD	WOOD
HM	HOLLOW METAL
ALUM	ALUMINUM
SS	STAINLESS STEEL

DOOR SCHEDULE LEGEND

101 ← DOOR MARK OR NUMBER - SEE DOOR SCHEDULE

INTERIOR DOOR TYPES

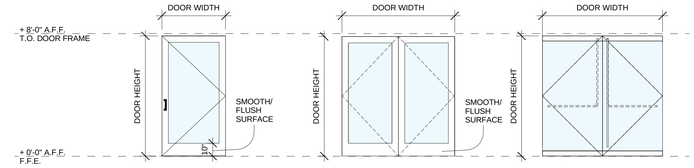


A FLUSH DOOR
B DOUBLE FLUSH DOOR WITH INTERIOR LITES
B1 DOUBLE FLUSH DOOR (NO INT. LITE)
C DOUBLE FLUSH DOOR - UNEVEN
D DOUBLE GLAZED DOOR WITH TRANSOM
E INTERIOR GLAZED DOOR

OPERABLE WINDOW LITE TYPES

W1 INSWING HOPPER, EXPOSED EXT. FRAME
W2 OUTSWING AWNING, ZERO SITELINE
W3 OUTSWING CASEMENT, ZERO SITELINE

EXTERIOR DOOR TYPES



G EXTERIOR GLAZED DOOR
H EXTERIOR GLAZED DOUBLE DOOR
I EXTERIOR GLAZED DOUBLE DOOR

ARCHITECTS

LMS^A

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STAMP

CONSULTANTS

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	BID # 2 - Ext. Skin D/B	06/06/14
2	BID # 2 - Addendum 1	07/22/14
4	100% CDs / Permit Submission Rev	08/15/14

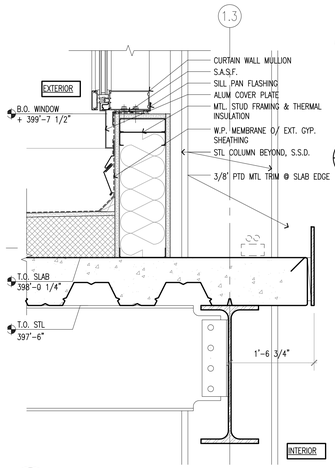
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: As indicated

SHEET TITLE

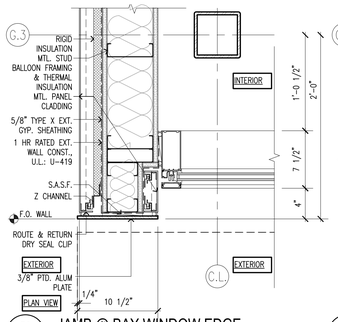
DOORS & WINDOWS - SCHEDULES & DETAILS

SHEET No

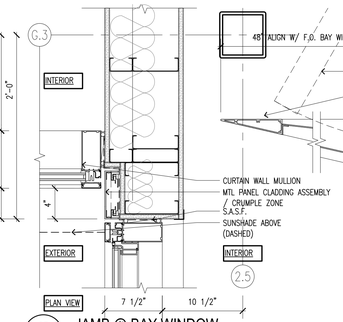
A8.1



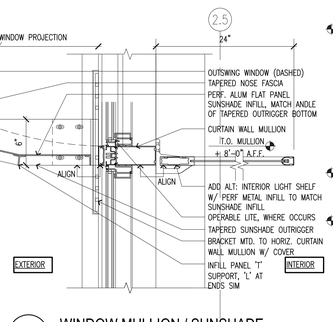
34 A8.2 **CLERESTORY SILL**
LOW ROOF / NORTH ELEV 1-1/2"=1'-0"



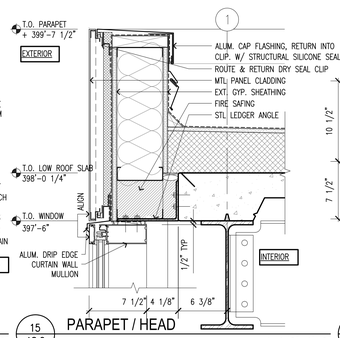
30 A8.2 **JAMB @ BAY WINDOW EDGE**
3RD FLOOR / SOUTH ELEV. 1-1/2"=1'-0"



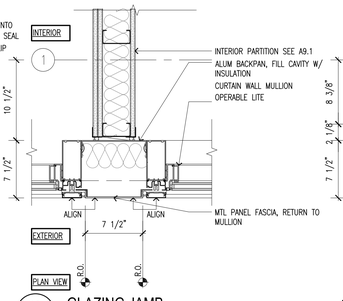
25 A8.2 **JAMB @ BAY WINDOW**
3RD FLOOR / SOUTH ELEV 1-1/2"=1'-0"



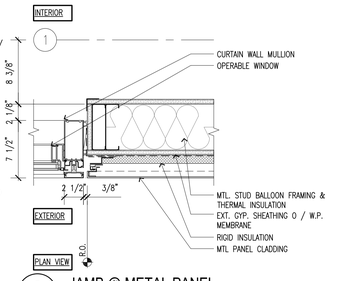
20 A8.2 **WINDOW MULLION / SUNSHADE**
TYP / SOUTH ELEV 1-1/2"=1'-0"



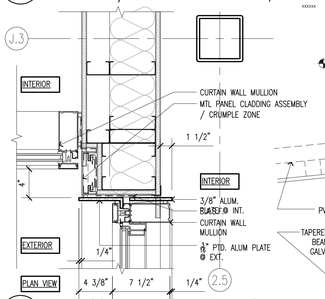
15 A8.2 **PARAPET / HEAD**
LOW ROOF / NORTH ELEV 1-1/2"=1'-0"



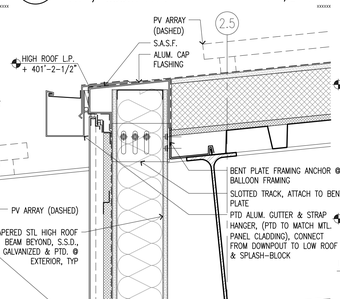
10 A8.2 **GLAZING JAMB**
TYP / NORTH CURTAIN WALL 1-1/2"=1'-0"

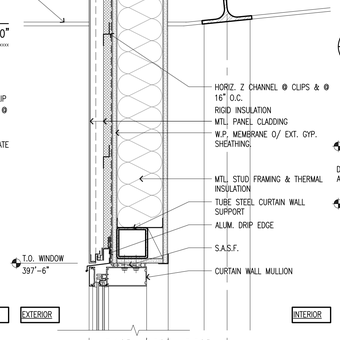


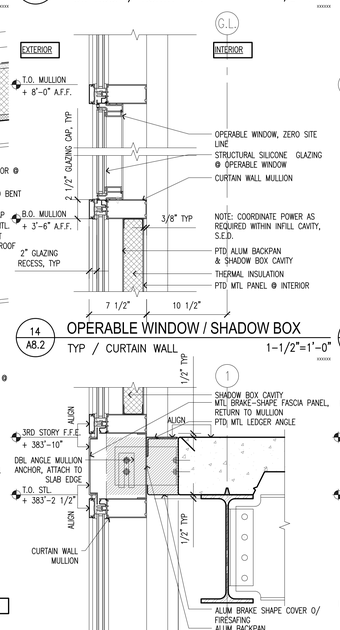
5 A8.2 **JAMB @ METAL PANEL**
TYP / NORTH ELEV, SOUTH SIM 1-1/2"=1'-0"



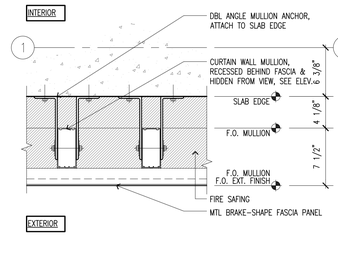
24 A8.2 **RECESSED JAMB @ BAY WINDOW**
3RD FLOOR / SOUTH ELEV 1-1/2"=1'-0"



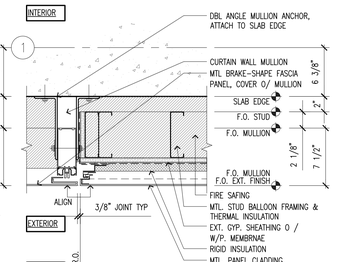




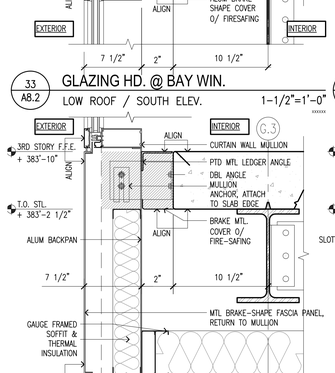
14 A8.2 **OPERABLE WINDOW / SHADOW BOX**
TYP / CURTAIN WALL 1-1/2"=1'-0"



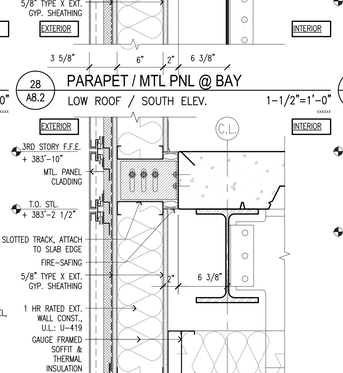
9 A8.2 **CURTAIN WALL MULLION ANCHOR**
TYP/ NORTH ELEV, SOUTH SIM 1-1/2"=1'-0"



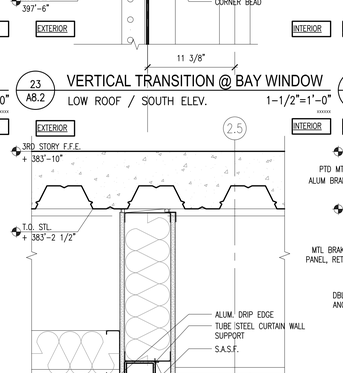
4 A8.2 **C.W. PANEL / MTL. PANEL VERT. JOINT**
TYP / NORTH ELEV, SOUTH SIM 1-1/2"=1'-0"



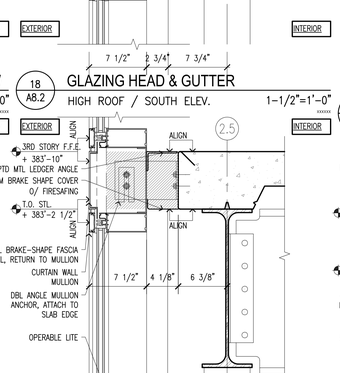
33 A8.2 **GLAZING HD. @ BAY WIN.**
LOW ROOF / SOUTH ELEV. 1-1/2"=1'-0"



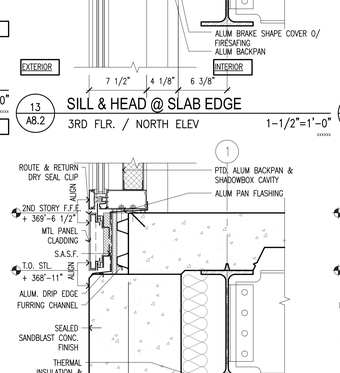
28 A8.2 **PARAPET / MTL PNL @ BAY**
LOW ROOF / SOUTH ELEV. 1-1/2"=1'-0"



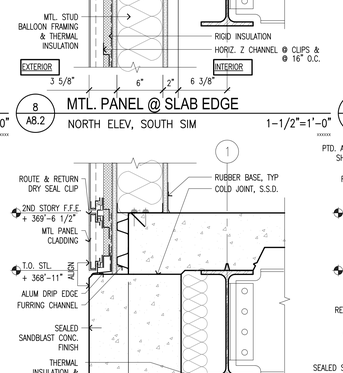
23 A8.2 **VERTICAL TRANSITION @ BAY WINDOW**
LOW ROOF / SOUTH ELEV. 1-1/2"=1'-0"



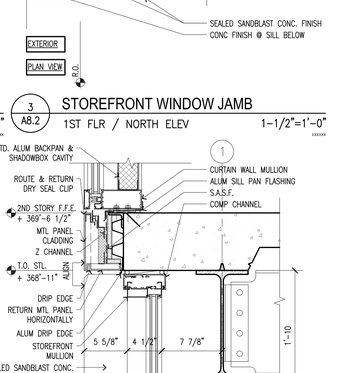
18 A8.2 **GLAZING HEAD & GUTTER**
HIGH ROOF / SOUTH ELEV. 1-1/2"=1'-0"



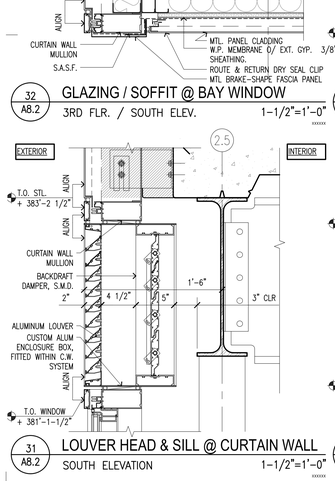
13 A8.2 **SILL & HEAD @ SLAB EDGE**
3RD FLR. / NORTH ELEV 1-1/2"=1'-0"



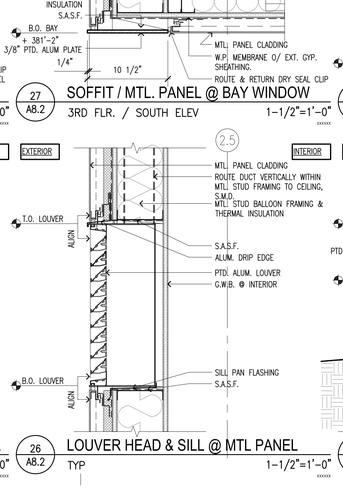
8 A8.2 **MTL. PANEL @ SLAB EDGE**
NORTH ELEV, SOUTH SIM 1-1/2"=1'-0"



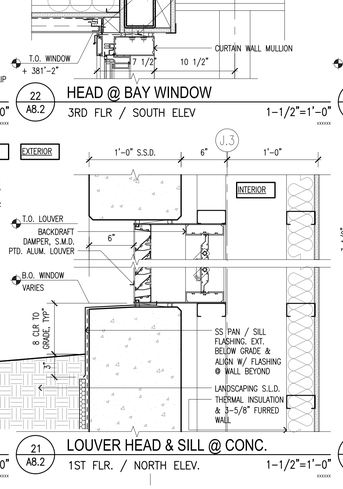
3 A8.2 **STOREFRONT WINDOW JAMB**
1ST FLR / NORTH ELEV 1-1/2"=1'-0"



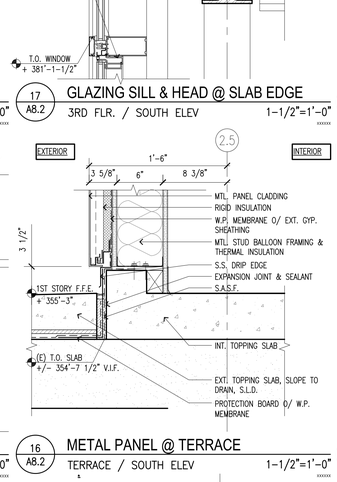
32 A8.2 **GLAZING / SOFFIT @ BAY WINDOW**
3RD FLR. / SOUTH ELEV. 1-1/2"=1'-0"



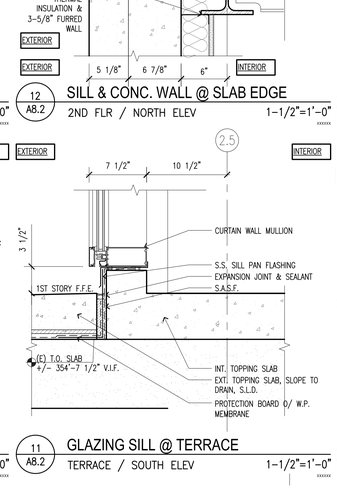
27 A8.2 **SOFFIT / MTL. PANEL @ BAY WINDOW**
3RD FLR. / SOUTH ELEV 1-1/2"=1'-0"



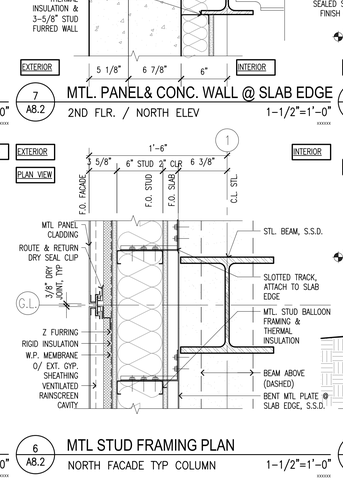
22 A8.2 **HEAD @ BAY WINDOW**
3RD FLR / SOUTH ELEV 1-1/2"=1'-0"



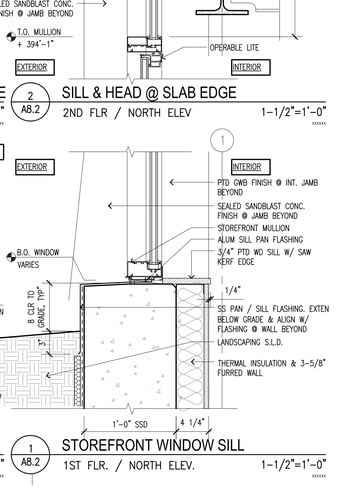
17 A8.2 **GLAZING SILL & HEAD @ SLAB EDGE**
3RD FLR / SOUTH ELEV 1-1/2"=1'-0"



12 A8.2 **SILL & CONC. WALL @ SLAB EDGE**
2ND FLR / NORTH ELEV 1-1/2"=1'-0"



7 A8.2 **MTL. PANEL& CONC. WALL @ SLAB EDGE**
2ND FLR. / NORTH ELEV 1-1/2"=1'-0"



2 A8.2 **SILL & HEAD @ SLAB EDGE**
2ND FLR / NORTH ELEV 1-1/2"=1'-0"

31 A8.2 **LOUVER HEAD & SILL @ CURTAIN WALL**
SOUTH ELEVATION 1-1/2"=1'-0"

26 A8.2 **LOUVER HEAD & SILL @ MTL PANEL**
TYP 1-1/2"=1'-0"

21 A8.2 **LOUVER HEAD & SILL @ CONC.**
1ST FLR. / NORTH ELEV. 1-1/2"=1'-0"

16 A8.2 **METAL PANEL @ TERRACE**
TERRACE / SOUTH ELEV 1-1/2"=1'-0"

11 A8.2 **GLAZING SILL @ TERRACE**
TERRACE / SOUTH ELEV 1-1/2"=1'-0"

6 A8.2 **MTL STUD FRAMING PLAN**
NORTH FACADE TYP COLUMN 1-1/2"=1'-0"

1 A8.2 **STOREFRONT WINDOW SILL**
1ST FLR. / NORTH ELEV. 1-1/2"=1'-0"

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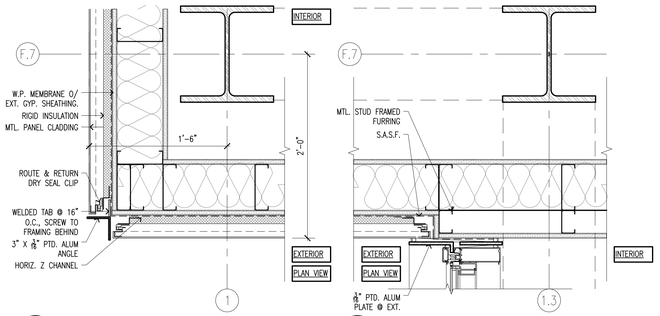
No	REVISION	DATE
	Bid #2: Ext Skin D/B	06/20/14
	Bid #3: Structure / Site Utilities / W.P.	06/23/14
	100% CDs / Permit Submission	08/15/14

DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : As Indicated

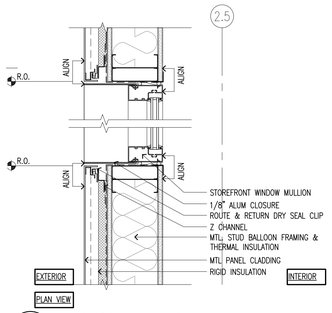
SHEET TITLE
EXT DETAILS DESIGN BUILD

SHEET No
A8.2

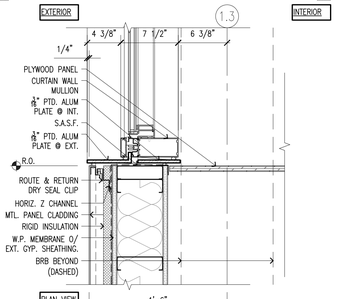


30 A8.3 OUTSIDE CORNER @ METAL PANEL
BALLOON FRAMING 1-1/2"=1'-0"

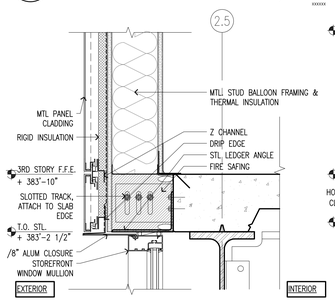
25 A8.3 RECESSED JAMB @ METAL PANEL
BALLOON FRAMING 1-1/2"=1'-0"



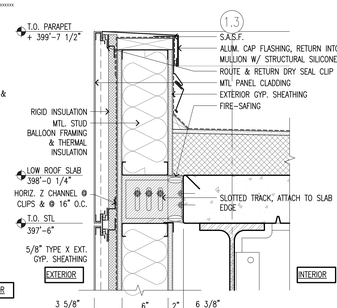
34 A8.3 RECESSED WINDOW JAMB
BALLOON FRAMING 1-1/2"=1'-0"



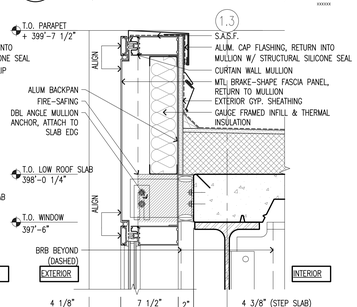
24 A8.3 RECESSED JAMB @ METAL PANEL
TYP / BALLOON FRAMING 1-1/2"=1'-0"



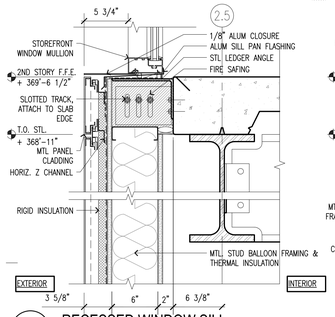
33 A8.3 RECESSED WINDOW HEAD
3RD FLOOR / BALLOON FRAMING 1-1/2"=1'-0"



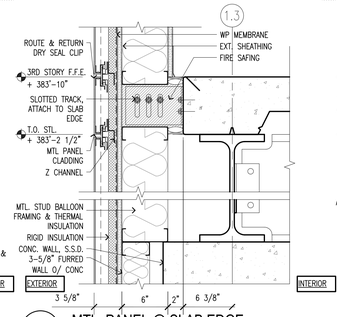
28 A8.3 PARAPET / MTL PANEL
LOW ROOF / BALLOON FRAMING 1-1/2"=1'-0"



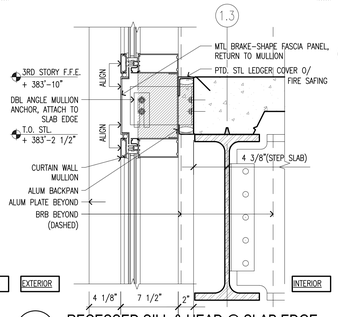
23 A8.3 RECESSED GLAZING HEAD
LOW ROOF / BALLOON FRAMING 1-1/2"=1'-0"



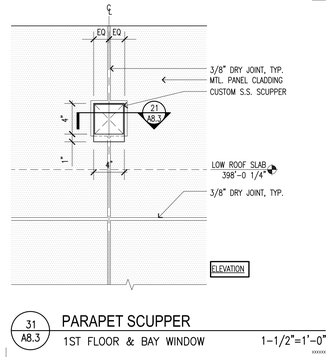
32 A8.3 RECESSED WINDOW SILL
2ND FLOOR / BALLOON FRAMING 1-1/2"=1'-0"



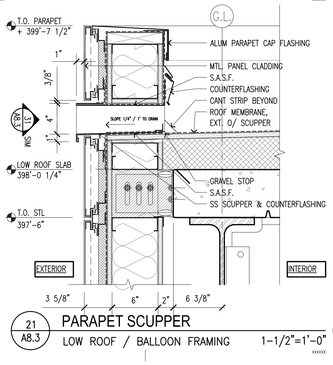
27 A8.3 MTL. PANEL @ SLAB EDGE
2ND FLOOR / BALLOON FRAMING 1-1/2"=1'-0"



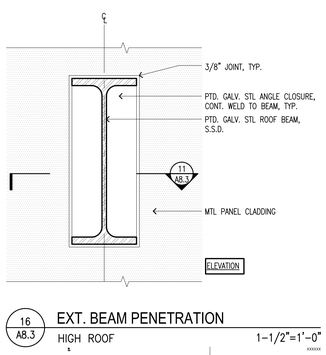
22 A8.3 RECESSED SILL & HEAD @ SLAB EDGE
TYP. / BALLOON FRAMING 1-1/2"=1'-0"



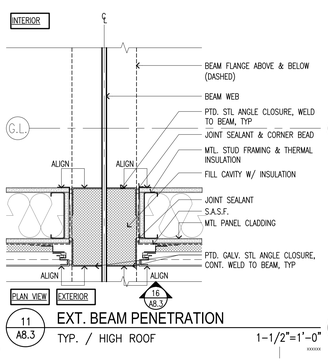
31 A8.3 PARAPET SCUPPER
1ST FLOOR & BAY WINDOW 1-1/2"=1'-0"



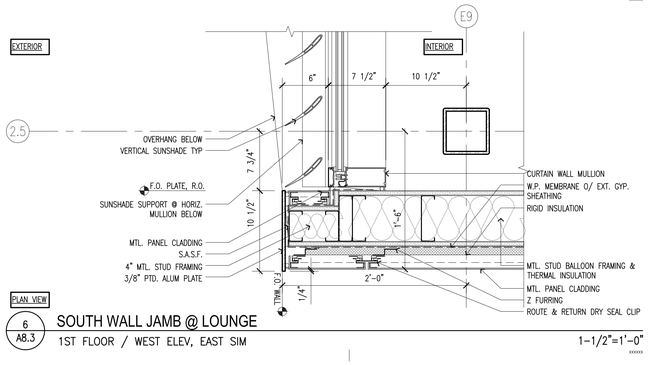
21 A8.3 PARAPET SCUPPER
LOW ROOF / BALLOON FRAMING 1-1/2"=1'-0"



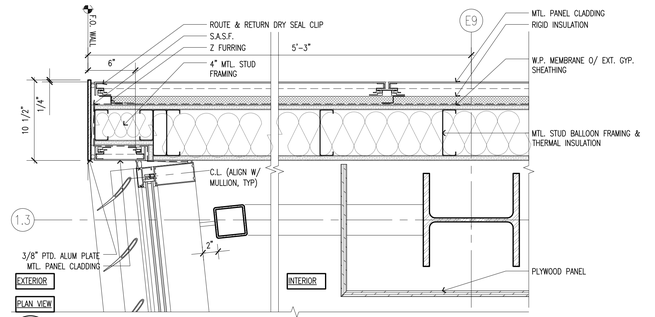
16 A8.3 EXT. BEAM PENETRATION
HIGH ROOF



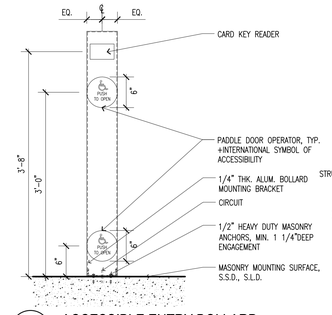
11 A8.3 EXT. BEAM PENETRATION
TYP. / HIGH ROOF 1-1/2"=1'-0"



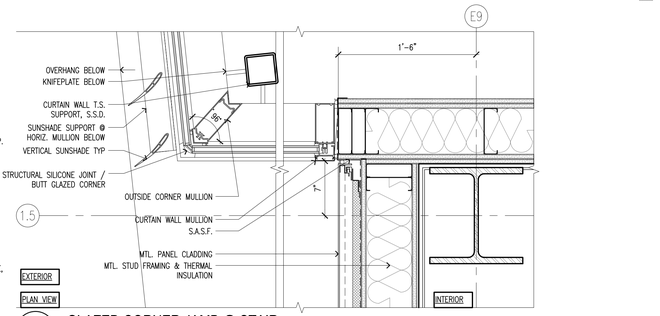
6 A8.3 SOUTH WALL JAMB @ LOUNGE
1ST FLOOR / WEST ELEV, EAST SIM 1-1/2"=1'-0"



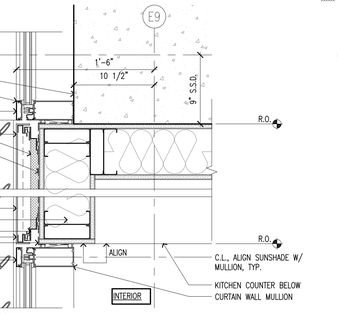
10 A8.3 NORTH WALL JAMB @ STAIR
TYP / WEST ELEV, EAST SIM 1-1/2"=1'-0"



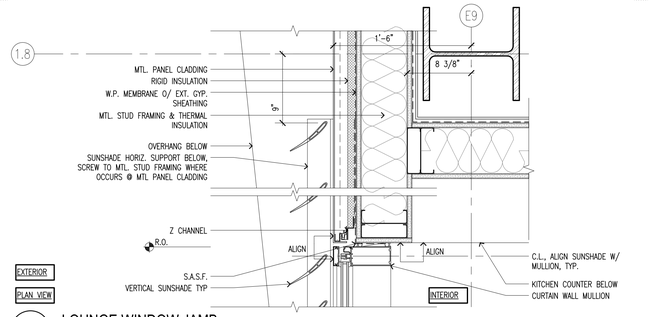
14 A8.3 ACCESSIBLE ENTRY BOLLARD
1"=1'-0"



9 A8.3 GLAZED CORNER JAMB @ STAIR
TYP / WEST ELEV, EAST SIM 1-1/2"=1'-0"



17 A8.3 WINDOW JAMB @ CONCRETE SHEAR WALL
1ST STORY / WEST ELEV 1-1/2"=1'-0"



7 A8.3 LOUNGE WINDOW JAMB
TYP / WEST ELEV, EAST SIM 1-1/2"=1'-0"

8 A8.3 RESTROOM WINDOW JAMB
TYP / WEST ELEV 1-1/2"=1'-0"

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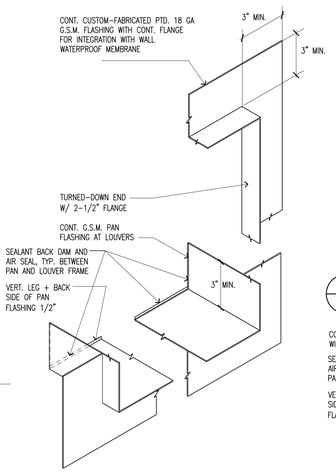
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Bid #2: Ext Skin D/B	06/20/14
	Bid #3: Structure / Site Utilities / W.P.	06/23/14
	100% CDs / Permit Submission	08/15/14

DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : As Indicated

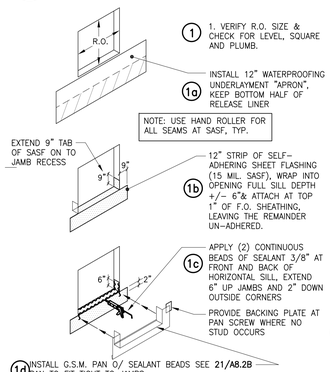
SHEET TITLE
EXT DETAILS DESIGN BUILD

SHEET No
A8.3

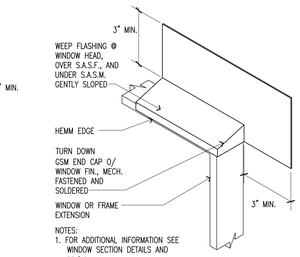


NOTES:
1. FOR ADDITIONAL INFORMATION SEE LOUVER SECTION DETAILS.
2. POP-RIVET AND FULLY SOLDER ALL CORNERS WATERTIGHT.
3. SHEET METAL LAPS 3" MIN. SET IN FULL BED OF SEALANT.
4. AT THE SILL, FLASH FLANGES OF PAN FLASHING WITH S.A.S.M. PRIOR TO THE INSTALLATION OF THE CASING BEAD AT THE JAMB.

34 A8.4 FLASHING @ LOUVER
N.T.S.

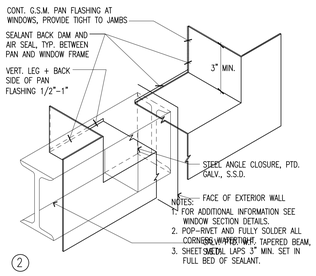


31 A8.4 FLASHING SEQUENCE
AT ALL WINDOW TYPES, TYP. N.T.S.



NOTES:
1. FOR ADDITIONAL INFORMATION SEE WINDOW SECTION DETAILS AND 33/A8.4
2. POP-RIVET AND FULLY SOLDER ALL CORNERS WATERTIGHT.
3. SHEET METAL LAPS 3" MIN. SET IN FULL BED OF SEALANT.

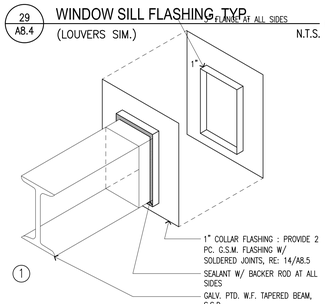
30 A8.4 WINDOW HEAD FLASHING, TYP.
N.T.S.



NOTES:
1. FOR ADDITIONAL INFORMATION SEE WINDOW SECTION DETAILS.
2. POP-RIVET AND FULLY SOLDER ALL CORNERS WATERTIGHT.
3. SHEET METAL LAPS 3" MIN. SET IN FULL BED OF SEALANT.

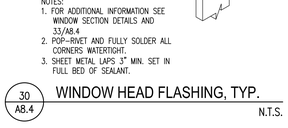
2

29 A8.4 WINDOW SILL FLASHING, TYP. (LOUVERS SIM.)
N.T.S.

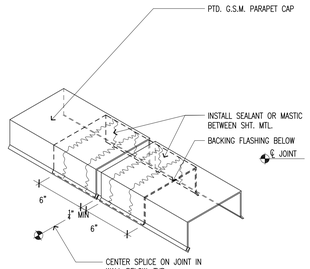


1

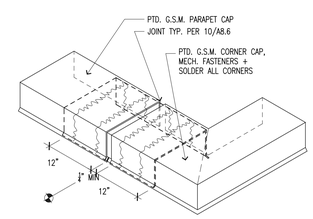
27 A8.4 CANOPY FLASHING SEQUENCE
– 1-1/2"=1'-0"



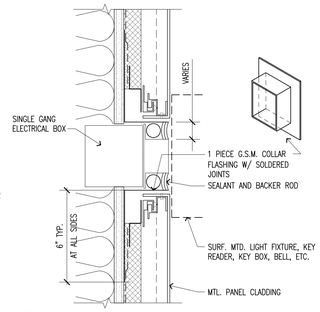
26 A8.4 AXONOMETRIC @ PARAPET
TYP. SADDLE FLASHING N.T.S.



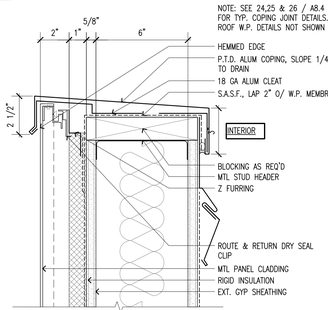
25 A8.4 AXONOMETRIC @ PARAPET CAP JOINT
TYPICAL N.T.S.



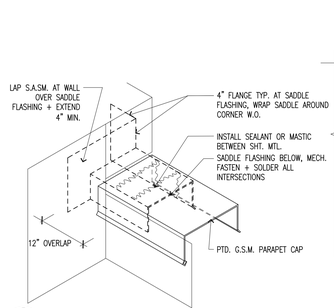
24 A8.4 AXONOMETRIC AT PARAPET
TYP. CORNER FLASHING 3"=1'-0"



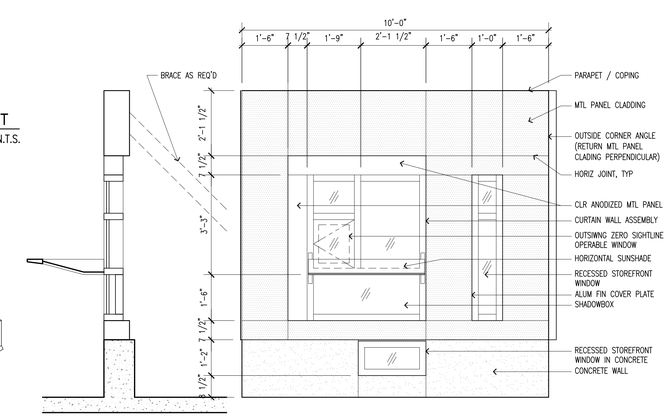
23 A8.4 ELECTRICAL BOX AT METAL PANEL
AT A6 TYPE LIGHT FIXTURE 3"=1'-0"



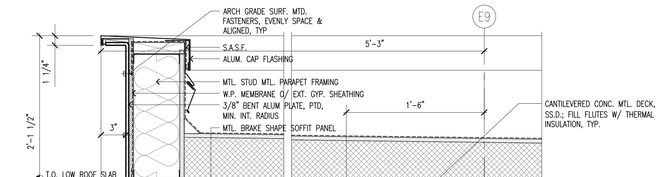
22 A8.4 SECTION @ PARAPET CAP
CEMENT PLASTER 3"=1'-0"



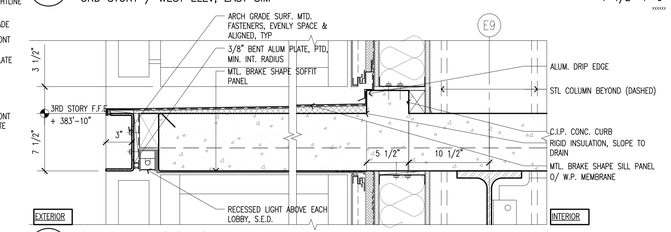
19 A8.4 TYP. SUBFRAMING AT WALL ELEVATION
(BASIS OF DESIGN) 1/2"=1'-0"



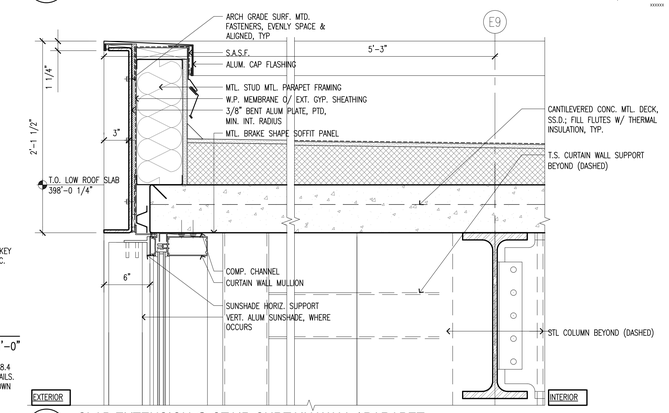
18 A8.4 MOCKUP SECTION & PLAN
1/2"=1'-0"



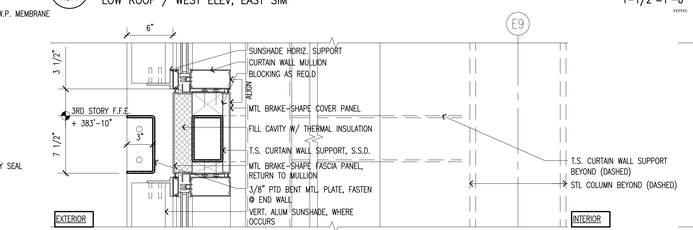
10 A8.4 SLAB EXTENSION @ MTL PANEL / PARAPET
3RD STORY / WEST ELEV, EAST SIM 1-1/2"=1'-0"



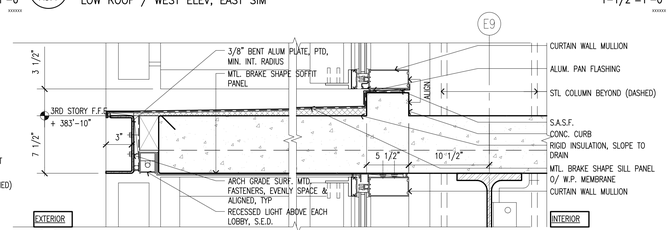
9 A8.4 SLAB EXTENSION @ METAL PANEL
3RD STORY / WEST ELEV, EAST SIM 1-1/2"=1'-0"



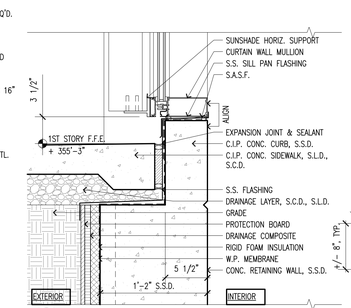
18 A8.4 SLAB EXTENSION @ STAIR CURTAIN WALL / PARAPET
LOW ROOF / WEST ELEV, EAST SIM 1-1/2"=1'-0"



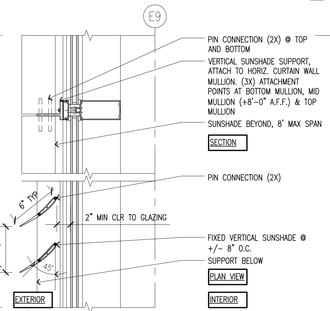
17 A8.4 CHANNEL @ STAIR CURTAIN WALL
TYP / WEST ELEV, EAST SIM 1-1/2"=1'-0"



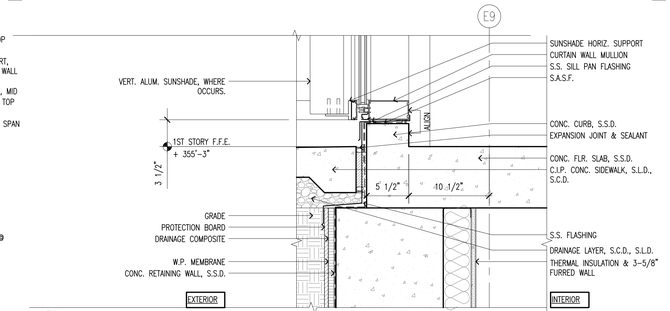
7 A8.4 SLAB EXTENSION @ CURTAIN WALL
TYP / WEST ELEV, EAST SIM 1-1/2"=1'-0"



16 A8.4 SILL @ STAIR CURTAIN WALL
1ST STORY WEST, 2ND/ EAST SIM 1-1/2"=1'-0"



11 A8.4 VERT. SUNSHADE SPLICE / CONNECTION
EAST & WEST ELEV 1-1/2"=1'-0"



6 A8.4 SILL @ LOBBY
1ST STORY WEST ELEV, 2ND STORY EAST SIM 1-1/2"=1'-0"

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PROJECT

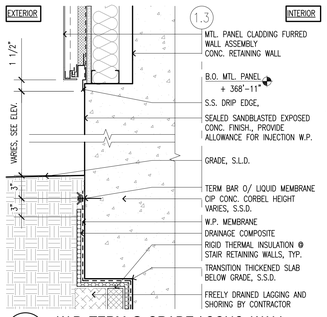
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Bid #2: Ext Skin D/B	06/20/14
	Bid #3: Structure / Site Utilities / W.P.	06/23/14
	100% CDs / Permit Submission	08/15/14

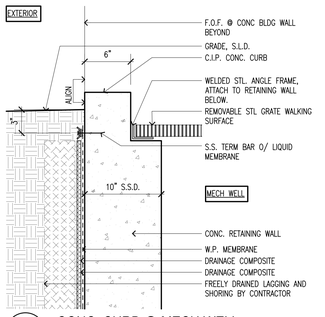
DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : As Indicated

SHEET TITLE
EXT DETAILS DESIGN BUILD

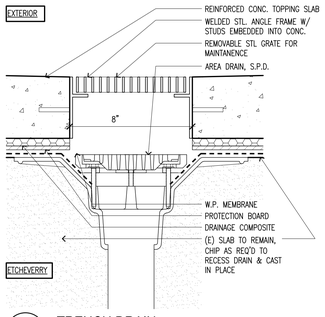
SHEET No
A8.4



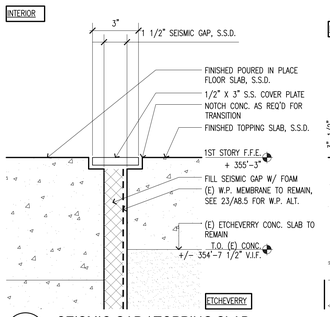
35 / A8.5 — **W.P. TERM @ GRADE / CONC. WALL**
1ST FLR — 1-1/2"=1'-0"



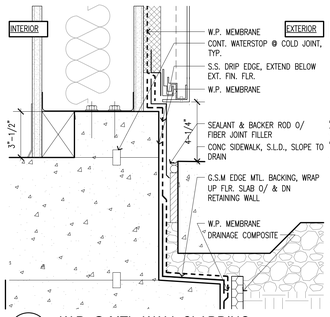
30 / A8.5 — **CONC. CURB @ MECH WELL**
1ST FLR — 1-1/2"=1'-0"



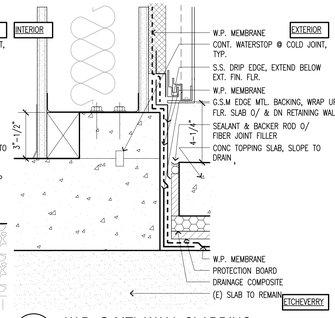
25 / A8.5 — **TRENCH DRAIN**
3RD FLR / TERRACE — 3"=1'-0"



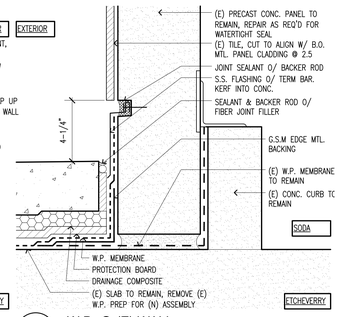
20 / A8.5 — **SEISMIC GAP / TOPPING SLAB**
3RD FLR / ETCHEVERRY — 3"=1'-0"



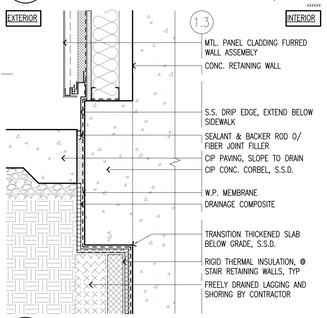
15 / A8.5 — **W.P. @ MTL. WALL CLADDING**
2ND / 3RD FLR ENTRIES — 3"=1'-0"



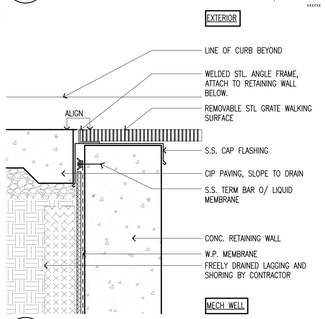
10 / A8.5 — **W.P. @ MTL WALL CLADDING**
TERRACE / 3RD FLR. — 3"=1'-0"



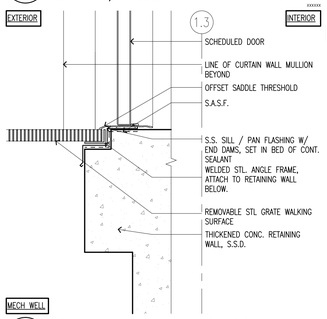
5 / A8.5 — **W.P. @ (E) WALL**
TERRACE / 3RD FLR. SODA HALL — 3"=1'-0"



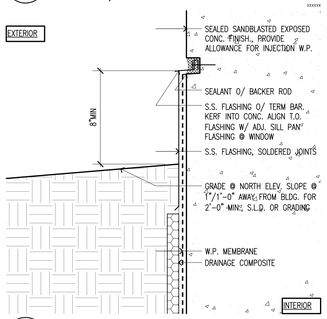
34 / A8.5 — **W.P. TERM @ PAVING / CONC. WALL**
1ST FLR — 1-1/2"=1'-0"



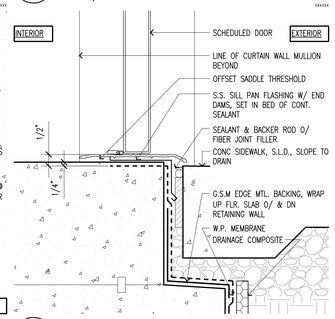
29 / A8.5 — **GRATING TRANSITION @ MECH WELL**
1ST FLR — 1-1/2"=1'-0"



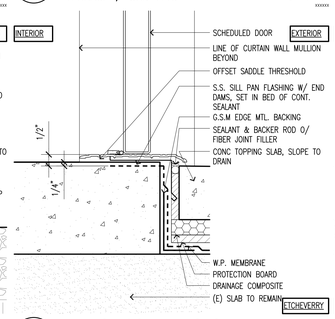
24 / A8.5 — **GRATING TRANSITION @ DOOR**
1ST FLR — 1-1/2"=1'-0"



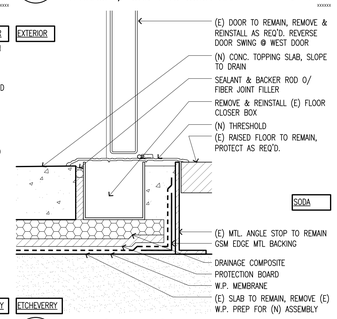
19 / A8.5 — **W.P. @ CONC WALL**
3RD FLR / NORTH ELEV — 3"=1'-0"



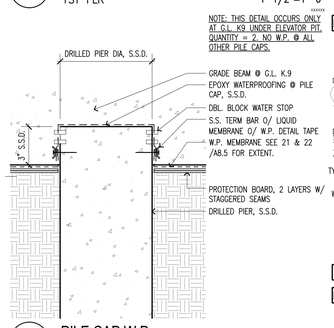
14 / A8.5 — **W.P. @ DOOR THRESHOLD**
2ND / 3RD FLR ENTRIES — 3"=1'-0"



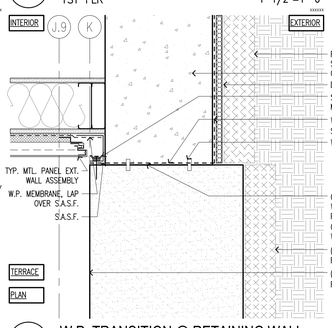
9 / A8.5 — **W.P. @ DOOR THRESHOLD**
TERRACE / 3RD FLR. — 3"=1'-0"



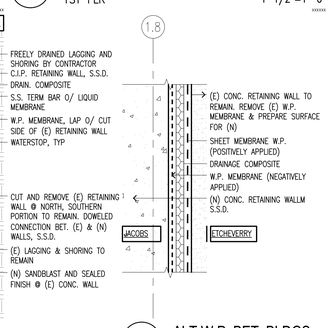
4 / A8.5 — **W.P. @ (E) DOOR**
TERRACE / 3RD FLR. SODA HALL — 3"=1'-0"



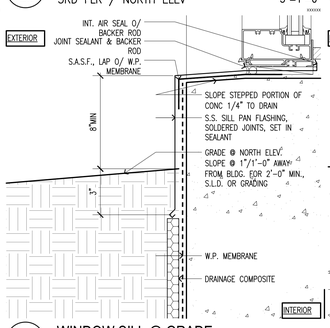
33 / A8.5 — **PILE CAP W.P**
ELEVATOR PIT — 1-1/2"=1'-0"



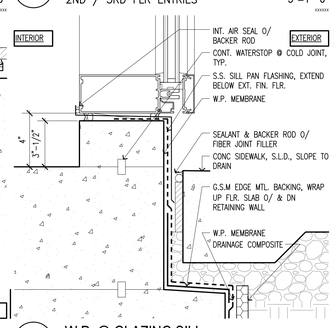
28 / A8.5 — **W.P. TRANSITION @ RETAINING WALL**
1ST FLR / TERRACE RETAINING — 1-1/2"=1'-0"



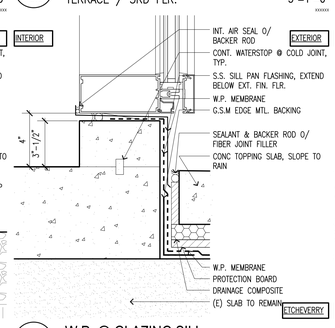
23 / A8.5 — **ALT W.P. BET. BLDGS.**
BASEMENT G.L.1.8 — 3"=1'-0"



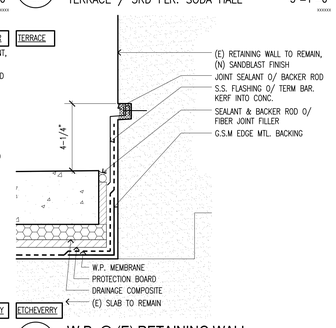
18 / A8.5 — **WINDOW SILL @ GRADE**
3RD FLR / NORTH ELEV — 3"=1'-0"



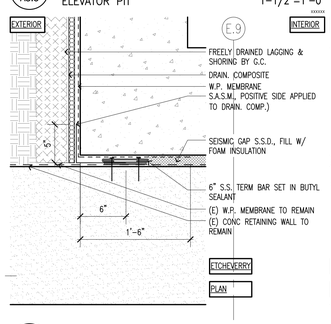
13 / A8.5 — **W.P. @ GLAZING SILL**
2ND / 3RD FLR ENTRIES — 3"=1'-0"



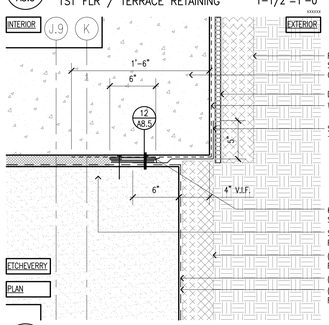
8 / A8.5 — **W.P. @ GLAZING SILL**
TERRACE / 3RD FLR — 3"=1'-0"



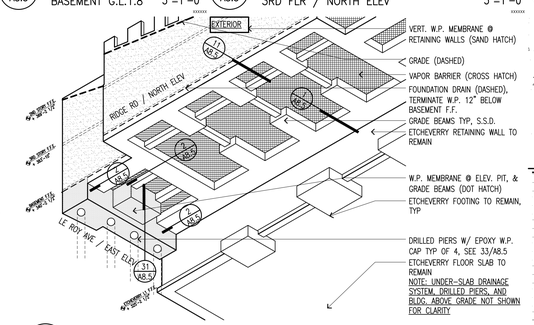
3 / A8.5 — **W.P. @ (E) RETAINING WALL**
TERRACE / 3RD FLR — 3"=1'-0"



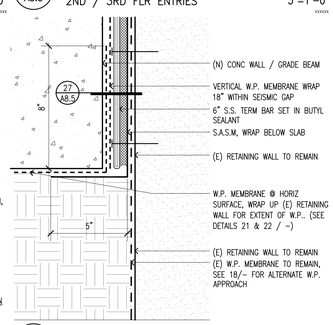
32 / A8.5 — **BELOW GRADE W.P. @ (E) WALL**
BASEMENT — 1-1/2"=1'-0"



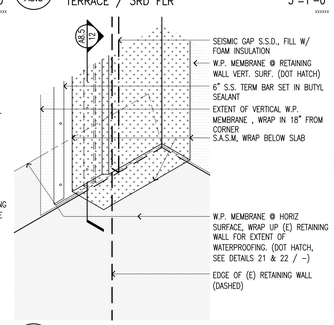
27 / A8.5 — **BELOW GRADE W.P. @ (E) WALL**
BASEMENT — 1-1/2"=1'-0"



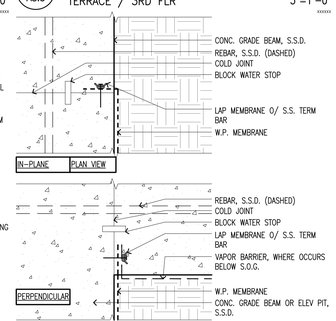
22 / A8.5 — **SUBGRADE AXONMETRIC (WORMSEYE VIEW)**
ELEV PIT / BLDG WEST END, LOOKING SE — 1/16" = 1'-0"



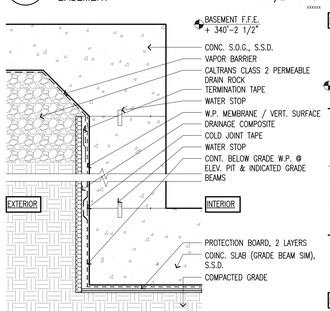
12 / A8.5 — **BELOW GRADE W.P. @ (E) WALL**
BASEMENT — 3"=1'-0"



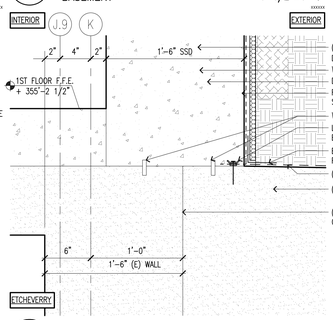
7 / A8.5 — **BELOW GRADE W.P. @ (E) WALL**
BASEMENT / WORMSEYE AXON — 1-1/2"=1'-0"



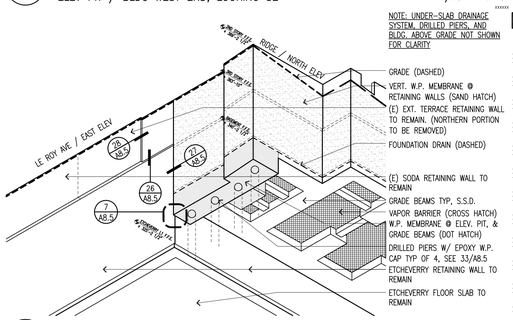
2 / A8.5 — **W.P, MEMBRANE TERMINATION**
ELEV PIT / GRADE BEAMS — 3"=1'-0"



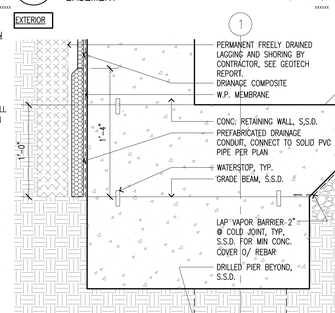
31 / A8.5 — **W.P. @ ELEV PIT, W.P. GRADE BEAM SIM**
BASEMENT — 1-1/2"=1'-0"



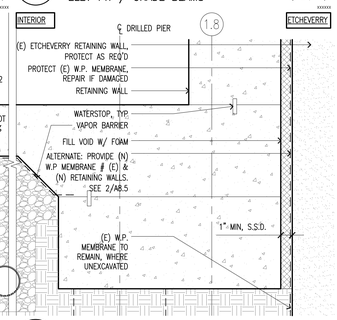
26 / A8.5 — **BELOW GRADE W.P. @ (E) WALL**
BASEMENT — 1-1/2"=1'-0"



21 / A8.5 — **SUBGRADE AXONMETRIC (WORMSEYE VIEW)**
ELEV PIT / BLDG WEST END, LOOKING SW — 1/16" = 1'-0"



11 / A8.5 — **TYP BELOW GRADE W.P. @ RETAINING WALL**
1-1/2" = 1'-0"



1 / A8.5 — **BELOW GRADE W.P. @ (E) BLDG.**
BASEMENT — 1-1/2"=1'-0"

ARCHITECTS
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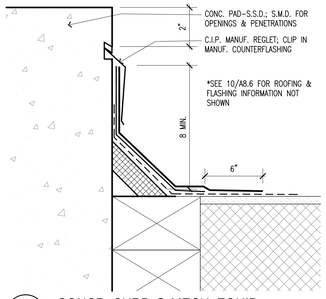
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Bid #3: Structure / Site Utilities / W.P.	06/23/14
	100% CDs / Permit Submission	08/15/14

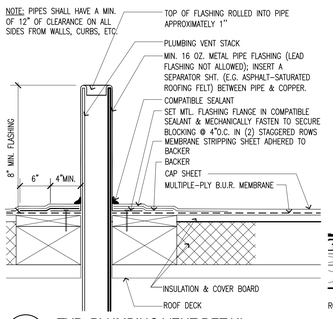
DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : As Indicated

SHEET TITLE
EXT DETAILS SUBGRADE WATER-PROOFING

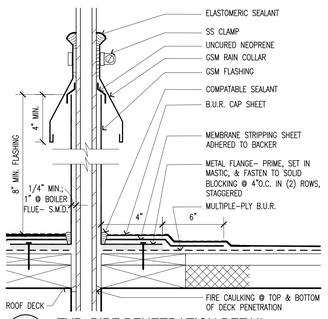
SHEET No
A8.5



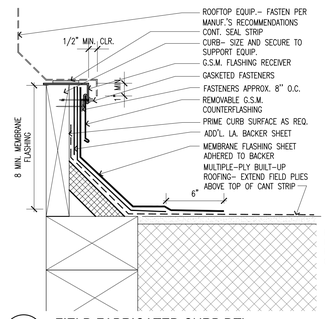
30 A8.6 CONCR. CURB @ MECH. EQUIP.
LOWER ROOF 3"=1'–0"



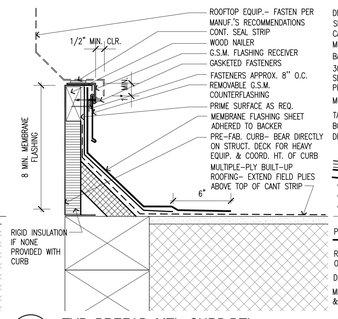
25 A8.6 TYP. PLUMBING VENT DETAIL
LOWER ROOF 3"=1'–0"



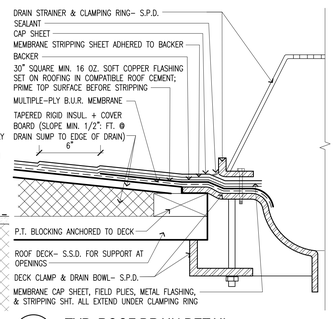
20 A8.6 TYP. PIPE PENETRATION DETAIL
LOWER ROOF 3"=1'–0"



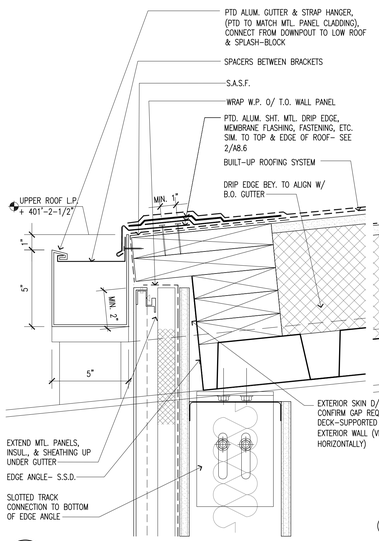
15 A8.6 FIELD FABRICATED CURB DTL.
LOWER ROOF 3"=1'–0"



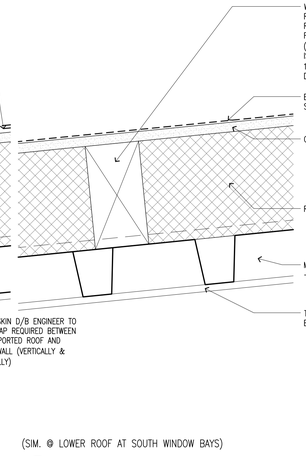
10 A8.6 TYP. PREFAB. MTL. CURB DTL.
LOWER ROOF 3"=1'–0"



5 A8.6 TYP. ROOF DRAIN DETAIL
LOWER ROOF 3"=1'–0"

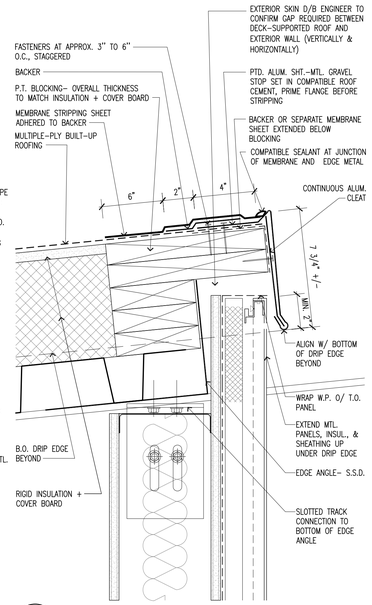


13 A8.6 GUTTER DETAIL
UPPER ROOF 3"=1'–0"

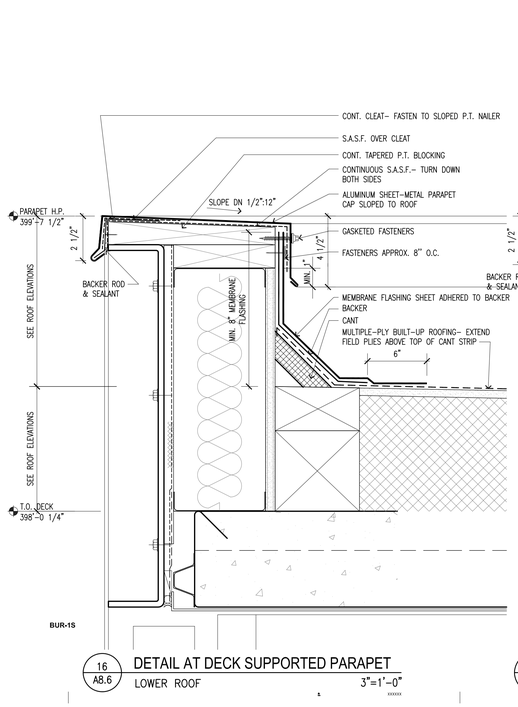


(SIM. @ LOWER ROOF AT SOUTH WINDOW BAYS)

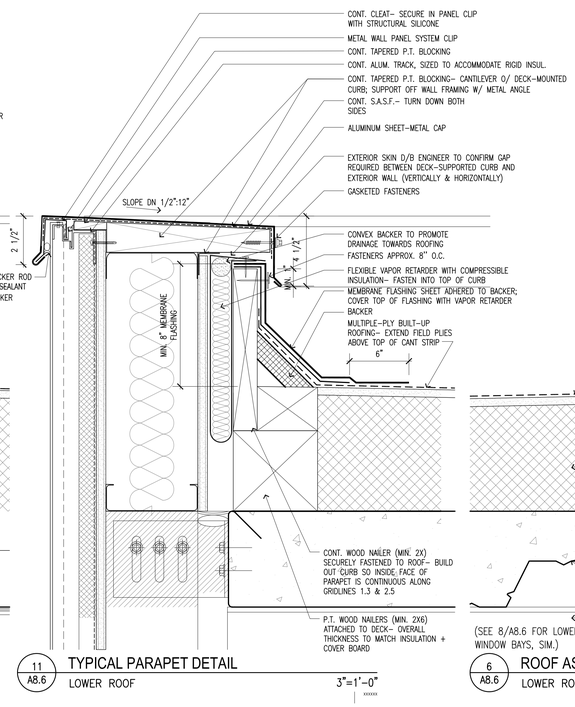
8 A8.6 ROOF ASSEMBLY
UPPER ROOF 3"=1'–0"



3 A8.6 DRIP EDGE/ GRAVEL STOP DETAIL
UPPER ROOF 3"=1'–0"



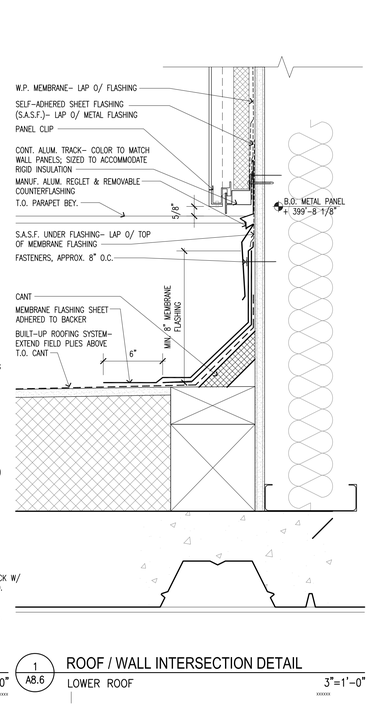
16 A8.6 DETAIL AT DECK SUPPORTED PARAPET
LOWER ROOF 3"=1'–0"



11 A8.6 TYPICAL PARAPET DETAIL
LOWER ROOF 3"=1'–0"

(SEE 8/A8.6 FOR LOWER ROOF AT SOUTH WINDOW BAYS, SIM.)

6 A8.6 ROOF ASSEMBLY
LOWER ROOF 3"=1'–0"



1 A8.6 ROOF / WALL INTERSECTION DETAIL
LOWER ROOF 3"=1'–0"

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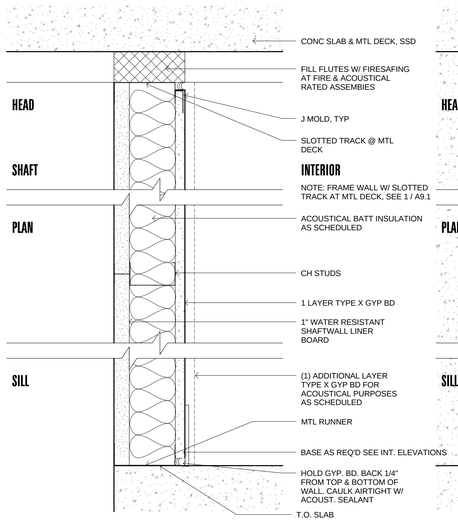
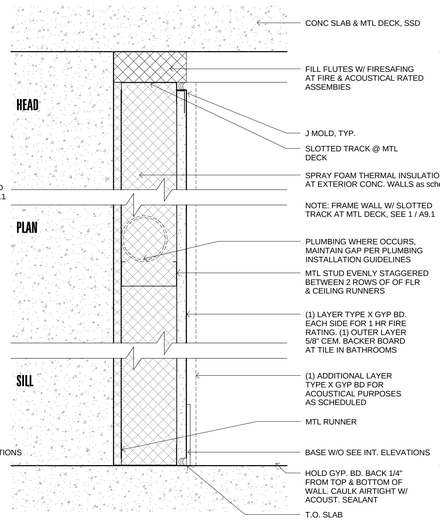
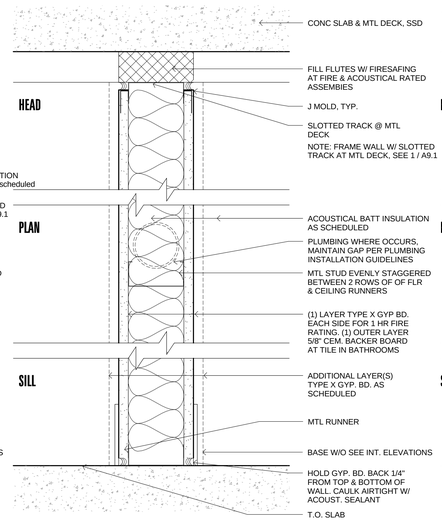
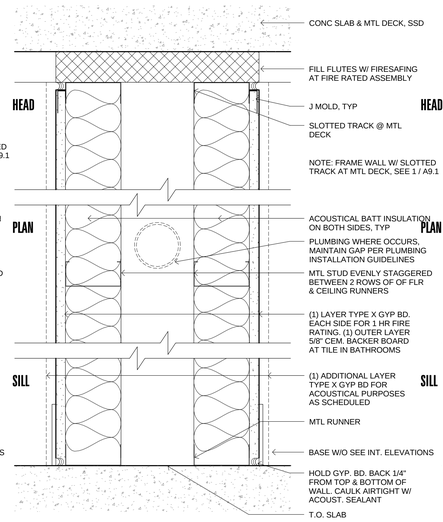
SHEET TITLE
ROOF DETAILS

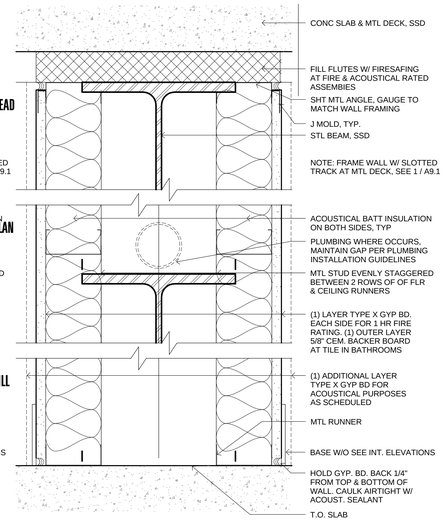
SHEET No
A8.6

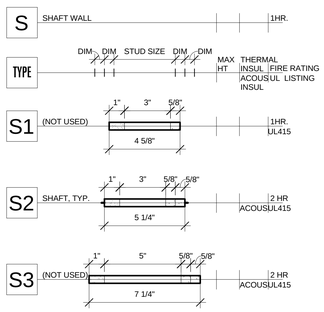


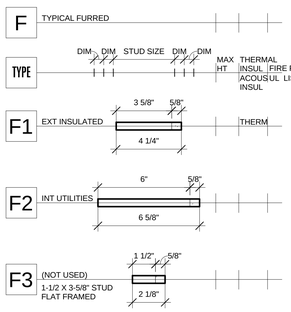


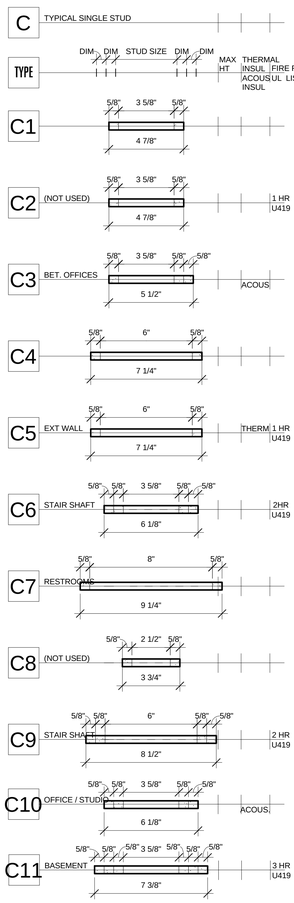


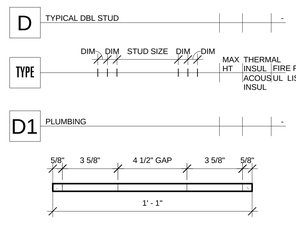


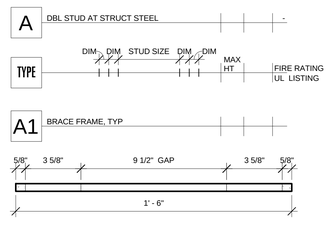


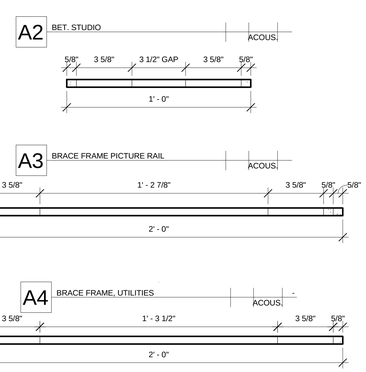


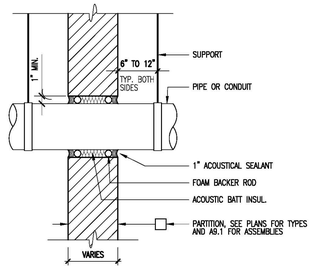




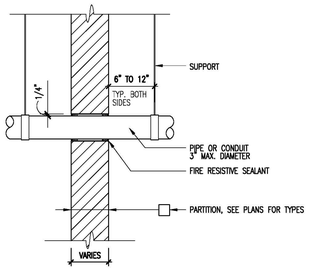




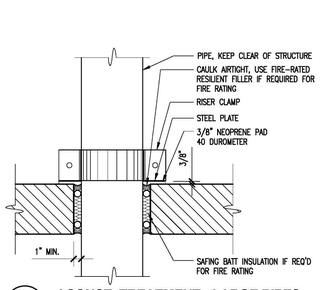




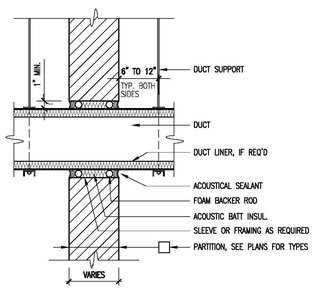
10 A9.1 **TYP. PIPE/CONDUIT PENETRATION**
THRU. SOUND RATED CONSTR. (GREATER THAN 3" DIA.) 1-1/2"=1'-0"



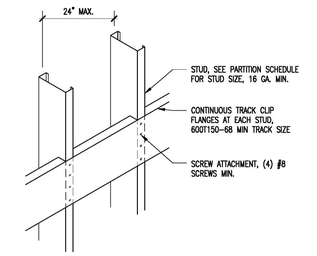
8 A9.1 **TYP. PIPE/CONDUIT PENETRATION**
THRU. SOUND RATED CONSTR. (3" OR LESS) 1-1/2"=1'-0"



6 A9.1 **ACOUST. TREATMENT - LARGE PIPES**
PLUMB. PIPES (>1" DIA.) PENETRATING FLOOR 1-1/2"=1'-0"

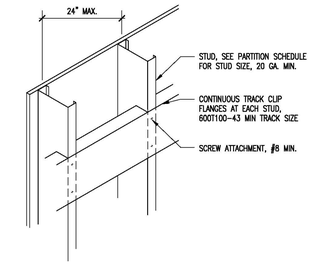


9 A9.1 **TYP. DUCT PENETRATION**
THRU. SOUND RATED CONSTR. 1-1/2"=1'-0"



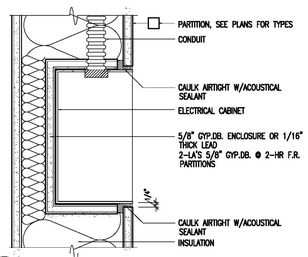
NOTE: CLIP TRACK BACKING FOR HEAVILY LOADED APPLICATIONS SUCH AS GRAB BARS, HANDRALS, AND WALL HUNG CABINETS, ETC.
INFORMATION CONTAINED IN THIS DETAIL IS A RECOMMENDATION ONLY, STRUCTURAL REQUIREMENTS FOR THIS ASSEMBLY IS TO BE BY THE DESIGN BUILD CONTRACTOR

7 A9.1 **BACKING - HEAVILY LOADED**
AT WALL N.T.S.

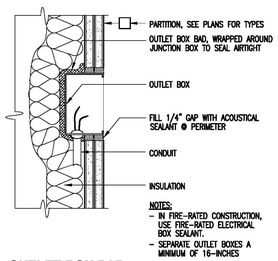


NOTE: FLAT STRAP BACKING FOR LIGHTLY LOADED APPLICATIONS SUCH AS PAPER TOWEL DISPENSERS, TOWEL BARS, AND TOILET PAPER HOLDERS, ETC.
INFORMATION CONTAINED IN THIS DETAIL IS A RECOMMENDATION ONLY, STRUCTURAL REQUIREMENTS FOR THIS ASSEMBLY IS TO BE BY THE DESIGN BUILD CONTRACTOR

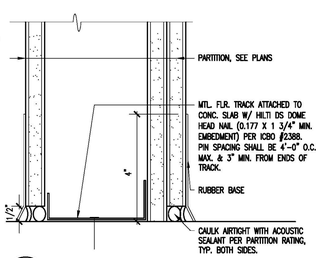
5 A9.1 **BACKING - LIGHTLY LOADED**
AT WALL N.T.S.



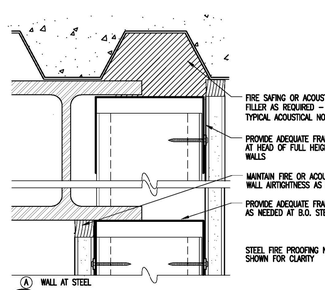
4 A9.1 **LARGE OUTLET BOX / PANEL PAD**
4-GANG/32 SQ. INCH OR LARGER 3" = 1' - 0"
PAR005



3 A9.1 **OUTLET BOX PAD**
TYPICAL 3" = 1' - 0"
PAR009



1 A9.1 **PARTITION ATTACHMENT @ BASE**
TYPICAL 6" = 1' - 0"
PAR007



2 A9.1 **PARTITION @ CLG.**
TYPICAL WALL 6"=1'-0"

GENERAL NOTES

1. USE MOISTURE RESISTANT GYPSUM BOARD IN BATHROOMS, JANITOR CLOSETS, AND KITCHEN.

2. PROVIDE HIGH-IMPACT GYPSUM BOARD AT GYM, I-LABS AND MULTIPURPOSE ROOMS.

3. ALL INTERIOR STUD WALLS TO BE FRAMED PER SSMA STANDARDS. REFER TO ACOUSTICAL REQUIREMENTS NOTED W.O.

4. PROVIDE 16 GA. SHEET METAL BACKING AT CABINETS, HANDRALS, GRAB BARS, DRYING RACKS, + OTHER WALL MOUNTED ACCESSORIES. PROVIDE HEAVY GA. STUDS AT TALLER SPANS. REFER TO DETAILS ON THIS SHEET

5. ALL WALLS FILLED WITH ACOUSTICAL BATT INSULATION.

6. SEE SHEET G2.0 FOR RATED WALL LOCATIONS. PROVIDE TYPE "X" GYPSUM WALL BOARD AT ALL FIRE RATED ASSEMBLIES. ALL FIRE RESISTIVE ASSEMBLIES SHALL BE CONSTRUCTED IN COMPLIANCE WITH THE BUILDING CODE, TESTING REQUIREMENTS AND MANUFACTURER'S RECOMMENDATIONS FOR CONDITIONS AS REQUIRED. CONSTRUCTION OF ALL SYSTEMS WILL BE EQUAL TO THAT OF TESTED ASSEMBLY. PROPERLY TERMINATE FIRE RATED ASSEMBLIES AT HEAD CONDITIONS AND PROVIDE FIRE SAFEING AND CAULKING AS REQUIRED AT ALL ASSEMBLY TERMINATIONS AND PENETRATIONS. REFER TO DETAILS ON THIS SHEET AND 12/A9.4.

7. ALL METAL STUD PARTITIONS ARE TO EXTEND TO UNDERSIDE OF STRUCTURE, UNLESS OTHERWISE NOTED.

8. TAPE, BED AND FINISH ALL JOINTS READY FOR FINISH.

9. PROVIDE CONTINUOUS CAULKING AT ALL DUCT PIPE AND CONDUIT PENETRATIONS THROUGH ASSEMBLIES REQUIRING RATINGS FOR FIRE OR ACOUSTICAL SEPARATION AS SHOWN ON DRAWINGS. SEE PLUMBING DRAWINGS FOR ADDITIONAL REQUIREMENTS.

10. FOR PARTITIONS W/ 2 LA. GYP. BD. ON ONE SIDE OF STUD + 1 LAYER ON THE OTHER SIDE, INSTALL 2 LAYERS ON SIDE OF PARTITION TAG.

11. SEE STRUCTURAL DRAWINGS FOR HEAVY GA. STUD REQUIREMENTS AT DOUBLE HEIGHT WALLS.

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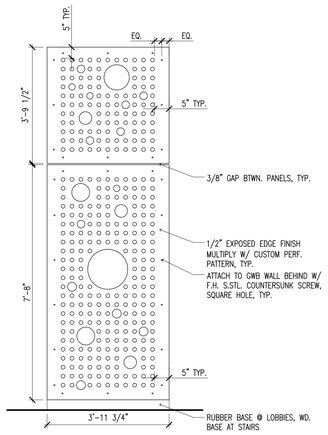
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
2	BID # 2 - Addendum 1	07/22/14
	100% CDs / Permit Submission	08/15/14

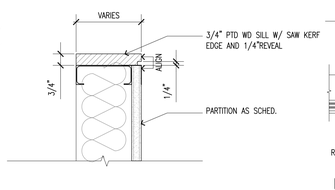
DATE: 15 August 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: Permit
PERMIT No:
SCALE: 3" = 1'-0"

SHEET TITLE
PARTITION SCHEDULE & DETAILS

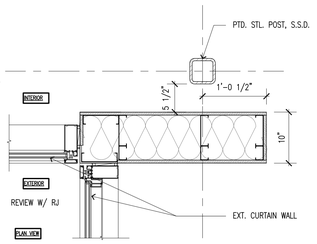
SHEET No
A9.1



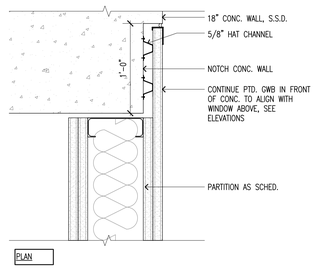
29 A9.2 TYP. PERF. PLYWD. WALL PANEL LAYOUT — LOBBY/STAIR — 1/2"=1'-0"



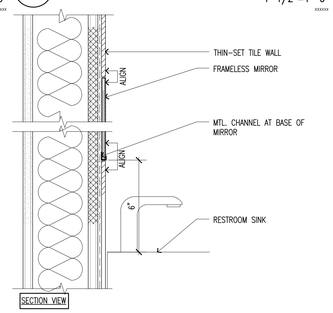
24 A9.2 TYP. INT. SILL — 3"=1'-0"



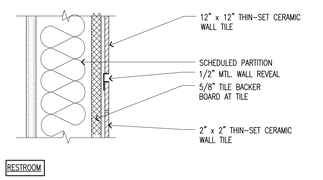
19 A9.2 WING WALL @ BAY WINDOW — 3RD FL. CRITIQUE SPACE — 1"=1'-0"



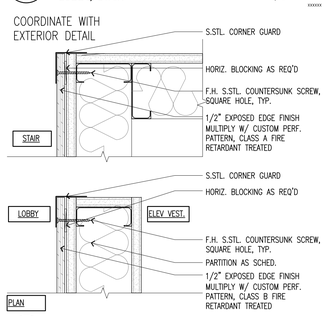
14 A9.2 WALL TRANSITION @ STAIR — STAIR 1 — 3"=1'-0"



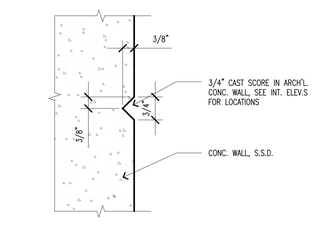
9 A9.2 RESTROOM MIRROR — RESTROOMS — 3"=1'-0"



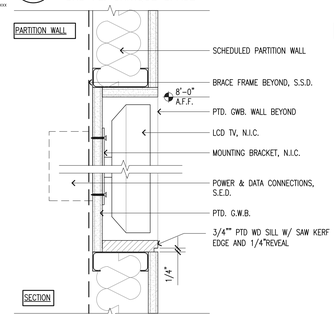
4 A9.2 METAL REVEAL WALL TRANSITIONS — 3"=1'-0"



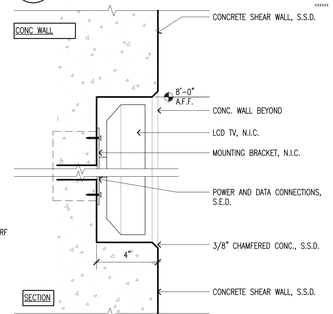
28 A9.2 PLYWOOD WALL PANEL ENDS — LOBBY & STAIR — 3"=1'-0"



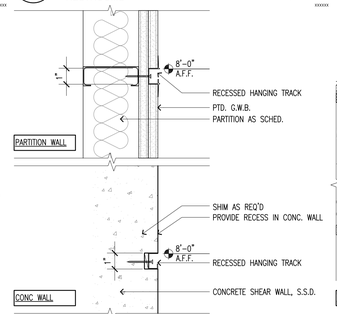
23 A9.2 TYP. CAST SCORE @ CONC. WALL — 6"=1'-0"



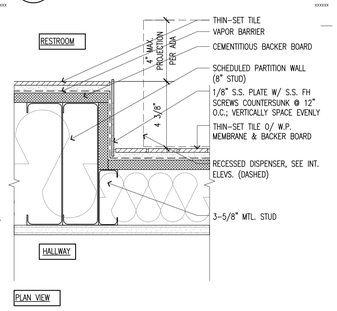
18 A9.2 RECESS IN WALL FOR LCD TVs — SECOND FLOOR LOBBY — 3"=1'-0"



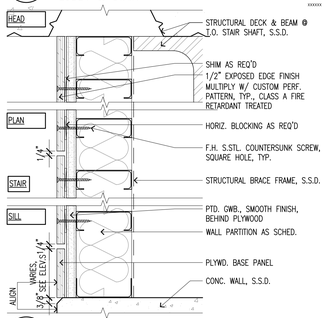
13 A9.2 RECESS IN WALL FOR LCD TVs — FIRST FLOOR LOBBY — 3"=1'-0"



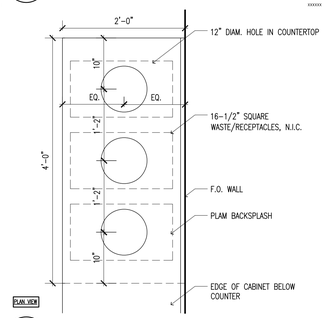
8 A9.2 RECESSED ART TRACK — LOBBY WALLS — 3"=1'-0"



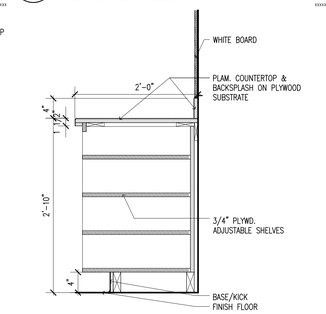
3 A9.2 WALL RECESS FOR DISPENSER — TYP RESTROOM — 3"=1'-0"



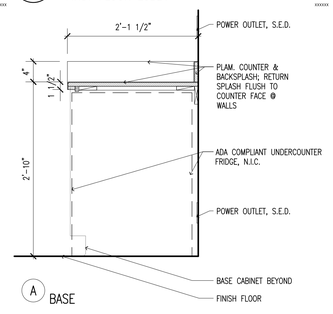
27 A9.2 PLYWOOD WALL PANELS — STAIR — 3"=1'-0"



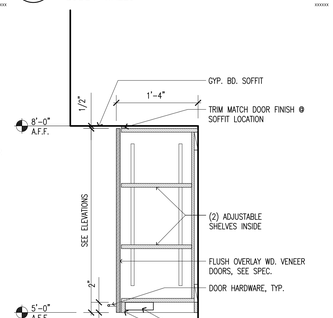
22 A9.2 TRASH/RECYCLE BIN CABINET — LOUNGE — 1"=1'-0"



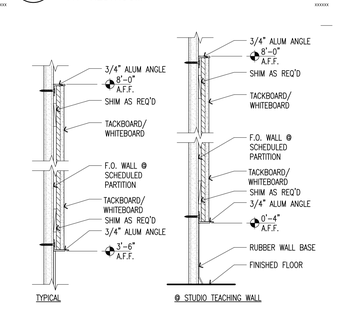
17 A9.2 S.S. COUNTER & OPEN SHELF — LOUNGE — 1"=1'-0"



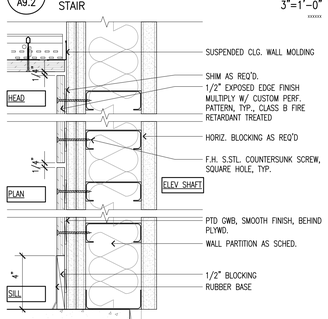
12 A9.2 CASEWORK DTL. @ FRIDGE — LOUNGE — 1"=1'-0"



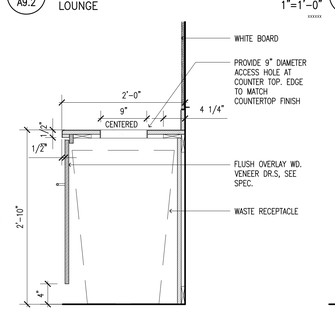
6 A9.2 CASEWORK DETAIL — LOBBY WALLS — 3"=1'-0"



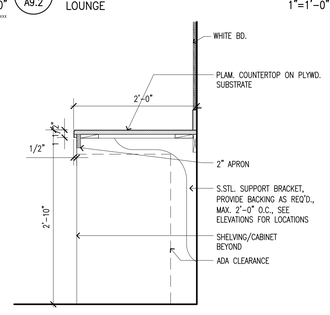
2 A9.2 TACKBOARD/WHITEBOARD WALL DETAIL — 3"=1'-0"



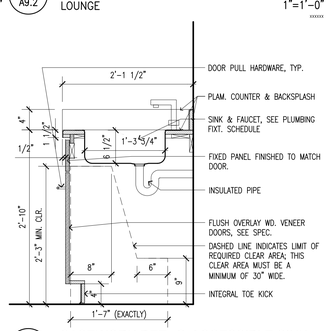
26 A9.2 PLYWOOD WALL PANELS — LOBBY — 3"=1'-0"



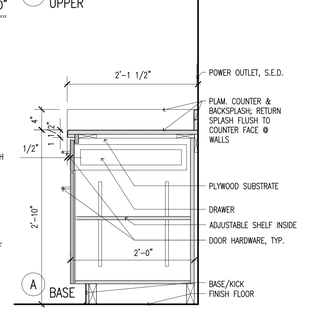
21 A9.2 TRASH/RECYCLE BIN CABINET — LOUNGE — 1"=1'-0"



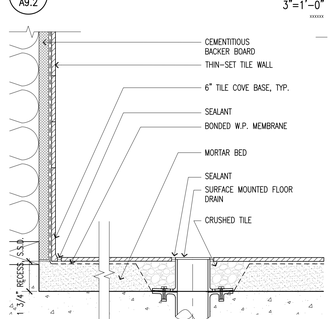
16 A9.2 WALL MOUNTED S.S. COUNTERTOP — LOUNGE — 1"=1'-0"



11 A9.2 CASEWORK DET. @ ACCESSIBLE SINK — LOUNGE — 1"=1'-0"



6 A9.2 CASEWORK DETAIL — LOUNGE — 1"=1'-0"



1 A9.2 TYP. TILE BASE & FLOOR DRAIN — RESTROOMS — 3" = 1'-0"

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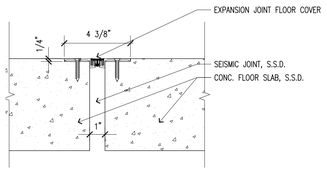
No	REVISION	DATE
	100% CDs / Permit Submission	08/15/14

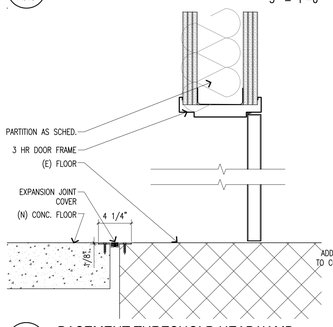
DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : As Indicated

SHEET TITLE
INTERIOR DETAILS

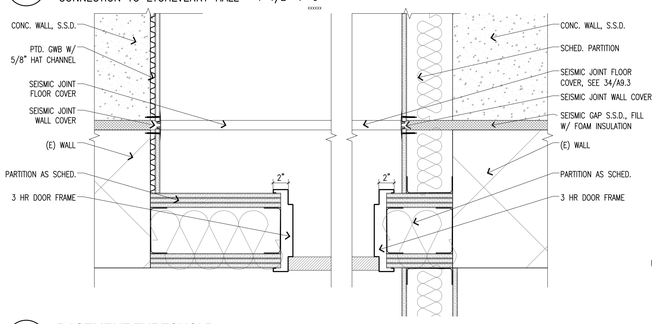
SHEET No
A9.2



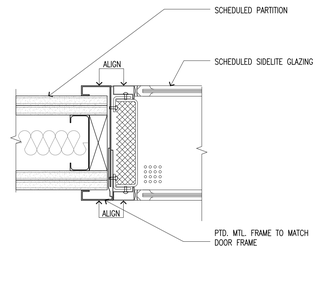
35 A9.3 EXPANSION JOINT COVER 3" = 1'-0"



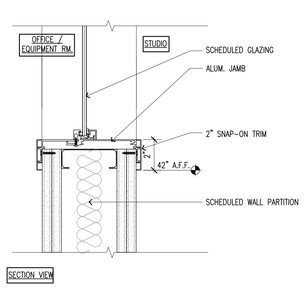
34 A9.3 BASEMENT THRESHOLD HEAD/JAMB CONNECTION TO ETCHEVERRY HALL 1-1/2"=1'-0"



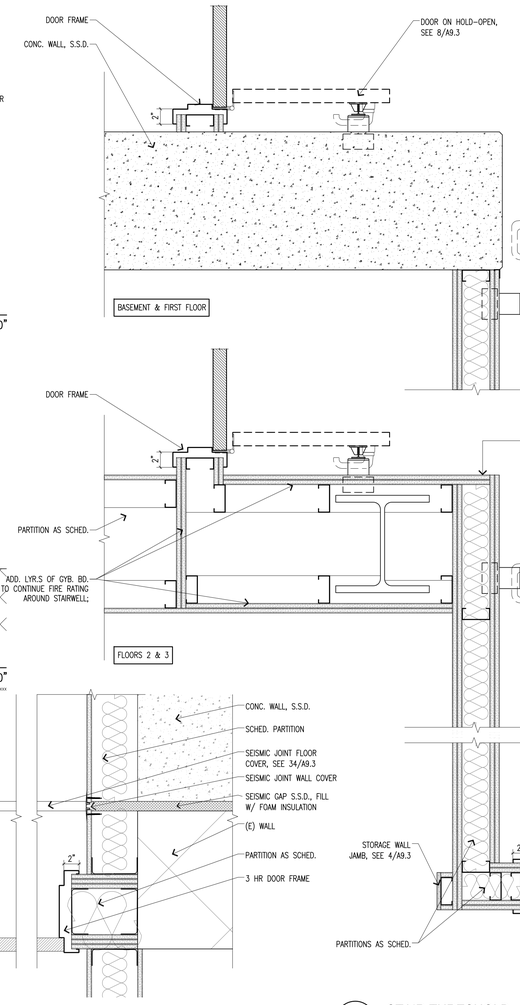
33 A9.3 BASEMENT THRESHOLD CONNECTION TO ETCHEVERRY HALL 1-1/2"=1'-0"



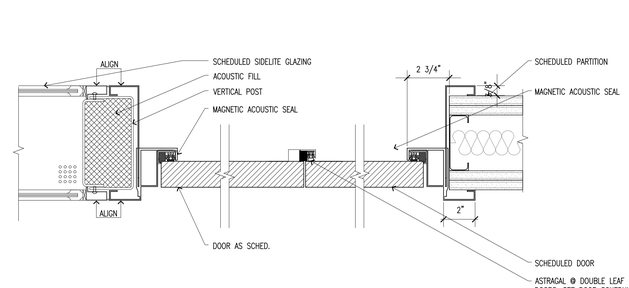
32 A9.3 JAMB/HEAD @ STC 47 RATED SIDELITE 3"=1'-0"



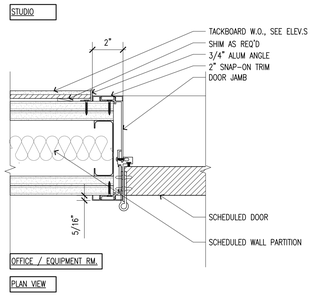
31 A9.3 GLAZING SILL @ PARTIAL HT. WALL TYP STUDIO 3"=1'-0"



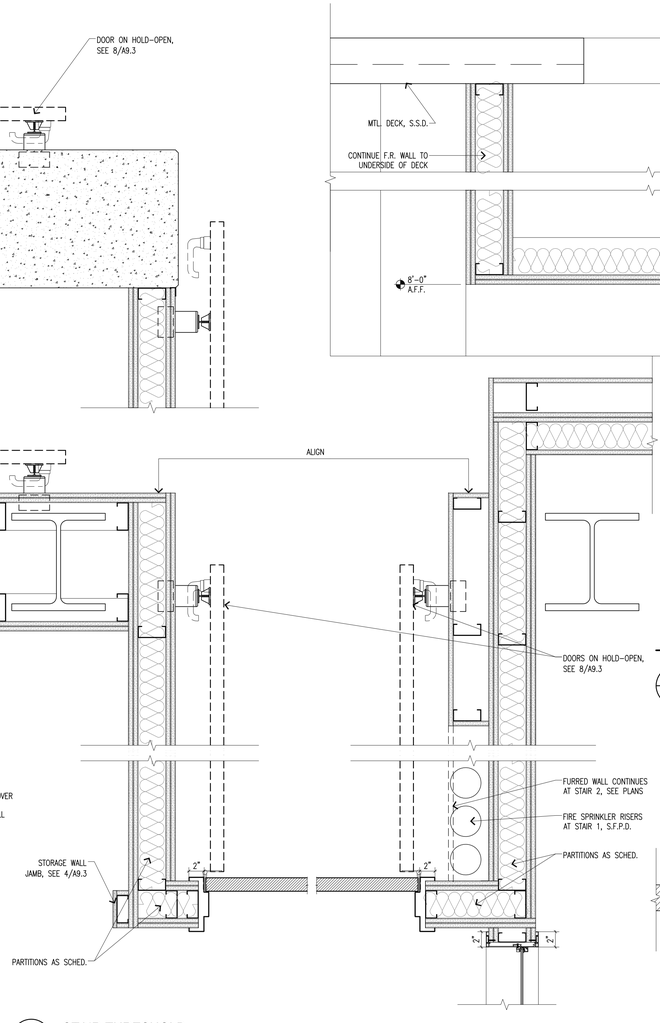
27 A9.3 JAMB @ STC 47 RATED DOOR/SIDELITE 3"=1'-0"



26 A9.3 DOOR JAMB TYP STUDIO 3"=1'-0"

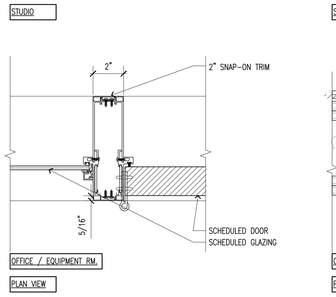


22 A9.3 JAMB @ STC 47 RATED DOOR 3"=1'-0"



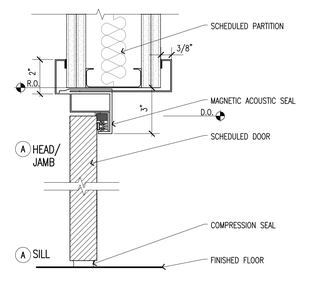
23 A9.3 STAIR THRESHOLD STUDIO TO STAIRS 1 & 2 1-1/2"=1'-0"

17 A9.3 HEAD/SILL @ STC 47 RATED DOORS 3"=1'-0"

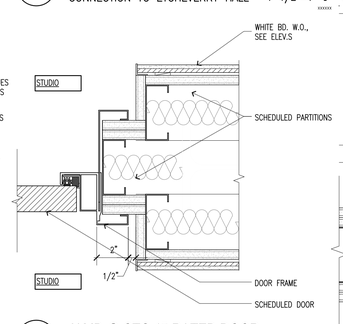


21 A9.3 DOOR JAMB @ INT. GLAZING TYP STUDIO 3"=1'-0"

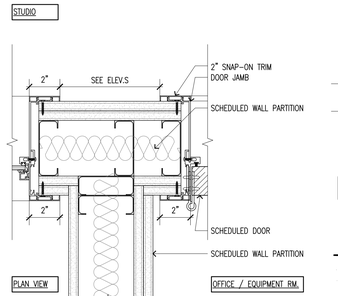
14 A9.3 STAIR THRESHOLD HEAD/SILL CONNECTION TO ETCHEVERRY HALL 1-1/2"=1'-0"



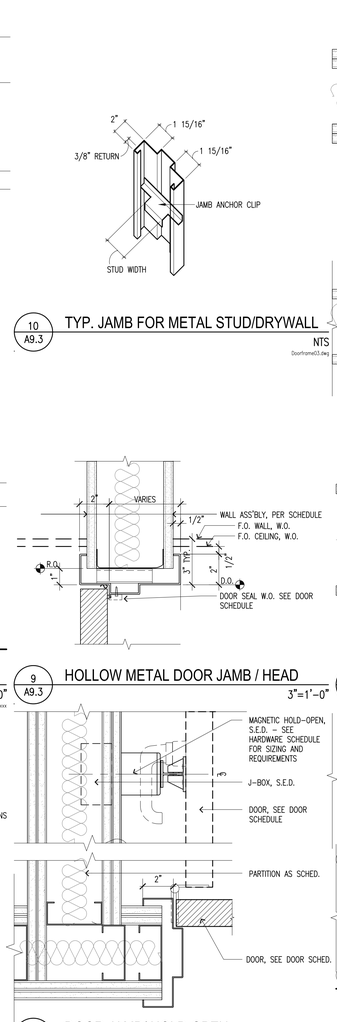
12 A9.3 DOOR HEADER @ TRANSOM TYP STUDIO 3"=1'-0"



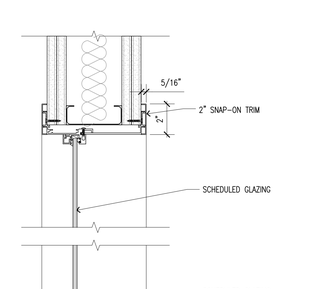
13 A9.3 JAMB @ STC 47 RATED DOOR CENTER STUDIO WALL 3"=1'-0"



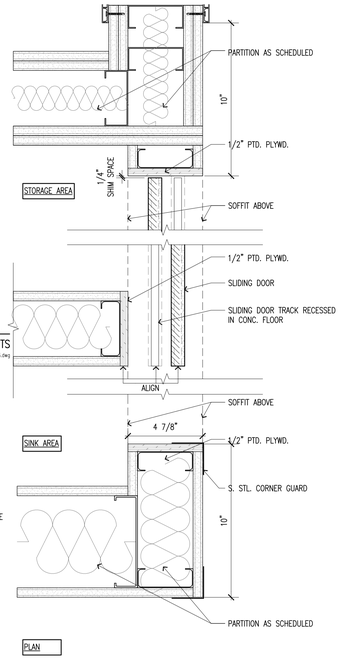
11 A9.3 DOOR/GLAZ. JAMB @ WALL INTERSECT. TYP STUDIO 3"=1'-0"



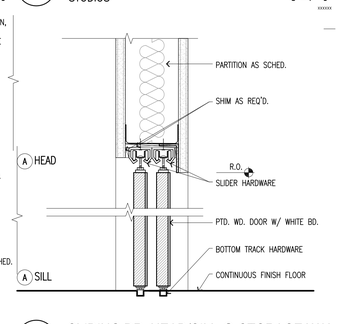
10 A9.3 TYP. JAMB FOR METAL STUD/DRYWALL NTS



8 A9.3 DOOR JAMB/ HOLD-OPEN 3"=1'-0"

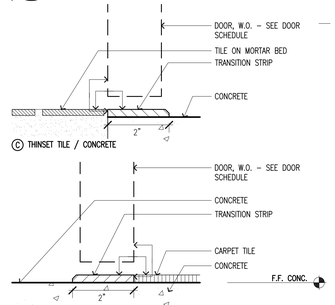


4 A9.2 JAMB DETAILS @ STORAGE WALL STUDIOS 3"=1'-0"

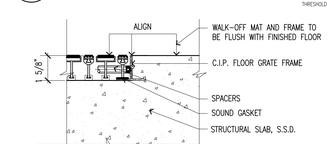


9 A9.3 HOLLOW METAL DOOR JAMB / HEAD 3"=1'-0"

3 A9.3 SLIDING DR. HEAD/SILL @ STORAGE WAL 3"=1'-0"



2 A9.3 DR THRSHD AND FLR TRANSITION DTLS 6" = 1'-0" THRESHOLD



1 A9.3 FLOOR TRANSITION @ WALK-OFF MAT LOBBIES 3"=1'-0"

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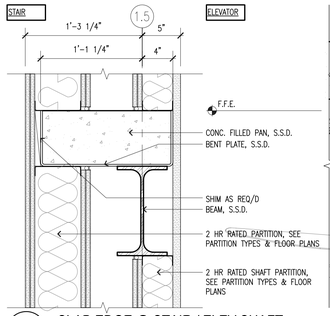
No	REVISION	DATE
	100% CDs / Permit Submission	08/15/14

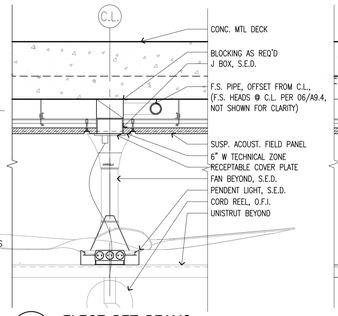
DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : As Indicated

SHEET TITLE
INTERIOR DETAILS

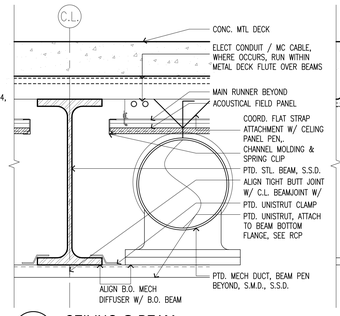
SHEET No
A9.3



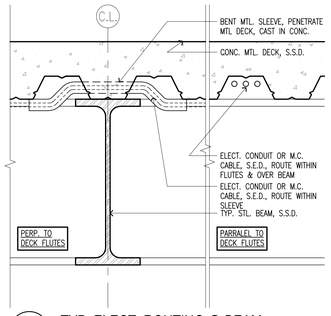
29 A9.4 SLAB EDGE @ STAIR / ELEV SHAFT
TYP. STUDIO 1-1/2"=1'-0"



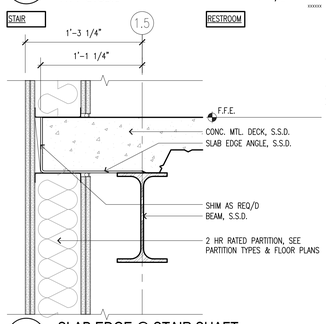
24 A9.4 ELECT. BET. BEAMS
TYP. STUDIO 1-1/2"=1'-0"



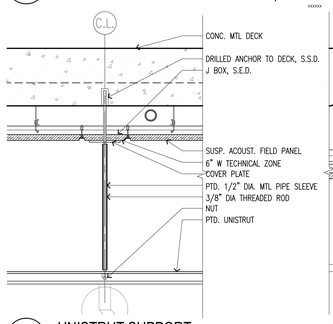
19 A9.4 CEILING @ BEAM
TYP. STUDIO 1-1/2"=1'-0"



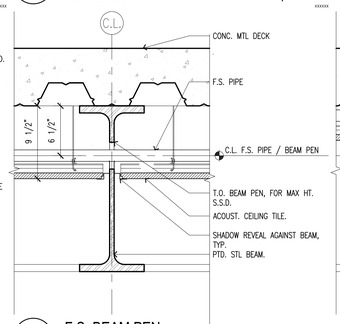
14 A9.4 TYP. ELECT. ROUTING @ BEAM
TYP. CEILING 1-1/2"=1'-0"



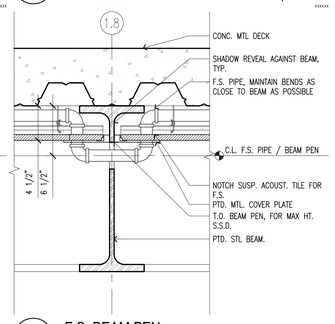
28 A9.4 SLAB EDGE @ STAIR SHAFT
TYP. STUDIO 1-1/2"=1'-0"



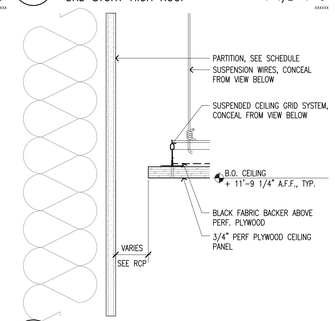
23 A9.4 UNISTRUT SUPPORT
23 1-1/2"=1'-0"



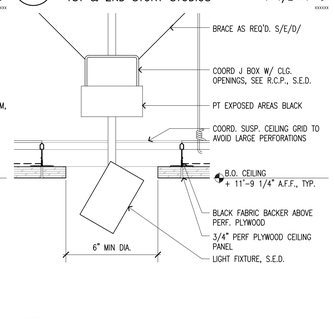
18 A9.4 F.S. BEAM PEN
3RD STORY HIGH ROOF 1-1/2"=1'-0"



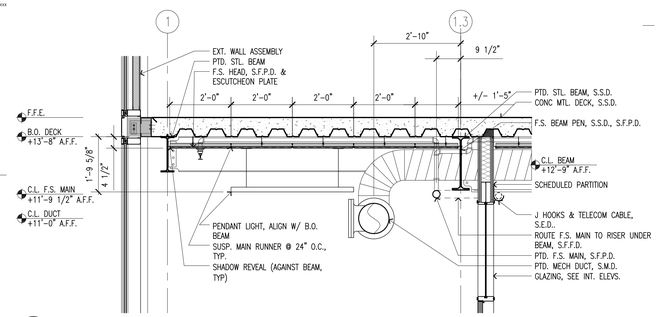
13 A9.4 F.S. BEAM PEN
1ST & 2ND STORY STUDIOS 1-1/2"=1'-0"



17 A9.4 EDGE @ PLYWOOD CEILING
LOBBIES & HALLS 3" = 1'-0"



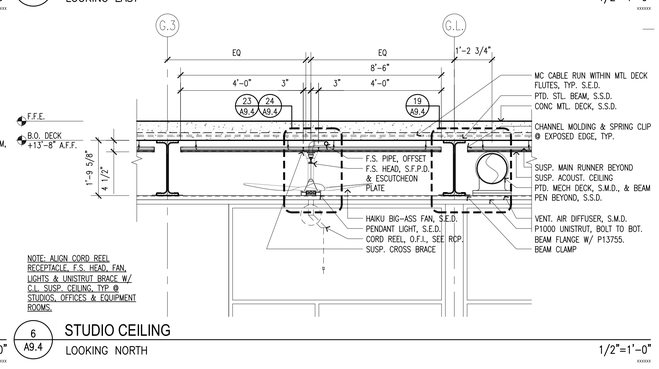
12 A9.4 LIGHT FIXTURE @ PLYWOOD CEILING
LOBBIES & HALLS 3" = 1'-0"



7 A9.4 OFFICE / EQUIPMENT ROOM CEILING
LOOKING EAST 1/2"=1'-0"

16 A9.4 EDGE @ PLYWOOD CEILING
LOBBIES 3" = 1'-0"

11 A9.4 PLYWOOD SUSPENDED CEILING
TYP. CEILING 1-1/2"=1'-0"



6 A9.4 STUDIO CEILING
LOOKING NORTH 1/2"=1'-0"

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CONSULTANTS

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY
1810 LEROY AVENUE, BERKELEY, CA 94709

No	REVISION	DATE
	100% CDs / Permit Submission	08/15/14

DATE : 15 August, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : PERMIT
PERMIT No :
SCALE : As Indicated

SHEET TITLE
INT DETAILS

SHEET No
A9.4

GENERAL

1. REFER TO SPECIFICATIONS FOR COMPLETE REQUIREMENTS. MORE STRINGENT REQUIREMENT CONTROLS WHERE INFORMATION SHOWN ON DRAWINGS AND IN SPECIFICATIONS ARE IN CONFLICT.

2. CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CALIFORNIA BUILDING CODE, 2010 EDITION.

3. DETAILS OF THE CONSTRUCTION NOT FULLY SHOWN OR NOTED ON THE DRAWINGS NOR CALLED FOR IN THE SPECIFICATIONS SHALL BE OF THE SAME SIZE AND CHARACTER AS FOR SIMILAR CONDITIONS WHICH ARE SHOWN AND NOTED.

4. THE WORD "TYPICAL" SHALL MEAN THAT THE INDICATED INFORMATION SHALL BE APPLIED TO ALL SIMILAR CONDITIONS WHETHER OR NOT THE INFORMATION IS SPECIFICALLY REFERENCED, UNLESS NOTED OTHERWISE ON THE DRAWINGS

5. THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS AT JOB SITE. THE CONTRACTOR SHALL COMPARE STRUCTURAL DRAWINGS WITH ARCHITECTURAL, CIVIL, LANDSCAPE, MECHANICAL, PLUMBING, AND ELECTRICAL DRAWINGS BEFORE COMMENCING WITH THE WORK AND SHALL NOTIFY THE ARCHITECT OF ANY DISCREPANCIES REQUIRING CLARIFICATION OR REVISION. DO NOT SCALE DRAWINGS.

6. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE SAFETY AND PRESERVATION OF THE BUILDING AND CONTENTS DURING CONSTRUCTION, AND SHALL BE SOLELY RESPONSIBLE FOR PROVIDING A SAFE PLACE TO WORK. THE CONTRACTOR SHALL EXECUTE WORK TO ENSURE SAFETY OF PERSONS AND PROPERTY AGAINST DAMAGE BY FALLING DEBRIS AND OTHER HAZARDS IN CONNECTION WITH THIS WORK, AND SHALL PROVIDE ADEQUATE SHORING AND BRACING DURING ALL DEMOLITION AND CONSTRUCTION.

7. ALL WORK THAT IS NOT SPECIFICALLY NOTED AS EXISTING OR (E) SHALL BE CONSIDERED NEW AND SHALL BE INCLUDED IN THE CONTRACT.

DESIGN BASIS

THE DESIGN IS IN ACCORDANCE WITH THE CALIFORNIA BUILDING CODE, 2010 EDITION AND PROVIDES FOR THE FOLLOWING LOADS:

LIVE LOADS

ROOFS	20 PSF
FLOORS	
CORRIDORS, STAIRS	100 PSF
MECHANICAL	100 PSF
CLASSROOM	50 PSF

WIND LOADS

BASIC WIND SPEED = 85mph
EXPOSURE CATEGORY = B
Iw = 1.0

SEISMIC LOADS

Cs (NORTH-SOUTH) =	0.225g
Cs (EAST-WEST) =	0.288g
SEISMIC DESIGN CATEGORY =	E
OCCUPANCY CATEGORY =	II
I =	1.0
Ip =	1.0 (USE Ip = 1.5 FOR COMPONENTS REQUIRED FOR LIFE SAFETY OR CONTAINING HAZARDOUS MATERIALS)

Ss = 2.46g
S1 = 0.795g
SITE CLASS = B
Sds = 1.64g
Sd1 = 0.53g
*NOTE: SEISMIC DESIGN VALUES ARE BASED ON UCB SITE SPECIFIC RESPONSE SPECTRUM FOR A ROCK SITE.

SEISMIC LOAD RESISTING SYSTEMS

NORTH -SOUTH DIRECTION:			
STEEL BUCKLING RESTRAINED BRACE FRAME (BRBF)	R = 7	Ωo = 2	Cd = 5.5
SPECIAL REINFORCED CONCRETE SHEAR WALLS	R = 5	Ωo = 2.5	Cd = 5
EAST-WEST DIRECTION:			
STEEL BUCKLING RESTRAINED BRACE FRAME (BRBF)	R = 7	Ωo = 2	Cd = 5.5
SPECIAL REINFORCED CONCRETE SHEAR WALLS	R = 5	Ωo = 2.5	Cd = 5

THE SEISMIC LOAD RESISTING SYSTEMS CONSISTS OF BRBFS OVER SPECIAL REINFORCED CONCRETE SHEAR WALLS AS JUSTIFIED BY A TWO STAGE ANALYSIS PER CBC. IN ADDITION TO THIS COLUMNS, COLLECTORS, METAL DECK ROOFS AND FLOORS PARTICIPATE IN THE SEISMIC LOAD RESISTING SYSTEM. ALL DRAWING SHEETS AND DETAILS NOTED AS SLRS INDICATE ELEMENTS THAT PARTICIPATE IN THE SEISMIC LOAD RESISTING SYSTEM. COLLECTORS ARE THOSE BEAMS NOTED ON THE PLANS TO HAVE COLLECTOR CONNECTIONS AT ONE OR BOTH ENDS.

BUILDING DRIFT

MAXIMUM INELASTIC SEISMIC STORY DRIFT:	
FIRST STORY - SECOND STORY:	1 INCH
SECOND STORY - THIRD STORY:	2.5 INCHES
THIRD STORY - LOW ROOF:	2.5 INCHES

TYPICAL PLAN NOTES

1. REFER TO GENERAL NOTES AND SPECIFICATIONS FOR REQUIREMENTS.

2. REFER TO S0.1, S0.2 AND S0.3 FOR GENERAL NOTES, ABBREVIATIONS, AND SYMBOL LEGEND.

3. REFER TO TYPICAL DETAIL SHEETS FOR DETAILS NOT SPECIFICALLY REFERENCED.

   a. CONCRETE: S5.1, 5.2, & S5.4
   b. STEEL: S6.1 - S6.3
   c. METAL DECK: S6.4 - S6.5

4. FOR COLUMN SCHEDULE, COLUMN TRANSITION DETAILS, AND BASE PLATE DETAILS, SEE 2/S5.5.

5. REFER TO NOTES TITLED "DOCUMENT COORDINATION" FOR REFERENCE TO INFORMATION FOUND ON OTHER DRAWINGS.

6. BEAMS, COLUMNS, BRACES, & WALLS ARE CENTERED ON GRID LINES, U.O.N. INFILL BEAMS ARE EQUALLY SPACED BETWEEN GRIDS OR SPECIFICALLY LOCATED MEMBERS, U.O.N

7. ALL CLADDING SYSTEMS AND INTERIOR PARTITIONS SHALL HAVE THE ABILITY TO COMPENSATE FOR VERTICAL DEFLECTIONS OF 3/4" MIN., U.O.N.

8. BEAM PENETRATIONS NOT SHOWN IN THE STRUCTURAL DRAWINGS ARE NOT PERMITTED WITHOUT APPROVAL OF THE ENGINEER.

9. STEEL-FRAMED FLOOR NOTES:

a. THE DIMENSION BETWEEN EDGE OF SLAB OPENING AND CENTERLINE OF CLOSEST STEEL FRAMING BEAM SHALL BE 8" FOR BEAMS NOT OTHERWISE SPECIFICALLY LOCATED.

b. ALL STEEL BEAMS SUPPORTING CONCRETE FILL OVER METAL DECK SHALL HAVE WELDED STUDS: MINIMUM SIZE AND SPACING SHALL BE ¾" DIA. @ 12" O.C., U.O.N. REFER TO TYPICAL DETAILS FOR STUD PLACEMENT REQUIREMENTS.

DOCUMENT COORDINATION

1. REFER TO ARCHITECTURAL DRAWINGS FOR SLAB EDGE DIMENSIONS.

2. ONLY LARGE FLOOR AND WALL OPENINGS ARE SHOWN ON STRUCTURAL DRAWINGS. REFER TO ARCHITECTURAL AND OTHER DRAWINGS FOR COMPLETE SCOPE OF OPENINGS AND FOR LOCATIONS AND DIMENSIONS OF ALL OPENINGS. REFER TO TYPICAL DETAILS FOR FRAMING AND/OR REINFORCEMENT REQUIREMENTS AROUND OPENINGS.

3. REFER TO ARCHITECTURAL DRAWINGS FOR ELEVATIONS NOT SHOWN AND LOCATION AND SIZE OF SLOPES, STEPS, DEPRESSIONS, BLOCKOUTS, RECESSES, CURBS, PADS, ETC.

4. REFER TO ARCHITECTURAL AND OTHER DRAWINGS FOR SIZES AND LOCATIONS OF EQUIPMENT SUPPORT PADS AND CURBS AND FOR EQUIPMENT ANCHORAGE/BRACING.

5. REFER TO ARCHITECTURAL AND OTHER DRAWINGS FOR SIZES, LOCATIONS, AND ELEVATIONS OF ITEMS CAST IN PLACE OR EMBEDDED IN CONCRETE AND COORDINATE WITH STRUCTURAL ELEMENTS. THESE ITEMS INCLUDE, BUT ARE NOT LIMITED TO:

   a. ANCHOR BOLTS, INSERTS, AND HANGERS FOR ATTACHMENT OF NON-STRUCTURAL BUILDING COMPONENTS.
   b. SLEEVES, DRAINS, BOXES, AND CONDUITS.

6. ITEMS WHICH ARE NOT SHOWN ON THE STRUCTURAL DRAWINGS, BUT ATTACH TO, EMBED, PENETRATE, OR OTHERWISE AFFECT THE BUILDING STRUCTURE ARE SUBJECT TO THE LIMITATIONS OUTLINED IN THE DRAWINGS AND INCLUDE THE FOLLOWING ITEMS:

   a. PLUMBING UNDER OR ADJACENT TO FOUNDATIONS: S5.2
   b. PENETRATIONS THROUGH FOOTINGS AND GRADE BEAMS: S5.2
   c. CONDUITS EMBEDDED IN STRUCTURAL CONCRETE: S5.4
   d. PENETRATIONS IN CONCRETE BEAMS: S5.4
   e. OPENINGS & PENETRATIONS IN CONCRETE WALLS AND SLABS: S5.4
   f. PENETRATIONS IN WEBS OF STEEL BEAMS: S6.2
   g. OPENINGS & PENETRATIONS IN CONCRETE FILL OVER STEEL DECK: S6.5
   i. SUSPENDED LOADS FROM STEEL DECK: S6.4

7. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATION AND DETAILS OF NON-BEARING INTERIOR AND EXTERIOR WALL CONSTRUCTION.

8. REFER TO ARCHITECTURAL AND OTHER DRAWINGS FOR SUPPLEMENTARY STRUCTURAL SUPPORTS AND EMBEDDED ATTACHMENTS FOR NON-STRUCTURAL SYSTEMS AND COMPONENTS NOT SPECIFICALLY DETAILED ON THE STRUCTURAL DRAWINGS , INCLUDING:

   a. CLADDING
   b. PARAPETS
   c. CEILINGS
   d. CANOPIES & TRELLISES
   e. SUNSHADES & SUN CONTROL DEVICES
   f. ROOF SCREENS
   g. STAIRS
   h. RAILINGS
   i. ELEVATORS AND MACHINE ROOMS
   j. LIGHT-GAGE METAL FRAMING
   k. WINDOW WASHING
   l. SUPPORT FRAMING AT ROLL-DOWN DOORS
   m. CANTILEVER FRAMING FOR PARTIAL-HEIGHT WALLS
   n. MISCELLANEOUS ARCHITECTURAL APPENDAGES
   o. SIGNS, FLAG POLES, AND BANNERS

9. REFER TO ARCHITECTURAL DRAWINGS FOR REQUIRED WATERPROOFING AND DRAINAGE SCOPE AND DETAILS. REFERENCE TO WATERPROOFING AND DRAINAGE IN THE STRUCTURAL DRAWINGS IS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR.

10. REFER TO ARCHITECTURAL DRAWINGS FOR REQUIRED EXTENT OF FIREPROOFING AND FIREPROOFING DETAILS FOR STRUCTURAL ELEMENTS.

11. REFER TO ARCHITECTURAL DRAWINGS FOR SCOPE OF CONCRETE SURFACES TO BE TREATED AS "ARCHITECTURAL CONCRETE".

12. REFER TO ARCHITECTURAL DRAWINGS FOR SCOPE OF STRUCTURAL STEEL TO BE TREATED AS "ARCHITECTURALLY EXPOSED STRUCTURAL STEEL (AESS)".

13. REFER TO ARCHITECTURAL DRAWINGS FOR DETAILED SCOPE OF FINISHES FOR STRUCTURAL STEEL INCLUDING GALVANIZING, PAINTING, AND OTHER COATINGS.

SPECIAL INSPECTION

THE SPECIAL INSPECTION REQUIREMENTS OF CHAPTER 17 OF THE CALIFORNIA BUILDING CODE APPLY TO THE FOLLOWING:

- STEEL CONSTRUCTION
- CONCRETE CONSTRUCTION
- ANCHORS AND DOWELS IN RESIN
- EXPANSION ANCHORS
- SOILS
- DRILLED PIER FOUNDATIONS

THE SUPPLEMENTAL SPECIAL INSPECTION REQUIREMENTS FOR SEISMIC RESISTANCE OF CBC SECTION 1707 APPLY TO THE FOLLOWING ELEMENTS OF THE SEISMIC LOAD RESISTING SYSTEM AND ARCHITECTURAL COMPONENTS:

- STRUCTURAL STEEL
- COLD-FORMED STEEL FRAMING
- PIER FOUNDATIONS
- ARCHITECTURAL COMPONENTS:
  EXTERIOR NON-BEARING COLD-FORMED STEEL WALLS

THE SUPPLEMENTAL STRUCTURAL TESTING REQUIREMENTS FOR SEISMIC RESISTANCE OF CBC SECTION 1708 APPLY TO THE FOLLOWING ELEMENTS OF THE SEISMIC LOAD RESISTING SYSTEM:

- STRUCTURAL STEEL

STRUCTURAL OBSERVATION

1. STRUCTURAL OBSERVATION FOR SEISMIC RESISTANCE SHALL BE PROVIDED IN ACCORDANCE WITH CBC SECTIONS 1702 AND 1710.

2. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AT LEAST 3 DAYS PRIOR TO COMPLETION OF ANY OF THE FOLLOWING CONSTRUCTION MILESTONES TO ALLOW TIMELY STRUCTURAL OBSERVATION TO OCCUR. THE SPECIFIC MILESTONES AND FREQUENCY OF STRUCTURAL OBSERVATION IS AT THE DISCRETION OF THE ENGINEER:

   a. FOUNDATION REINFORCEMENT AND EMBEDDED ANCHOR BOLTS.
   b. STRUCTURAL STEEL ERECTION.
   c. METAL DECK WELDING.
   d. SHEARWALL CONCRETE REINFORCEMENT.

3. AT THE CONCLUSION OF THE STRUCTURAL WORK, THE OBSERVER SHALL SUBMIT A WRITTEN STATEMENT TO THE BUILDING OFFICIAL THAT THE SITE VISITS HAVE BEEN MADE AND IDENTIFY ANY REPORTED DEFICIENCIES THAT, TO THE BEST OF THE STRUCTURAL OBSERVER'S KNOWLEDGE, HAVE NOT BEEN RESOLVED.

SUBMITTALS

1. REFER TO SPECIFICATIONS FOR COMPLETE REQUIREMENTS.

2. THE CONTRACTOR SHALL SUBMIT A SUBMITTAL SCHEDULE FOR REVIEW FOUR WEEKS BEFORE THE FIRST SUBMITTAL IS ISSUED.

3. THE CONTRACTOR IS TO REVIEW EACH SUBMITTAL PRIOR TO FORWARDING TO THE ARCHITECT AND STRUCTURAL ENGINEER. THE CONTRACTOR IS TO STAMP EACH SUBMITTAL VERIFYING THAT THE FOLLOWING IS ADDRESSED:

   a. THE SUBMITTAL IS REQUESTED BY THE CONTRACT DOCUMENTS.
   b. THE SUBMITTAL IS BASED ON THE MOST CURRENT EDITION OF THE CONTRACT DOCUMENTS INCLUDING ALL ADDENDA, SUPPLEMENTS, BULLETINS, RFI'S, ETC.
   c. THE ARCHITECT'S AND STRUCTURAL ENGINEER'S COMMENTS FROM ANY PREVIOUS SUBMITTALS ARE ADDRESSED.
   d. THE WORK IS COORDINATED AMONG ALL CONSTRUCTION TRADES.
   e. REVISIONS FROM PREVIOUS SUBMITTALS ARE CLEARLY MARKED BY CIRCLING OR CLOUDS.
   f. SUBMITTAL IS COMPLETE.
   g. SUBMITTAL DOES NOT INCLUDE A SUBSTITUTION REQUEST.
   h. SUBMITTAL SHALL INCLUDE A STAMP INDICATING PROJECT NAME AND LOCATION, SUBMITTAL NUMBER, SPECIFICATION SECTION NUMBER.

4. THE STRUCTURAL ENGINEER SHALL RETURN, WITHOUT COMMENT, SUBMITTALS WHICH THE CONTRACTOR HAS NOT STAMPED OR WHICH DO NOT MEET THE ABOVE REQUIREMENTS. THE STRUCTURAL ENGINEER'S REVIEW OF SUBMITTALS SHALL BE FOR GENERAL CONFORMANCE WITH THE DESIGN INTENT. NO WORK SHALL BE STARTED WITHOUT SUCH REVIEW.

5. THE STRUCTURAL ENGINEER WILL ONLY STAMP SUBMITTALS FOR ITEMS WITHIN THE SCOPE OF WORK THAT APPEARS IN THE STRUCTURAL DRAWINGS AND SPECIFICATIONS. THE STRUCTURAL ENGINEER MAY REVIEW AND PROVIDE COMMENTS ON SUBMITTALS FOR ITEMS THAT APPEAR ON OTHER DRAWINGS OR ARE DELEGATED DESIGN ELEMENTS, BUT WILL NOT STAMP THESE SUBMITTALS.

a. CONCRETE MIX DESIGNS AND WELD PROCEDURE SPECIFICATIONS WILL BE REVIEWED BY THE STRUCTURAL ENGINEER, BUT NOT STAMPED, SINCE THESE SUBMITTALS ARE DESIGNED BY ANOTHER ENGINEER.

DELEGATED DESIGN ELEMENTS

1. DELEGATED DESIGN ELEMENTS ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. DELEGATED DESIGN ELEMENTS TO BE DESIGNED BY THE CONTRACTOR INCLUDE:

   a. TEMPORARY SHORING AND BRACING
   b. SITE SHORING
   c. CONCRETE FORMWORK AND FALSEWORK
   d. OTHER DESIGN REQUIRED FOR TEMPORARY MEANS AND METHODS OF THE CONTRACTOR
   e. STEEL STAIRS INCLUDING RAILINGS AND CONNECTIONS BACK TO THE MAIN STRUCTURE
   f. PRECAST STAIRS
   g. HANDRAILS AND GUARDRAILS
   h. ANCHORAGE AND BRACING OF ALL MEP EQUIPMENT AND DISTRIBUTION LINES (EXCEPT FOR ITEMS SPECIFICALLY DETAILED ON THE CONTRACT DOCUMENTS)
   i. INTERIOR LIGHT GAUGE FRAMED PARTITIONS
   j. EXTERIOR LIGHT GAUGE FRAMED CLADDING
   k. VENDOR-SUPPLIED CLADDING AND CONNECTIONS (EXCEPT FOR SPECIFICALLY DETAILED BACK-UP & SUPPORT STEEL)
   l. CANOPIES (EXCEPT FOR SPECIFICALLY DETAILED CANOPY FRAMING)
   m. SUNSHADES (EXCEPT FOR SPECIFICALLY DETAILED BACK-UP & SUPPORT STEEL)
   n. ROOF SCREENS (EXCEPT FOR SPECIFICALLY DETAILED ROOF SCREEN FRAMING)
   o. SKYLIGHTS (EXCEPT FOR SPECIFICALLY DETAILED SUPPORT STEEL)
   p. ELEVATORS (EXCEPT FOR GUIDERAIL SUPPORT TUBES)
   q. WINDOW-WASHING DAVITS (EXCEPT FOR SPECIFICALLY DETAILED SUPPORT STEEL)
   r. FALL ARREST SYSTEMS (EXCEPT FOR SPECIFICALLY DETAILED SUPPORT STEEL)
   s. SEISMIC JOINT COVERS
   t. CONCRETE MIX DESIGNS

2. DESIGN OF ALL DELEGATED DESIGN ELEMENTS SHALL BE BY A REGISTERED CALIFORNIA STRUCTURAL OR CIVIL ENGINEER.

3. DELEGATED DESIGN ELEMENT SHOP DRAWING AND CALCULATION SUBMITTALS SHALL BE STAMPED AND SIGNED BY THE CONTRACTOR'S DESIGN ENGINEER.

4. DELEGATED DESIGN ELEMENT CALCULATIONS SHALL HAVE A SUMMARY PAGE STATING THE DESIGN ASSUMPTIONS INCLUDING CODES AND DESIGN LOADS.

5. DELEGATED DESIGN ELEMENT SHOP DRAWINGS SHALL SHOW THE MAGNITUDES, DIRECTIONS, LOCATIONS, AND CONNECTION CONDITIONS OF ALL LOADS IMPOSED ON THE BUILDING STRUCTURE BY THE ELEMENT INCLUDING, BUT NOT LIMITED TO:

   a. STAIRS
   b. RAILINGS
   c. MEP EQUIPMENT
   d. CLADDING
   e. CANOPIES & TRELLISES
   f. SUNSHADES & SUN CONTROL DEVICES
   g. ROOF SCREENS
   h. SKYLIGHTS
   i. ELEVATORS
   j. WINDOW-WASHING DAVITS
   k. FALL ARREST SYSTEMS

6. ALL DELEGATED DESIGN ELEMENTS MUST BE SUBMITTED TO THE OWNER AND THE ARCHITECT FOR REVIEW.

7. AFTER OWNER & ARCHITECT REVIEW IS COMPLETE, ALL DELEGATED DESIGN ELEMENTS MUST BE SUBMITTED BY THE CONTRACTOR TO THE AUTHORITY HAVING JURISDICTION FOR REVIEW AND APPROVAL.

EXTERIOR CLADDING

1. THESE NOTES APPLY TO ARCHITECTURAL CURTAIN WALL AND CLADDING, DENOTED HEREIN AS "EXTERIOR WALL".

2. ALL PRIMARY STRUCTURAL STEEL FRAMING SHALL BE CONSIDERED AS HAVING NO (ZERO) TORSIONAL CAPACITY AND NO (ZERO) CAPACITY FOR LATERAL LOADS APPLIED TRANSVERSELY TO UNBRACED FLANGES OF BEAMS. ANY BEAM FLANGE THAT IS NOT SECURED TO THE FLOOR SLAB BY WELDED STUDS SHALL BE CONSIDERED UNBRACED. WHERE CONNECTIONS IMPOSE TORSIONAL LOADS OR LOADS TO UNBRACED FLANGES OF BEAMS, COMPLETE SECONDARY STEEL BRACING OF THE SUPPORTING STRUCTURE SHALL BE DESIGNED AND PROVIDED BY THE CONTRACTOR.

3. REFER TO PARAGRAPH ABOVE FOR LIMITATIONS ON LOADS AND STRESSES IMPOSED ON THE PRIMARY STRUCTURE AND PROVIDE ALL SECONDARY FRAMING INCLUDING BUT NOT LIMITED TO KICKERS, GIRTS OR POSTS, AND BRACING REQUIRED BY THESE SPECIFICATIONS. LATERAL AND /OR TORSIONAL LOADS MAY BE IMPOSED ON BUILDING FLOOR AND ROOF PERIMETER SPANDREL BEAMS WITHOUT SECONDARY BRACING AT THE FOLLOWING LOCATIONS:

   a. WITHIN SIX INCHES OF EITHER SIDE OF THE CENTERLINE OF BEAMS SUPPORTED BY THE SPANDREL GIRDER, ONLY WHERE SAID BEAMS ARE INDICATED ON THE FRAMING PLANS WITH THE FOLLOWING SYMBOL AT THE BEAM END FRAMING INTO THE PERIMETER SPANDREL:

   

   b. WITHIN 30 INCHES OF EITHER SIDE OF COLUMN CENTERLINE (THIS IS NOT ALLOWED IN PLASTIC HINGE REGIONS OF STEEL MOMENT RESISTING FRAMES).

4. WHERE LATERAL LOADS ARE APPLIED BY EXTERIOR WALL TO BEAM BOTTOM FLANGES AT ANY LOCATION OTHER THAN THOSE IDENTIFIED ABOVE, EXTERIOR WALL TRADE CONTRACTOR SHALL PROVIDE SECONDARY BRACING OF THE BEAM BOTTOM FLANGE IN ACCORDANCE WITH THE SPECIFICATIONS.

5. PRIMARY STRUCTURAL BEAMS AND COLUMNS ARE DETAILED AND ERECTED USING TOLERANCES IN ACCORDANCE WITH THE LATEST EDITION OF AISC SPECIFICATIONS AND EXTERIOR CLADDING SHALL BE DETAILED TO PERMIT INSTALLATION WITHIN THESE TOLERANCES.

STAIRS

1. THESE NOTES APPLY TO ALL STAIRS NOT DETAILED IN THE STRUCTURAL DRAWINGS. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

2. STAIR DESIGN DOCUMENTS AND CALCULATIONS SHALL BE STAMPED AND SIGNED BY A CIVIL OR STRUCTURAL ENGINEER REGISTERED IN CALIFORNIA. THIS PACKAGE SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW.

3. ALL PRIMARY STRUCTURAL STEEL FRAMING SHALL BE CONSIDERED AS HAVING NO (ZERO) TORSIONAL CAPACITY AND NO (ZERO) CAPACITY FOR LATERAL LOADS APPLIED TRANSVERSELY TO UNBRACED FLANGES OF BEAMS. ANY BEAM FLANGE THAT IS NOT SECURED TO THE FLOOR SLAB BY WELDED STUDS SHALL BE CONSIDERED UNBRACED. WHERE CONNECTIONS IMPOSE TORSIONAL LOADS OR LOADS TO UNBRACED FLANGES OF BEAMS, COMPLETE SECONDARY STEEL BRACING OF THE SUPPORTING STRUCTURE SHALL BE DESIGNED AND PROVIDED BY THE TRADE CONTRACTOR.

4. REFER TO PARAGRAPH ABOVE FOR LIMITATIONS ON LOADS AND STRESSES IMPOSED ON THE PRIMARY STRUCTURE AND PROVIDE ALL SECONDARY FRAMING INCLUDING BUT NOT LIMITED TO KICKERS, GIRTS OR POSTS, AND BRACING REQUIRED BY THESE SPECIFICATIONS. LATERAL AND /OR TORSIONAL LOADS MAY BE IMPOSED ON BUILDING FLOOR AND ROOF BEAMS WITHOUT SECONDARY BRACING AT THE FOLLOWING LOCATIONS:

   a. WITHIN SIX INCHES OF EITHER SIDE OF THE CENTERLINE OF BEAMS SUPPORTED BY THE SPANDREL GIRDER, ONLY WHERE SAID BEAMS ARE INDICATED ON THE FRAMING PLANS WITH THE FOLLOWING SYMBOL AT THE BEAM END FRAMING INTO THE PERIMETER SPANDREL:

   b. ON STRUCTURAL BEAM, WITHIN 30 INCHES OF EITHER SIDE OF COLUMN CENTERLINE .

5. WHERE LATERAL LOADS ARE APPLIED BY STAIRS TO BEAM BOTTOM FLANGES AT ANY LOCATION OTHER THAN THOSE IDENTIFIED ABOVE, STAIR TRADE CONTRACTOR SHALL PROVIDE SECONDARY BRACING OF THE BEAM BOTTOM FLANGE IN ACCORDANCE WITH THE SPECIFICATIONS.

6. PRIMARY STRUCTURAL BEAMS AND COLUMNS ARE DETAILED AND ERECTED USING TOLERANCES IN ACCORDANCE WITH THE LATEST EDITION OF AISC SPECIFICATIONS AND STAIRS SHALL BE DETAILED TO PERMIT INSTALLATION WITHIN THESE TOLERANCES.

GEOTECHNICAL INFORMATION

1. THE OWNER'S GEOTECHNICAL ENGINEER, A3GEO HAS PREPARED AN INVESTIGATION REPORT FOR USE ON THIS PROJECT, TITLED: "GEOTECHNICAL INVESTIGATION REPORT, JACOBS HALL, UNIVERSITY OF CALIFORNIA BERKELEY", DATED 5/30/2014.

2. THE CONTRACTOR SHALL REVIEW AND UNDERSTAND THE INFORMATION CONTAINED IN THE REPORT, BUT SHALL NOT ASSUME THAT SUCH INFORMATION IS SUFFICIENT FOR THE CONTRACTOR'S PURPOSES.

3. THE CONTRACTOR SHALL BE FAMILIAR WITH THE GEOTECHNICAL CONDITIONS AT THE PROJECT SITE.

4. THE CONTRACTOR SHALL BE RESPONSIBLE TO OBTAIN GEOTECHNICAL STUDIES AND INFORMATION NECESSARY TO COMPLETE THE WORK.

5. THE CONTRACTOR SHALL OBTAIN THE SERVICES OF AN INDEPENDENT GEOTECHNICAL ENGINEER LICENSED IN THE STATE OF CALIFORNIA TO ANALYZE AVAILABLE INFORMATION AND TO MAKE ADDITIONAL INVESTIGATIONS AS NECESSARY TO COMPLETE THE WORK.

6. THE OWNER'S GEOTECHNICAL ENGINEER SHALL INSPECT AND APPROVE THE PREPARED SUBGRADE FOR CONFORMANCE WITH THE REQUIREMENTS OF THE GEOTECHNICAL REPORT PRIOR TO PLACEMENT OF FOUNDATION REINFORCEMENT.

FOUNDATIONS

1. REFER TO GENERAL NOTES SECTION TITLED "GEOTECHNICAL INFORMATION".

2. SLABS ON GRADE AND FOUNDATIONS SHALL BEAR ON APPROVED NATIVE SUBGRADE OR COMPACTED SOIL.

3. FOOTINGS AND GRADE BEAMS SHALL BE CAST IN NEAT TRENCHED EXCAVATIONS (1" MINIMUM WIDER THAN SCHEDULED). IF FOOTINGS CANNOT BE CAST IN TRENCHES, FORM FOOTINGS TO SCHEDULED DIMENSIONS.

4. COMPACTED NATURAL SOIL, FILL, AND BACKFILL IS TO BE UNIFORMLY COMPACTED WITH APPROVED COMPACTION EQUIPMENT. FILL MATERIAL AND OPERATIONS SHALL BE INSPECTED BY THE OWNER'S GEOTECHNICAL ENGINEER.

5. WATER SHALL NOT BE ALLOWED TO STAND IN TRENCHES OR FORMS BEFORE OR AFTER CONCRETE IS PLACED, AND SHALL BE PUMPED OUT. IF BOTTOMS OF TRENCHES BECOME SOFTENED DUE TO RAIN OR OTHER WATER BEFORE FOOTINGS ARE CAST, THE CONTRACTOR SHALL EXCAVATE THE SOFTENED MATERIAL AND REPLACE WITH CONCRETE.

6. BASEMENT WALLS (RESTRAINED AT THE TOP) DESIGN PRESSURE: 60 PCF (ABOVE GROUNDWATER TABLE)

7. DO NOT BACKFILL BASEMENT WALLS UNTIL LEVEL 4 CONSTRUCTION IS COMPLETE AND CONCRETE SLAB AND FILL ON METAL DECK OF SUPPORTING LEVELS HAS ATTAINED ITS 28-DAY STRENGTH.

8. SPECIAL INSPECTION REQUIREMENTS APPLY TO FILL AND BACKFILL OPERATIONS. FOOTING EXCAVATIONS SHALL BE INSPECTED AND APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO PLACING REINFORCEMENT STEEL.

DRILLED PIERS

1. REFER TO GEOTECHNICAL REPORT, AS LISTED IN THE FOUNDATIONS SECTION OF THE GENERAL NOTES, FOR DRILLED PIER CRITERIA AND RECOMMENDATIONS.

2. ALLOWABLE SKIN FRICTION CAPACITIES FOR DRILLED PIERS IN NATIVE SOIL ARE AS FOLLOWS:

DEAD LOAD + LIVE LOAD	500 PSF
DEAD PLUS LIVE + SEISMIC (OR WIND) LOAD	667 PSF
UPLIFT LOAD (INCLUDING SEISMIC)	533PSF

3. ALLOWABLE SKIN FRICTION CAPACITIES FOR DRILLED PIERS IN BEDROCK ARE AS FOLLOWS:

DEAD LOAD + LIVE LOAD	1,500 PSF
DEAD PLUS LIVE + SEISMIC (OR WIND) LOAD	2,000 PSF
UPLIFT LOAD (INCLUDING SEISMIC)	1,600 PSF

4. DRILLED PIERS SHALL BE INSPECTED AND APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO CONCRETE PLACEMENT.

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F/E Job #13-059

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #2 – Ext. Skin D/B	06/06/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
GENERAL NOTES

SHEET No
S0.1

CONCRETE

1. ALL CONCRETE SHALL DEVELOP THE FOLLOWING COMPRESSIVE STRENGTHS AT 28 DAYS (AND 56 DAYS WHERE APPLICABLE):

NORMAL WEIGHT CONCRETE	28 DAYS
DRILLED PIERS	5000 PSI
FOOTINGS, GRADE BEAMS	5000 PSI
WALLS, PILASTERS, SLABS, COLUMNS	5000 PSI
SLABS-ON-GRADE, CURBS	4000 PSI
FILL ON METAL DECK	4000 PSI
LIGHTWEIGHT CONCRETE	
FILL ON METAL DECK	4000 PSI

2. REFER TO SPECIFICATIONS FOR CONCRETE CLASS DESIGNATIONS.
3. ALL EXPOSED CORNERS OR EDGES OF COLUMNS, PIERS, WALLS, BEAMS, ETC., SHALL BE FORMED WITH A 3/4" CHAMFER UNLESS OTHERWISE NOTED ON DRAWINGS.
4. CONSTRUCTION JOINTS SHALL BE LOCATED WHERE SHOWN AND, IF NOT SHOWN, WHERE DIRECTED BY THE ARCHITECT. THEY SHALL BE LOCATED SO AS TO LEAST IMPAIR THE STRENGTH OF THE STRUCTURE AND TO MINIMIZE SHRINKAGE. PROVIDE DOWELS AND KEYS AS DETAILED AND DIRECTED, AND THOROUGHLY CLEAN AND REMOVE LAITANCE FROM SURFACES BEFORE PROCEEDING WITH THE NEXT PLACEMENT.
5. CONTRACTOR SHALL SUBMIT CONSTRUCTION JOINT LAYOUT FOR REVIEW.
6. FOR DRIP EDGES, REGLETS, REVEALS, AND OTHER FEATURES NOT SHOWN ON THE STRUCTURAL DRAWINGS, SEE ARCHITECTURAL DRAWINGS.

SHOTCRETE

1. SHOTCRETE MAY BE USED IN LIEU OF CAST-IN-PLACE CONCRETE AT THE CONTACTOR'S OPTION WITH THE APPROVAL OF THE ARCHITECT.
2. REFER TO CAST-IN-PLACE GENERAL NOTES FOR STRENGTH REQUIREMENTS FOR EACH CONCRETE CLASS.
3. PRESCONSTRUCTION TESTS SHALL BE REQUIRED. CONTRACTOR TO SUBMIT TEST PLAN FOR REVIEW PRIOR TO COMMENCING WITH TEST PANELS. SHOTCRETE TEST PANELS SHALL BE CONSTRUCTED ON-SITE AND EXECUTED BY THE PROJECT-SPECIFIED NOZZLE OPERATORS UNDER REPRESENTATIVE JOB-SITE CONDITIONS USING THE SPECIFIED SHOTCRETE MIXES. WHERE SHOTCRETE WALLS WILL BE EXPOSED, FACE OF TEST PANELS SHALL BE FINISHED. ALL TEST PANELS SHALL BE CORED AND SAW-CUT FOR EXAMINATION. APPROVED TEST PANELS SHALL BE CONSIDERED THE STANDARD FOR THE PROJECT.
4. ALL EXPOSED CORNERS OR EDGES OF COLUMNS, PIERS, WALLS, BEAMS, ETC., SHALL BE FORMED WITH A 3/4" CHAMFER UNLESS OTHERWISE NOTED ON DRAWINGS.
5. FOR FEATURES, DRIP EDGES, REGLETS, REVEALS, ETC., SEE ARCHITECTURAL DRAWINGS.
6. REBOUND SHALL NOT BE REUSED AS AGGREGATE.

CONCRETE REINFORCEMENT

1. ALL CONCRETE SHALL BE REINFORCED. REINFORCEMENT SHALL BE NEW DEFORMED STEEL BARS, ASTM A615, GRADE 60, U.O.N. THE FOLLOWING REINFORCEMENT IS USED IN THE PROJECT AS NOTED BELOW AND SPECIFIED IN THE DRAWINGS:
   ASTM A706, GRADE 60 FOR SPECIAL SHEAR WALLS AND BARS TO BE WELDED
   ASTM A615, GRADE 75 FOR DRILLED PIER SPIRAL REINFORCEMENT
   ASTM A615, GRADE 75 FOR GRADE BEAM REINFORCEMENT

   ALL REINFORCEMENT SHALL BE CLEARLY INDCATED FOR FIELD PERSONNEL AND INSPECTORS TO DISTINGISH AND CONFIRM REINFORCEMENT GRADES.
2. ALL CONCRETE REINFORCEMENT DETAILS SHALL CONFORM TO ACI 315, " MANUAL OF STANDARD PRACTICE FOR DETAILING CONCRETE STRUCTURES".
3. CONCRETE COVER SHALL BE TO FACE OF BAR, MECHANICAL COUPLER, OR WELDED HEADED BAR AS FOLLOWS, UNLESS OTHERWISE NOTED ON DRAWINGS:

CAST-IN-PLACE CONCRETE	MINIMUM CONCRETE COVER
CAST AGAINST AND EXPOSED TO EARTH	3"
EXPOSED TO EARTH OR WEATHER	
#5 AND SMALLER	1 ½"
#6 AND LARGER	2"
NOT EXPOSED TO WEATHER OR IN CONTACT WITH EARTH	
SLABS, JOISTS	1"
WALLS	1 ½"
COLUMNS, BEAMS	1 ½"
SLABS ON GRADE	MID-DEPTH

4. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF REINFORCEMENT LAYOUTS AND DETAILS FOR REVIEW PRIOR TO FABRICATION. SHOW ALL PROPOSED SPLICE LOCATIONS. FABRICATE FROM APPROVED DRAWINGS ONLY.
5. THE LENGTHS AND SPLICES OF REINFORCEMENT SHOWN ON DRAWINGS REPRESENT A SUGGESTED CONSTRUCTION JOINT LAYOUT. BAR SPLICES MAY BE DELETED AND CONTINUOUS REINFORCEMENT USED AT THE CONTRACTOR'S OPTION. LONG BARS OR BENT BARS SHOWN MAY BE SPLICED IF NECESSARY FOR PLACEMENT OR EASE OF CONSTRUCTION PROVIDED MINIMUM SCHEDULED LAP LENGTHS ARE FOLLOWED WITH APPROVAL FROM THE ARCHITECT. MECHANICAL COUPLERS SHALL BE USED WHERE SHOWN ON THE DRAWINGS AND MAY BE USED IN LIEU OF LAP SPLICES WITH APPROVAL FROM THE ARCHITECT.
6. PROVIDE DOWELS OR CONTINUOUS REINFORCEMENT BETWEEN ALL CONCRETE ELEMENTS, UNLESS OTHERWISE NOTED. IN GENERAL, BAR SPLICES SHALL BE MADE AT POINTS OF MINIMUM STRESS. IN FRAMED BEAMS AND SLABS, SPLICE TOP BARS AT MID-SPAN, BOTTOM BARS OVER SUPPORTS, UNLESS OTHERWISE NOTED. IN GRADE BEAMS SUPPORTED ON SOIL, SPLICE TOP BARS AT COLUMNS, BOTTOM BARS AT MID-SPAN BETWEEN COLUMNS, UNLESS OTHERWISE NOTED ON DRAWINGS. IN GRADE BEAMS SUPPORTED ON PIERS OR PILES, SPLICE TOP BARS AT MID-SPAN BETWEEN SUPPORTS, BOTTOM BARS AT SUPPORTS, UNLESS OTHERWISE NOTED ON DRAWINGS. VERTICAL REINFORCEMENT FROM COLUMNS, PILASTERS, AND WALLS SHALL BE DOWELED TO SUPPORTING FOOTINGS WITH BARS OF SAME SIZE AND SPACING AS VERTICAL REINFORCEMENT UNLESS OTHERWISE NOTED ON DRAWINGS.
7. ALL SPLICES OF #10 AND LARGER REINFORCEMENT SHALL BE MADE USING TYPE II MECHANICAL COUPLERS (AS DEFINED IN THE PROJECT SPECIFICATIONS), UNLESS OTHERWISE SHOWN. LAP SPLICES FOR #10 AND LARGER BARS SHALL NOT BE PERMITTED.
8. TYPE II MECHANICAL COUPLERS (AS DEFINED IN THE PROJECT SPECIFICATONS) SHALL CONFORM TO DIMENSIONAL REQUIREMENTS SHOWN ON THE DRAWINGS, SO AS NOT TO REQUIRE SPECIAL STIRRUPS OR HOOPS, OR VIOLATE THE REQUIRED CLEAR COVER OF CONCRETE. HRC TYPE 510 XTENDER OR EQUAL (NO KNOWN EQUAL). MECHANICAL COUPLERS SHALL BE STAGGERED A MINIMUM OF 3'-0" FROM MECHANICAL COUPLERS ON ADJACENT BARS, UNLESS OTHERWISE NOTED ON DRAWINGS.
9. CONTRACTOR SHALL ORDER ADEQUATE ADDITIONAL UNITS OF REINFORCEMENT SPLICED WITH MECHANICAL COUPLERS AND ADEQUATE ADDITIONAL UNITS OF REINFORCEMENT TERMINATED WITH WELDED HEADED BARS TO FACILITATE THE MINIMUM TESTING REQUIREMENTS TO BE PERFORMED BY THE OWNER'S TESTING AGENCY.
10. THE OWNER'S TESTING AGENCY SHALL TENSION TEST ONE TYPE II MECHANICAL COUPLER (AS DEFINED IN THE PROJECT SPECIFICATONS) FOR EACH ONE HUNDRED DEVICES UTILIZED ON PROJECT. ROUND UP TO NEXT HIGHEST 100 FOR INTERMEDIATE NUMBER OF DEVICES, AND TEST A MINIMUM OF TWO DEVICES. OWNER'S TESTING AGENCY SHALL TENSION TEST ONE WELDED HEADED BAR FOR EACH ONE HUNDRED DEVICES UTILIZED ON PROJECT. ROUND UP TO NEXT HIGHEST 100 FOR INTERMEDIATE NUMBERS AND TEST TWO DEVICES MINIMUM. FAILURE OF A DEVICE SHALL REQUIRE ADDITIONAL TESTS OF ONE IN TEN DEVICES OF THE SAME HEAT OF DEVICE. ADDITIONAL REINFORCEMENT REQUIRED DUE TO FAILED DEVICES SHALL BE AT THE EXPENSE OF THE CONTRACTOR.
11. THE OWNER'S TESTING AGENCY SHALL TORQUE TEST TEN PERCENT OF ALL IN-PLACE TYPE II MECHANICAL COUPLERS (AS DEFINED IN THE PROJECT SPECIFICATONS) TO THE VALUES TABULATED ON THE DRAWINGS. IF ANY ONE TORQUE TEST FAILS, ALL TYPE II MECHANICAL COUPLERS INSTALLED THAT DAY SHALL BE TORQUE TESTED BY THE OWNER'S TESTING AGENCY. THE CONTRACTOR SHALL CORRECT ALL TYPE II MECHANICAL COUPLERS IDENTIFIED AS HAVING FAILED TORQUE TESTS AT NO ADDITIONAL COST TO THE OWNER. THE OWNER'S TESTING AGENCY SHALL RETEST ALL FAILED COUPLERS.
12. ANY REINFORCEMENT INTERRUPTED BY STRUCTURAL STEEL SHAPES OR PLATES THAT IS NOT DETAILED IN THE DRAWINGS SHALL BE BROUGHT TO THE ARCHITECT'S ATTENTION FOR DETAILING REQUIREMENTS.

WELDED HEADED STUDS

1. ALL STEEL BEAMS SUPPORTING CONCRETE SLABS OR CONCRETE FILL ON METAL DECK SHALL HAVE WELDED STUDS IN ACCORDANCE WITH THE SCHEDULE THE DRAWINGS. MINIMUM SIZE AND SPACING SHALL BE ¾" DIAMETER AT 12" O.C. UNLESS OTHERWISE NOTED.
2. EACH WELDED STUD MAY REPLACE ONE DECK WELD.

STRUCTURAL STEEL

1. STEEL MATERIALS SHALL CONFORM TO THE FOLLOWING:

W-SHAPES, WT-SHAPES	ASTM A 992
CHANNEL AND ANGLE SHAPES	ASTM A 36
RECTANGULAR AND ROUND HSS	ASTM A 500, GRADE B
PIPE	ASTM A 53, GRADE B
PLATES	ASTM A 36 OR ASTM A 572, GRADE 50 AS INDICATED
BASE PLATES	ASTM A 36 OR ASTM A 572, GRADE 50 AS INDICATED
ANCHOR RODS	ASTM F 1554 GRADE 36
MACHINE BOLTS	ASTM A 307
HIGH STRENGTH BOLTS	ASTM A 325-N TYP. U.O.N., SC OR X AS INDICATED
WELDED HEADED STUDS	ASTM A 108

2. ALL STRUCTURAL STEEL SHALL CONFORM TO AISC SPECIFICATIONS FOR THE DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS.
3. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR REVIEW PRIOR TO FABRICATION. FABRICATE FROM APPROVED DRAWINGS ONLY.
4. ALL HIGH STRENGTH BOLTS SHALL BE SNUG TIGHT ONLY UNLESS OTHERWISE NOTED ON THE DRAWINGS AS SLIP CRITICAL (SC). ALL BOLTED CONNECTIONS NOTED AS SLIP CRITICAL SHALL BE FULLY TENSIONED IN ACCORDANCE WITH THE SPECIFICATIONS.
5. WELDING SHALL ONLY BE PERFORMED BY CERTIFIED WELDERS. ALL WELDING SHALL CONFORM TO AWS SPECIFICATIONS. PROVIDE TEMPORARY BACK-UP PLATES OR WELDS AT ALL COMPLETE JOINT PENETRATION (CJP) WELD LOCATIONS AS REQUIRED; REMOVE PLATES AFTER CJP WELDING AND GRIND AREA SMOOTH WHERE EXPOSED.
6. WHERE FIELD WELDING IS SPECIFICALLY NOTED, THE DESIGNATION IS GIVEN AS A SUGGESTED CONSTRUCTION PROCEDURE ONLY. CONTRACTOR SHALL DETERMINE SUITABILITY OF SHOP OR FIELD WELDING FOR ALL CONDITIONS.
7. DO NOT CUT THROUGH ERECTED STEEL PLATES, BOLTS, ANGLES OR SHAPES WITHOUT PERMISSION OF THE ARCHITECT. WHERE STEEL WILL BE EXPOSED TO VIEW, ALL SLAG AND ROUGH EDGES SHALL BE MECHANICALLY REMOVED TO PROVIDE A SMOOTH EDGE AFTER CUTTING OR BORING. ALL SURFACES CUT BY THERMAL PROCESSES SHALL BE GROUND (1/32 INCH MIN.) TO BRIGHT METAL.
8. ALL SHOP AND FIELD WELDING SHALL BE INSPECTED BY THE OWNER'S TESTING AGENCY.
9. SPECIAL WELD PROCEDURES WILL BE REQUIRED WHERE WELDING TO EXISTING STRUCTURAL STEEL IS REQUIRED. THE WELD PROCEDURES SHALL BE PROPOSED BY THE CONTRACTOR AND SUBMITTED FOR REVIEW BY THE ARCHITECT. PROCEDURES FOR WELDING TO EXISTING STRUCTURAL STEEL SHALL BE PRE-QUALIFIED BY THE OWNER'S TESTING AGENCY IN ACCORDANCE WITH AWS D1.1.
10. WHERE STRUCTURAL STEEL IS TO BE ATTACHED USING POST-INSTALLED ANCHORS, ANCHOR HOLES SHALL BE DRILLED PRIOR TO PREPARATION OF STEEL SHOP DRAWINGS AND FABRICATION. DRILLED HOLE LOCATIONS SHALL BE RECORDED AND TRANSFERRED USING TEMPLATES FOR THE PURPOSE OF ACCURATELY LOCATING HOLES IN STRUCTURAL STEEL.
11. SEE ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS FOR ARCHITECTURALLY EXPOSED STRUCTURAL STEEL (AESS).
12. SHOP PRIME STRUCTURAL STEEL WHERE REQUIRED, SEE SPECIFICATIONS.
13. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR PAINTING AND OTHER COATING REQUIREMENTS.
14. HOT - DIP GALVANIZE ALL EXTERIOR EXPOSED STEEL MEMBERS & CONNECTIONS AND OTHER MEMBERS SPECIFICALLY SHOWN ON THE DRAWINGS.
15. CUTTING AND BORING OF EXISTING STEEL SHALL NOT BE DONE EXCEPT WHERE SPECIFICALLY CALLED FOR ON THE DRAWINGS. HOLES THROUGH EXISTING STEEL MAY BE DRILLED, FLAME CUT, OR MADE USING AIR-ARC, AND SHALL NOT BE MORE THAN ½ INCH DIAMETER LARGER THAN REQUIRED TO PASS REINFORCEMENT, ANCHORS, ETC., SHOWN ON DRAWINGS, UNLESS OTHERWISE NOTED.
16. ALL FLAME CUTTING AND AIR-ARC CUTTING SHALL BE DONE ONLY BY CERTIFIED WELDERS.
17. AFTER CUTTING OR BORING, ALL SLAG AND ROUGH EDGES SHALL BE MECHANICALLY REMOVED TO PROVIDE A SMOOTH EDGE.

METAL DECK

1. SEE SHEET S6.4 FOR DECK PROFILES.
2. STEEL DECK SHALL BE WELDED TO ALL STRUCTURAL STEEL AND TO ADJACENT DECK SECTIONS IN ACCORDANCE WITH THE DECK WELDING SCHEDULE ON SHEET S6.4. MINIMUM DECK WELDS TO STRUCTURAL STEEL SHALL BE ¾-INCH DIAMETER FUSION WELDS AT 24 INCHES O.C. OR ALTERNATE CELLS.
3. WELDING OF DECK SHALL BE IN ACCORDANCE WITH AWS STANDARDS AND PERFORMED BY WELDERS CERTIFIED FOR LIGHT-GAGE METALS.
4. PROVIDE VENTED DECK FOR ALL DECKS TO RECEIVE CONCRETE FILL UNLESS OTHERWISE NOTED. DECKS WITHOUT CONCRETE FILL SHALL NOT BE VENTED.

DRILLED HOLES FOR ANCHORS AND DOWELS IN CONCRETE

1. DRILLED HOLE DEPTH TO ACHIEVE MINIMUM ANCHOR OR DOWEL EMBEDMENT MAY BE GREATER THAN REQUIRED EMBEDMENT SHOWN IN ANCHOR OR DOWEL TABLES. VERIFY HOLE DEPTH REQUIREMENTS WITH MANUFACTURER. HOLE DEPTH SHALL NOT BE LESS THAN TABULATED DEPTH.
2. VERIFY DRILL BIT TYPE AND DIAMETERS WITH MANUFACTURER.
3. USE CARE AND CAUTION AT ALL TIMES TO AVOID CUTTING OR DAMAGING REINFORCEMENT STEEL. DRILL HOLE SIZE AS RECOMMENDED BY MANUFACTURER. UNLESS OTHERWISE NOTED ON THE DRAWINGS. ALL LOCATIONS TO BE DRILLED SHALL BE CAREFULLY PRESCANNED USING EFFECTIVE MEANS PRIOR TO DRILLING. THE USE OF PACHOMETERS MAY NOT BE EFFECTIVE. USE OF X-RAYS WILL NOT BE PERMITTED. DRILL PILOT HOLES WITH SMALLER DIAMETERS THAN FINAL HOLES (3/8" MAXIMUM PILOT HOLE DIAMETER) TO DETECT REINFORCEMENT WHERE OTHER MEANS ARE NOT EFFECTIVE.
4. WHERE REINFORCEMENT IS ENCOUNTERED, SHIFT THE ANCHOR OR DOWEL LOCATION SO AS TO AVOID THE REINFORCEMENT BAR.
5. ALL ABANDONED HOLES SHALL BE REPAIRED USING APPROVED MATERIALS AND METHODS. SEE SPECIFICATIONS.
6. WHERE STRUCTURAL STEEL IS TO BE ATTACHED USING DRILLED ANCHORS, ANCHOR HOLES SHALL BE DRILLED PRIOR TO PREPARATION OF STEEL SHOP DRAWINGS AND FABRICATION. DRILLED HOLE LOCATIONS SHALL BE RECORDED AND TRANSFERRED USING TEMPLATES FOR THE PURPOSE OF ACCURATELY LOCATING HOLES IN STRUCTURAL STEEL.

EXPANSION ANCHORS IN CONCRETE

1. EXPANSION ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. EXPANSION ANCHORS SHALL NOT BE USED TO RESIST VIBRATORY OR SHOCK LOADS.
3. MINIMUM EXPANSION ANCHOR EMBEDMENT SHALL BE AS INDICATED IN THE APPROPRIATE TABLES BELOW, UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
4. THE OWNER'S TESTING AGENCY SHALL PERFORM TENSION LOAD TESTS ON 10% OF EXPANSION ANCHORS TO THE TENSION LOAD VALUES INDICATED IN THE TABLES BELOW. TORQUE LOAD TESTS MAY BE PERFORMED IN LIEU OF TENSION LOAD TESTS FOR NON-STRUCTURAL ANCHORS ONLY.
5. SEE SPECIFICATIONS FOR REQUIREMENTS WHEN AN EXPANSION ANCHOR FAILS A TENSION LOAD TEST. NOTIFY THE ARCHITECT IMMEDIATELY WHEN AN EXPANSION ANCHOR FAILS A TEST.
6. EXPANSION ANCHORS SPECIFICALLY NOTED ON THE DRAWINGS AS "NO TEST REQUIRED" DO NOT REQUIRE LOAD TESTS.
7. THE TESTING AGENCY SHALL DEVELOP AND UTILIZE AN EFFECTIVE METHOD OF FIELD MARKING EXPANSION ANCHOR TEST LOCATIONS AND RESULTS.
8. THE TENSION TEST VALUES FOR EXPANSION ANCHORS ARE BASED ON THE LESSER OF THE FOLLOWING:
   - 200% OF THE SEISMIC DESIGN STRENGTH VALUES AS COMPUTED IN ACCORDANCE WITH ACI 318-08 AND THE INTERNATIONAL CODE COUNCIL EVALUATION SERVICES (ICC-ES) TEST REPORTS FOR THE MANUFACTURERS LISTED IN THE SPECIFICATIONS FOR 2,500 PSI CONCRETE AND,
   - 80% OF THE SPECIFIED YIELD STRENGTH OF THE EXPANSION ANCHOR.
9. TENSION TEST VALUES ARE "FREE-FIELD" VALUES AND APPLY ONLY FOR DOWELS AND ANCHORS WITH NO REDUCTIONS IN STRENGTH DUE TO SPACING AND EDGE DISTANCE. FOR EXPANSION ANCHORS INSTALLED LESS THAN 1.5x DESIGN DEPTH (Hef) FROM THE EDGE OF CONCRETE, TENSION TEST VALUES BELOW SHALL BE REDUCED BY 50%.
10. NOTE THAT HOLE DEPTH, ho, IS LARGER THAN EMBEDMENT, hef, LISTED IN TABLE
11. EXPANSION ANCHORS PLACED IN CONCRETE SHALL CONFORM TO ICC REPORTS ESR-1917, ESR-1771, OR APPROVED EQUAL.
12. EXPANSION ANCHORS SPECIFIED ON THE DRAWINGS SHALL BE HILTI KB-TZ WITH EMBEDMENT DEPTHS SHOWN ON THE TABLES BELOW. AT THE CONTRACTORS OPTION, AND AT NO ADDITIONAL EXPENSE TO THE PROJECT, THE CONTRACTOR MAY SUBSTITUTE A SIMPSON STRONG-BOLT ANCHOR PER THE TABLE LISTED BELOW.

EXPANSION ANCHORS (EXA) INSTALLED IN NORMAL WEIGHT CONCRETE (HILTI Kwik Bolt TZ)

ANCHOR DIAMETER	Hef, Design Depth	TENSION TEST LOAD (Pounds)	TORQUE TEST (ft-lbf)
3/8"	2"	2200	25
1/2"	3.75"	4600	40
5/8"	4"	6000	60
3/4"	4.75"	8600	110

NORMAL WEIGHT CONCRETE SUBSTITUTION TABLE

HILTI KB-TZ	SIMPSON STRONG-BOLT			
ANCHOR DIAMETER	ANCHOR DIAMETER	Hef, Design Depth	TENSION TEST LOAD (Pounds)	TORQUE TEST (ft-lbf)
3/8"	1/2"	2.25"	2800	50
1/2"	5/8"	4.5"	5100	85
5/8"	3/4"	6.75"	6400	180
3/4"	1"	9"	9200	230

EXPANSION ANCHORS IN CONCRETE (continued)

EXPANSION ANCHORS (EXA) INSTALLED IN LIGHTWEIGHT CONCRETE (HILTI Kwik Bolt TZ)

ANCHOR DIAMETER	Hef, Design Depth	TENSION TEST LOAD (Pounds)	TORQUE TEST (ft-lbf)
3/8"	2"	1300	25
1/2"	3.75"	2700	40
5/8"	4.75"	3600	60
3/4"	5.75"	5100	110

LIGHTWEIGHT CONCRETE SUBSTITUTION TABLE

HILTI KB-TZ	SIMPSON STRONG-BOLT			
ANCHOR DIAMETER	ANCHOR DIAMETER	Hef, Design Depth	TENSION TEST LOAD (Pounds)	TORQUE TEST (ft-lbf)
3/8"	1/2"	2.25"	1700	50
1/2"	5/8"	4.5"	3000	85
5/8"	3/4"	6.75"	3800	180
3/4"	1"	9"	5500	230

RESIN ANCHORS AND DOWELS IN CONCRETE

1. DRILLED RESIN ANCHORS AND DOWELS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. DRILLED RESIN ANCHORS AND DOWELS SHALL NOT BE USED TO RESIST VIBRATORY OR SHOCK (IMPACT) LOADS.
3. MINIMUM ANCHOR OR DOWEL EMBEDMENT SHALL BE AS INDICATED IN THE APPROPRIATE TABLES BELOW, UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
4. ANCHORS SHALL BE ASTM A307 ALL-THREAD ROD, EXCEPT AS NOTED OTHERWISE ON THE DRAWINGS OR IN THE SPECIFICATIONS. DOWELS SHALL BE ASTM A 615 GRADE 60, EXCEPT AS NOTED OTHERWISE ON DRAWINGS OR IN THE SPECIFICATIONS.
5. THE OWNERS TESTING AGENCY SHALL PERFORM TENSION LOAD TESTS ON 10% OF RESIN ANCHORS AND DOWELS TO THE TENSION LOAD VALUES INDICATED IN THE TABLES BELOW.
6. WHEN ANCHOR OR DOWEL FAILS A TENSION LOAD TEST, NOTIFY THE ARCHITECT IMMEDIATELY. REFER TO SPECIFICATIONS FOR REPLACEMENT AND RETESTING REQUIREMENTS. ABANDONED HOLES SHALL BE PATCHED.
7. ANCHORS AND DOWELS SPECIFICALLY NOTED ON THE DRAWINGS AS "NO TEST REQUIRED," DO NOT REQUIRE LOAD TESTS.
8. THE OWNER'S TESTING AGENCY SHALL DEVELOP AND UTILIZE AN EFFECTIVE METHOD FOR FIELD MARKING LOCATIONS OF ANCHOR AND DOWEL TESTS.
9. THE TENSION LOAD TEST VALUES FOR ANCHORS ARE BASED ON THE LESSER OF THE FOLLOWING:
   - 150% OF THE STATIC DESIGN STRENGTH VALUES AS COMPUTED IN ACCORDANCE WITH ACI 318-05 AND THE INTERNATIONAL CODE COUNCIL EVALUATION SERVICES (ICC-ES) TEST REPORTS FOR THE MANUFACTURERS LISTED IN THE SPECIFICATION FOR 2500 PSI CONCRETE, AND
   - 80% OF THE SPECIFIED YIELD STRENGTH OF THE DOWEL OR ANCHOR.
10. TENSION TEST VALUES BELOW ARE "FREE-FIELD" VALUES AND APPLY ONLY FOR DOWELS AND ANCHORS WITH NO REDUCTIONS IN STRENGTH DUE TO SPACING AND EDGE DISTANCE. FOR DOWELS OR ANCHORS INSTALLED LESS THAN 1.5x MINIMUM EMBEDMENT (Hef) FROM THE EDGE OF CONCRETE, TENSION TEST SHALL BE REDUCED BY 50%. THIS TABLE (EMBEDMENT DEPTHS & TEST VALUES) APPLY ONLY TO ITEMS SPECIFICALLY CALLED OUT AS RESIN ANCHORS / DOWELS ON THE DRAWINGS, OR FOR ITEMS WHERE RESIN ANCHORS / DOWELS ARE LISTED AS AN OPTION.
11. EPOXY ANCHORS PLACED IN CONCRETE SHALL CONFORM TO ICC REPORTS ESR-2322, ESR-2508, OR APPROVED EQUAL.

RESIN DOWELS INSTALLED IN EXISTING CONCRETE

BAR SIZE	MINIMUM EMBEDMENT	TENSION TEST LOAD (Pounds)	
		NORMAL WT CONC.	LIGHT WT CONC.
#3	4"	5,300	5,200
#4	6"	9,400	9,400
#5	7 1/2"	14,700	13,700
#6	9"	21,200	16,900
#7	10"	28,800	18,900
#8	12"	37,600	30,200

RESIN ANCHORS INSTALLED IN EXISTING CONCRETE

ANCHOR DIAMETER	MINIMUM EMBEDMENT	TENSION TEST LOAD (Pounds)	
		NORMAL WT CONC.	LIGHT WT CONC.
3/8"	3 3/8"	3,200	3,200
1/2"	4 1/2"	5,600	5,600
5/8"	5 5/8"	9,200	9,200
3/4"	6 3/4"	13,200	12,700
7/8"	8"	18,400	14,900
1"	10"	24,400	22,600

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F/E Job #13-059

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
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	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
GENERAL NOTES

SHEET No
S0.2

PATCHING OF SPALLS IN EXISTING CONCRETE

1. GENERAL
   - A. REFER TO SPECIFICATIONS FOR APPROVED PATCHING PRODUCT MANUFACTURERS.
   - B. PREPARATION, MIXING, APPLICATION, AND FINISH SHALL BE ACCORDING TO PRODUCT MANUFACTURER'S RECOMMENDATIONS.
   - C. FOR EXTENT AND LOCATION OF EXISTING CONCRETE REPAIR, SEE ARCHITECTURAL DRAWINGS.
2. SPALLS WHERE EXISTING REINFORCING IS NOT EXPOSED (SURFACE SPALLS)
   - A. REMOVE ALL LOOSE MATERIAL TO EXPOSE SOUND EXISTING CONCRETE. SURFACE OF EXISTING CONCRETE SHALL BE CLEANED AND PREPARED ACCORDING TO THE PRODUCT MANUFACTURER'S RECOMMENDATIONS PRIOR TO APPLICATION OF PATCHING MATERIAL.
3. SPALLS WHERE EXISTING REINFORCMENT IS EXPOSED
   - A. REMOVE ALL LOOSE MATERIAL TO EXPOSE SOUND EXISTING CONCRETE.
   - B. REMOVE EXISTING CONCRETE TO CREATE 1"CLEAR AROUND REINFORCEMENT AND AT EACH END OF EXISTING SPALLS TO PROVIDE SPACE FOR THE PATCH MATERIAL TO SURROUND THE EXISTING REINFORCEMENT. THE SURFACE OF EXISTING SOUND CONCRETE SHALL BE CLEANED AND PREPARED ACCORDING TO THE PRODUCT MANUFACTURER'S RECOMMENDATIONS, INCLUDING APPLICATION OF A CHEMICAL BONDING AGENT.
   - C. EXPOSED REINFORCEMENT SHALL BE CLEANED AND COATED WITH AN APPROVED CORROSION INHIBITOR IN ACCORDANCE WITH THE PRODUCT MANUFACTURER'S RECOMMENDATIONS.
   - D. THE SPALL SHALL BE PATCHED USING A CEMENTITIOUS PATCHING MATERIAL, FORMED EDGES, AND WITH COARSE AGGREGATE AS REQUIRED.
4. SUBMITTALS
   - A. CONTRACTOR SHALL SUBMIT TECHNICAL INFORMATION FOR PROPOSED REPAIR PRODUCTS TO THE ARCHITECT FOR REVIEW AT LEAST FIVE WORKING DAYS BEFORE INTENDED USE.

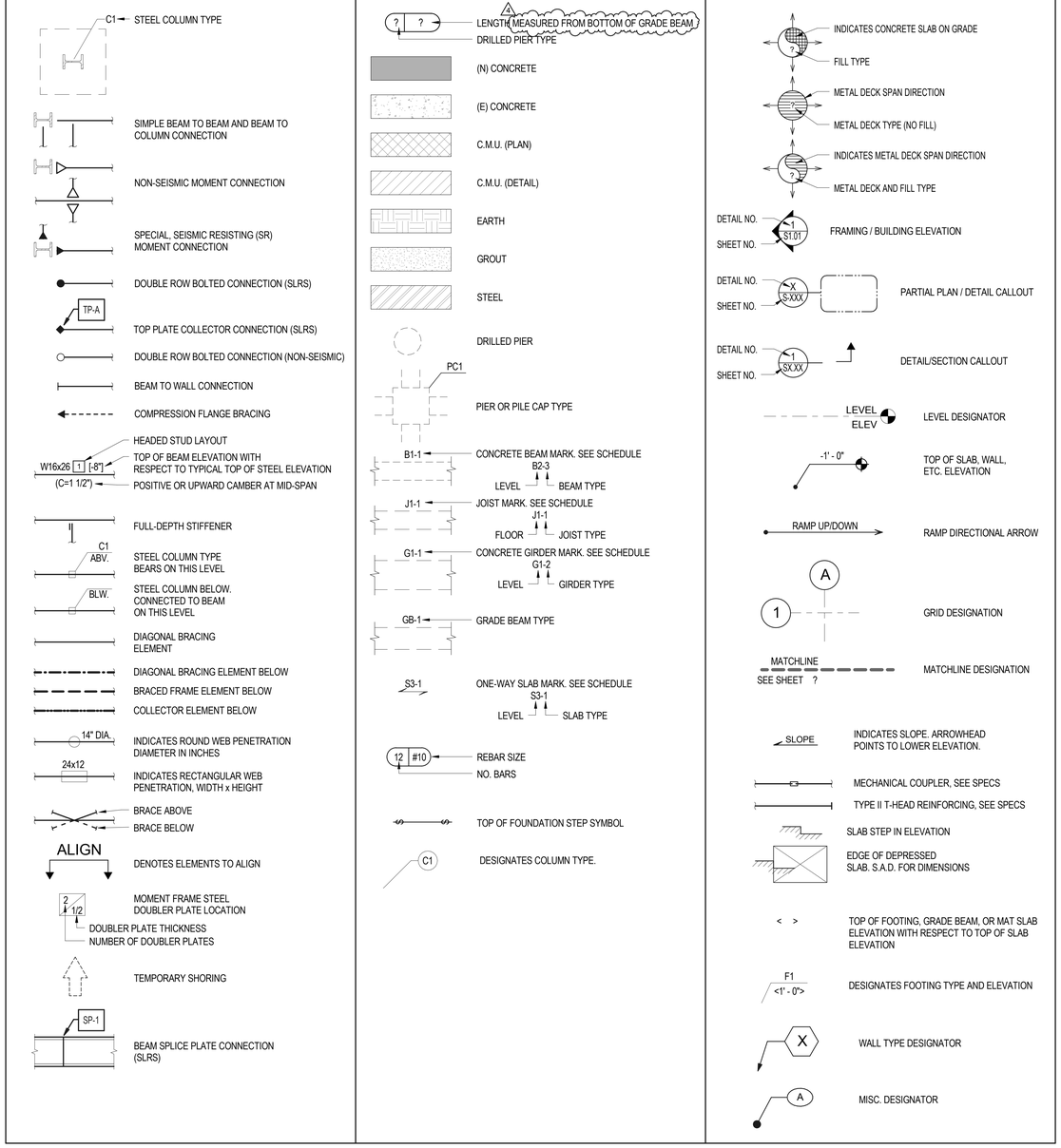
EPOXY INJECTION OF CRACKS IN EXISTING CONCRETE

1. CLEAN ALL AREAS OF EXISTING CONCRETE ADJACENT TO CRACKS TO BE INJECTED. ALL SURFACE DIRT, LAITANCE, GREASE, OR OTHER FOREIGN MATTER SHALL BE COMPLETELY REMOVED FROM THE AREA AROUND THE CRACKS.
2. SURFACE AREA WITHIN CRACKS SHALL BE CLEANED BY VACUUM PROCESS, BLOWING OUT, OR OTHER EFFECTIVE MEANS.
3. ALL CRACKS TO BE PORTED AND SEALED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS. INJECTION AND CURING OF EPOXY RESIN ADHESIVE SHALL BE IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
4. CORE SAMPLES OF THE INJECTED CONCRETE SHALL BE TESTED FOR VOID PENETRATION AND COMPRESSIVE STRENGTH.
5. SURFACE OF REPAIRED CONCRETE SHALL BE CLEANED AND ALL TEST CORE HOLES SHALL BE PATCHED.

BUCKLING-RESTRAINED BRACES

1. BUCKLING-RESTRAINED BRACES SHALL BE DESIGNED BY A STRUCTURAL ENGINEER REGISTERED IN THE STATE OF CALIFORNIA, HIRED AND PAID BY THE CONTRACTOR, TO ACHIEVE THE TABULATED DESIGN PARAMETERS SHOWN ON THE DRAWINGS. THESE PARAMETERS INCLUDE YIELD LOAD, CORE PLATE INITIAL STIFFNESS, MINIMUM ELONGATION CAPACITY, AND MAXIMUM CASING DIMENSION.
2. SEE DRAWINGS AND SPECIFICATIONS FOR OTHER REQUIREMENTS.

LEGEND



Master - Abbreviations

&	AND
@	AT
A.B.	ANCHOR BOLT
ABV.	ABOVE
ALT.	ALTERNATE
A.R.	ANCHOR ROD
BLW.	BELOW
BM.	BEAM
B.O.	BOTTOM OF
BOTT.	BOTTOM
BRG.	BEARING
B.S.	BACK SIDE
BTW.	BETWEEN
C.I.P.	CAST-IN-PLACE
C.J.	CONSTRUCTION JOINT
CJP.	COMPLETE PENETRATION JOINT
C.L.	CENTERLINE
CLR.	CLEAR
C.M.U.	CONCRETE MASONRY UNIT
COL.	COLUMN
CONC.	CONCRETE
COND.	CONDITION
CONN.	CONNECTION
CONT.	CONTINUOUS
CTR'D.	CENTERED
C.S.	CONCRETE SCREW
D.B.A.	DEFORMED BAR ANCHOR
DBL.	DOUBLE
DET.	DETAIL
DIA. or Ø	DIAMETER
DIAG.	DIAGONAL
DN.	DOWN
DWG.	DRAWING(S)
DWL.	DOWEL
(E)	EXISTING
EA.	EACH
E.F.	EACH FACE
E.J.	EXPANSION JOINT
EL. or ELEV.	ELEVATION
E.P.S.	EXPANDED POLYSTYRENE
EQ.	EQUAL
E.S.	EACH SIDE
E.W.	EACH WAY
EXA	EXPANSION ANCHOR
FDN.	FOUNDATION
FIN.	FINISH
FLG.	FLANGE
FLR.	FLOOR
F.O.C.	FACE OF CONCRETE
F.O.W.	FACE OF WALL
FRMG.	FRAMING
F.S.	FAR SIDE
FTG.	FOOTING
GALV.	GALVANIZED
G.B.	GRADE BEAM
GR.	GRADE
H. or HORIZ.	HORIZONTAL
HDR.	HEADER
H.S.	HEADED STUD
HSB	HIGH STRENGTH BOLT
HSS	HOLLOW STRUCTURAL SHAPE
I.F.	INSIDE FACE
JT.	JOINT
LLH.	LONG LEG HORIZONTAL
LLV.	LONG LEG VERTICAL
MAX.	MAXIMUM
MB	MACHINE BOLT
MIN.	MINIMUM
(N)	NEW
N/A	NOT APPLICABLE
N.I.C.	NOT IN CONTRACT
N.S.	NEAR SIDE
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
O.F.	OUTSIDE FACE
O.H.	OPPOSITE HAND

Master - Abbreviations

OP'G. or OPG	OPENING
PJP	PARTIAL JOINT PENETRATION
PL.	PLATE
R.A.	RESIN ANCHOR
R.D.	RESIN DOWEL
REINF.	REINFORCING
REQ.	REQUIRED
R.O.	ROUGH OPENING
S.A.D.	SEE ARCHITECTURAL DRAWINGS
S.C.D.	SEE CIVIL DRAWINGS
SECT.	SECTION
S.E.D.	SEE ELECTRICAL DRAWINGS
SHT.	SHEET(S)
SIM.	SIMILAR
S.J.	SEISMIC JOINT
S.M.D.	SEE MECHANICAL DRAWINGS
S.M.S.	SHEET METAL SCREW
S.P.D.	SEE PLUMBING DRAWINGS
SPECS.	SPECIFICATIONS
SQ.	SQUARE
SLRS	SEISMIC LATERAL RESISTING SYSTEM
STAGG'D.	STAGGERED
STD.	STANDARD
STIFF.	STIFFENER
STL.	STEEL
SYMM.	SYMMETRICAL
T&B	TOP AND BOTTOM
T.B.	TIE BEAM
T.F.F.	TOP OF FINISHED FLOOR
T.O.C.	TOP OF CONCRETE
T.O.S.	TOP OF STEEL
TYP.	TYPICAL
U.A.	UNDERCUT ANCHOR
U.O.N.	UNLESS OTHERWISE NOTED
V.I.F.	VERIFY IN FIELD
(V) or VERT.	VERTICAL
W/	WITH
W/O	WITHOUT
W.P.	WORK POINT
W.T.S.	WELDED THREADED STUD
W.W.F.	WELDED WIRE FABRIC
CLSM	CONTROLLED LOW STRENGTH MATERIAL

STRUCTURAL SHEET LIST

Sheet Number	Sheet Name
S0.1	GENERAL NOTES
S0.2	GENERAL NOTES
S0.3	GENERAL NOTES, ABBREVS., LEGEND & SHEET LIST
S0.4	3D ISOMETRIC - BUILDING VIEW NW CORNER
S0.5	3D ISOMETRIC - BUILDING VIEW SE CORNER
S2.0	BASEMENT FRAMING PLAN
S2.1	1ST STORY FRAMING PLAN
S2.2	2ND STORY FRAMING PLAN
S2.3	3RD STORY FRAMING PLAN
S2.4	LOW ROOF/HIGH ROOF FRAMING PLAN
S3.1	ELEVATIONS
S3.2	ELEVATIONS
S4.1	BUILDING AND WALL SECTIONS
S4.2	BUILDING AND WALL SECTIONS
S5.1	TYPICAL CONCRETE DETAILS
S5.2	TYPICAL CONCRETE DETAILS
S5.3	CONCRETE FOUNDATION DETAILS
S5.4	TYPICAL CONCRETE DETAILS
S5.5	TYPICAL CONCRETE DETAILS
S5.6	CONCRETE DETAILS
S6.1	TYPICAL STEEL DETAILS
S6.2	TYPICAL STEEL DETAILS
S6.3	TYPICAL STEEL DETAILS
S6.4	TYPICAL METAL DECK DETAILS
S6.5	TYPICAL METAL DECK DETAILS
S6.6	BRACE FRAME DETAILS
S6.7	STEEL DETAILS
S6.8	STEEL DETAILS

STRUCTURAL SHEET LIST

Sheet Number	Sheet Name

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F/E Job #13-059

PROJECT

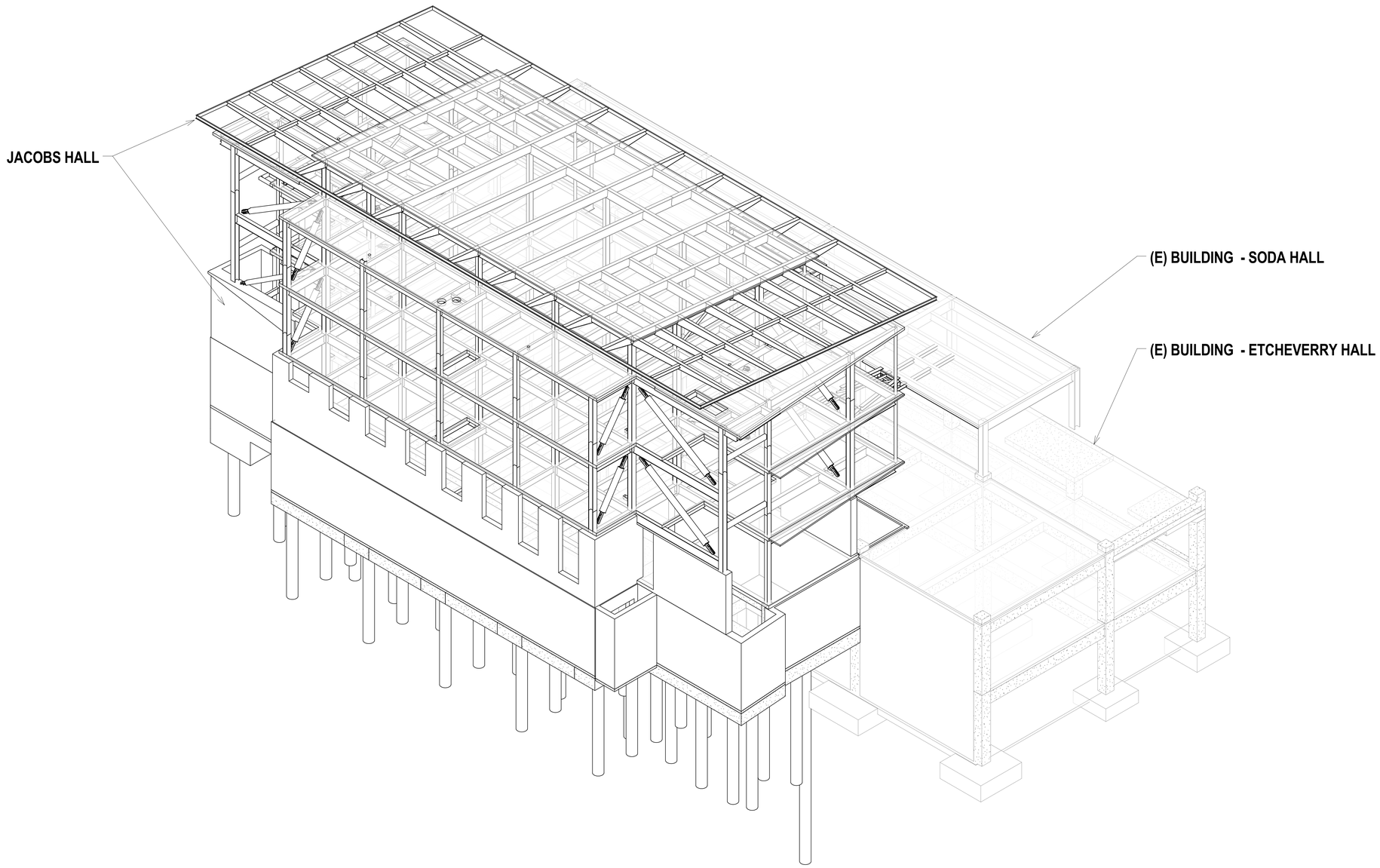
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
GENERAL NOTES, ABBREVS., LEGEND & SHEET LIST

SHEET No
S0.3



3D ISOMETRIC - BLDG VIEW NW CORNER

1
S0.4

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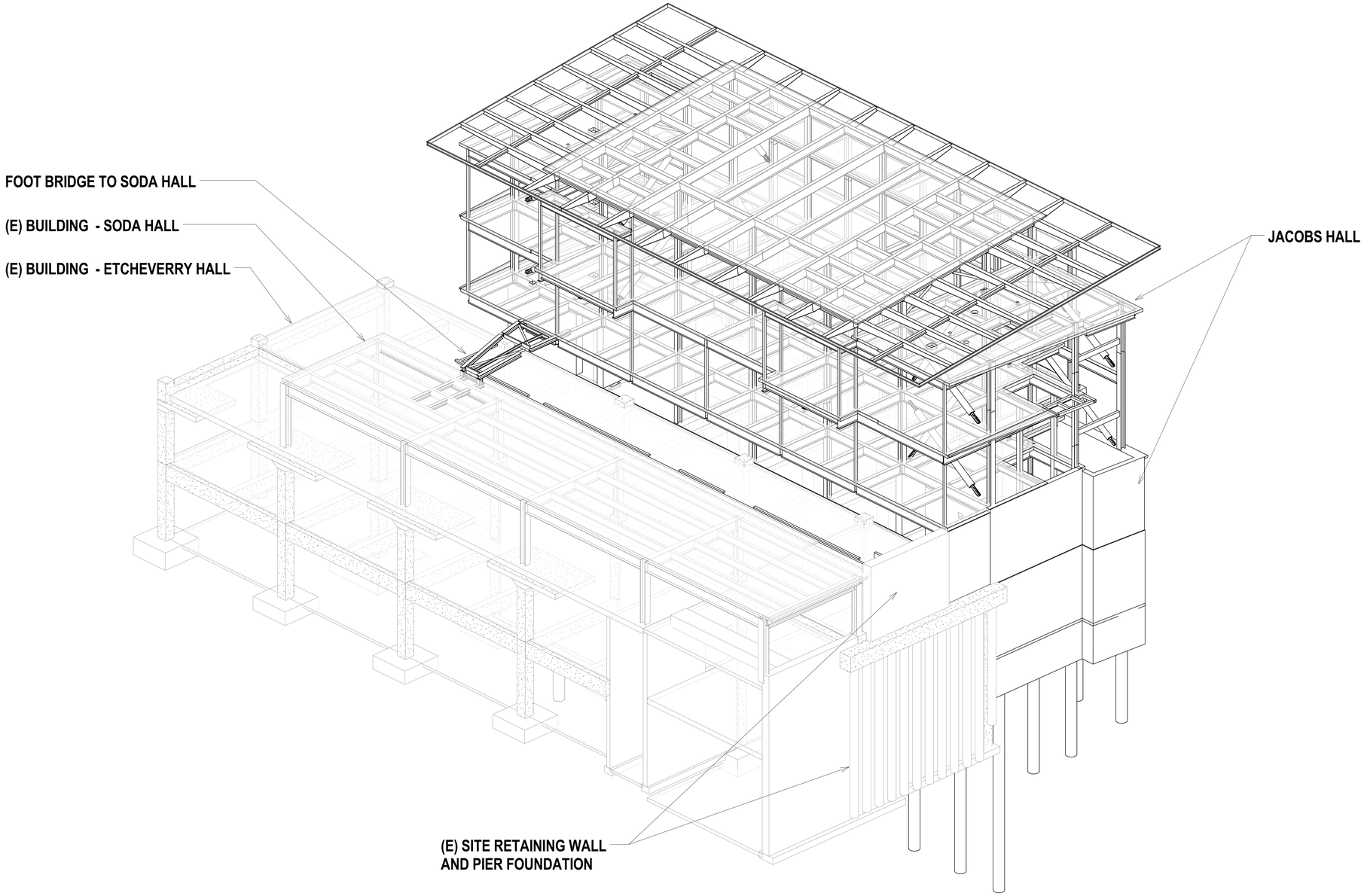
3D ISOMETRIC - BUILDING VIEW NW CORNER

SHEET No

S0.4



3D ISOMETRIC - BUILDING VIEW SE CORNER

1
S0.5

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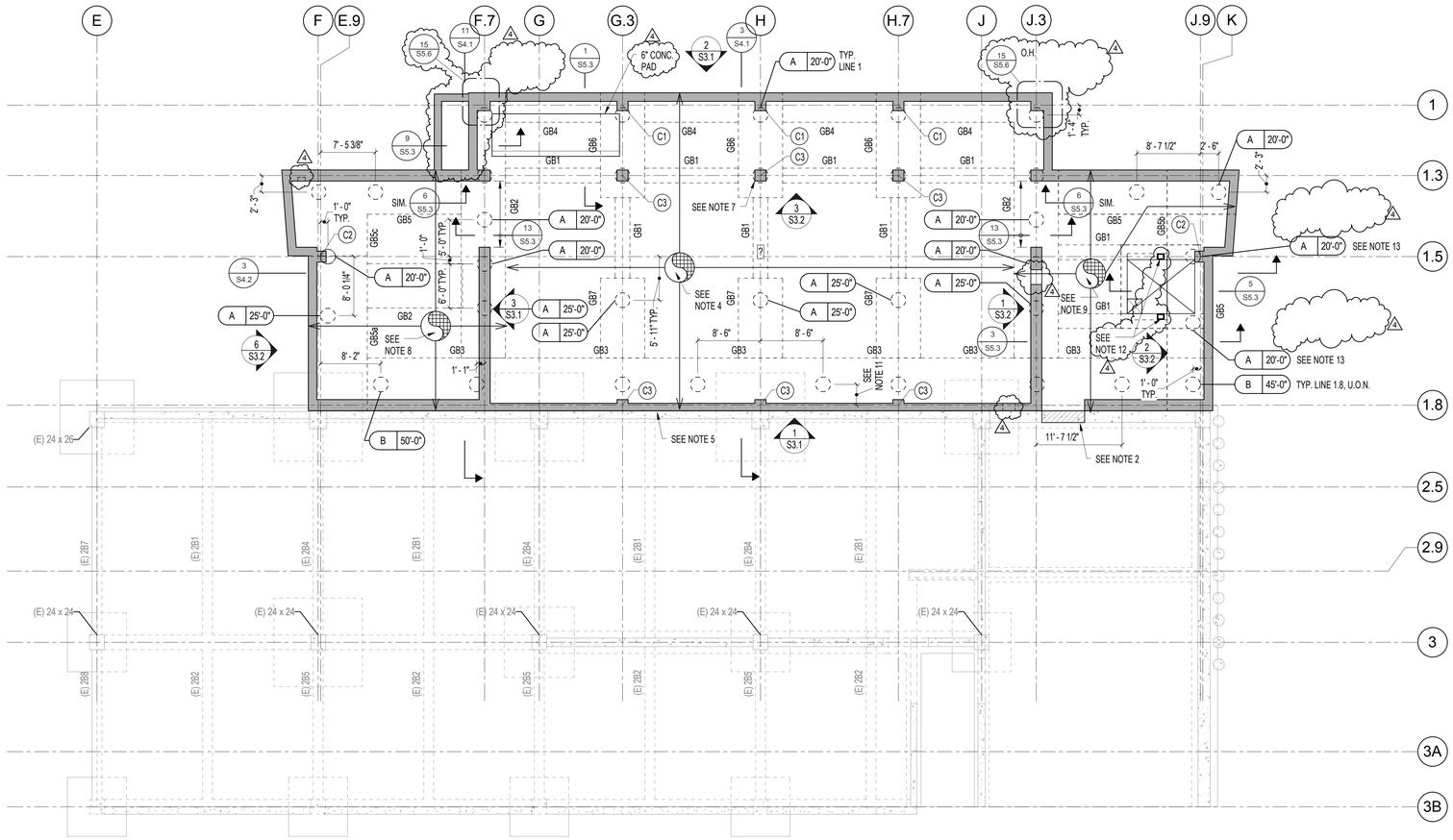
SHEET TITLE

3D ISOMETRIC - BUILDING VIEW SE CORNER

SHEET No

S0.5



BASEMENT FRAMING PLAN

1/8" = 1'-0" (1 / S2.0)

N

PLAN NOTES

***REFER TO S0.1 FOR TYPICAL PLAN NOTES**

1. FOR DRILLED PIER TYPE A, SEE 18/S5.2, FOR DRILLED PIER TYPE B, SEE 22/S5.2
2. SAWCUT EXISTING CONCRETE WALL FOR NEW DOOR OPENING, REFER TO 20 / S5.1. WALL SHALL BE SCANNED TO DETERMINE LOCATION OF (E) REINFORCEMENT. LAYOUT OF (E) REINFORCEMENT SHALL BE PROVIDED TO A.O.R. AND S.E.O.R. FOR REVIEW PRIOR TO SAWCUTTING. S.A.D. FOR OPENING DIMENSIONS.
3. PIER DEPTHS NOTED ARE FROM BOTTOM OF GRADE BEAM, SEE LEGEND. 4
4. 6" SLAB ON GRADE w/ #5 @ 12" O.C. EACH WAY AT MID-DEPTH OF SLAB. T.O.S. ELEVATION = **340'-2 1/2"**.
5. PROVIDE 1" MIN JOINT BETWEEN EDGE OF NEW GRADE BEAM AND EXISTING STRUCTURE. JOINT TO BE MAINTAINED THROUGH SLAB ON GRADE.
6. SEE 1/S5.2 FOR GRADE BEAM SCHEDULE.
7. SEE 2/S5.5 FOR COLUMN SCHEDULE.
8. 6" SLAB ON GRADE w/ #6 @ 12" O.C., EACH WAY, SEE NOTE 4 FOR T.O.S. ELEV. 3 4
9. 12" SLAB ON GRADE w/ #5 @12" O.C. EACH WAY T&B, SEE NOTE 4 FOR T.O.S. ELEV.
10. REFER TO FRAME ELEVATIONS FOR FRAME COLUMN SIZES AND DETAILS FOR CONNECTION TO CONCRETE SHEAR WALLS.
11. REFER TO SECTION 11/S4.1 FOR PIER LOCATION WITH RESPECT TO EXISTING FOUNDATION ELEMENTS. TYP. AT GRIDLINE 1.8.
12. HSS8X10X3/8 GUIDERAIL SUPPORT TUBES, SEE 10/S6.3 FOR CONNECTION DETAILS.
13. EPOXY WATERPROOFING ON PIER HEADS IS ACCEPTABLE PROVIDED EPOXY IS "HI MOD" AND BRUSH APPLIED. EPOXY SHALL NOT BE APPLIED TO PIER REINF.
14. ALLOW (16) GRADE BEAM PENETRATIONS FOR MEP NOT SHOWN, THIS FLOOR. REFER TO 12 / S5.2 FOR DETAILING AND LOCATION REQUIREMENTS. 4 SUBMIT PROPOSED LAYOUT FOR APPROVAL.

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UNIVERSITY OF CALIFORNIA, BERKELEY

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	CM/Contractor RFP	03/31/14
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4	100% CDs / Permit Submission	08/15/14

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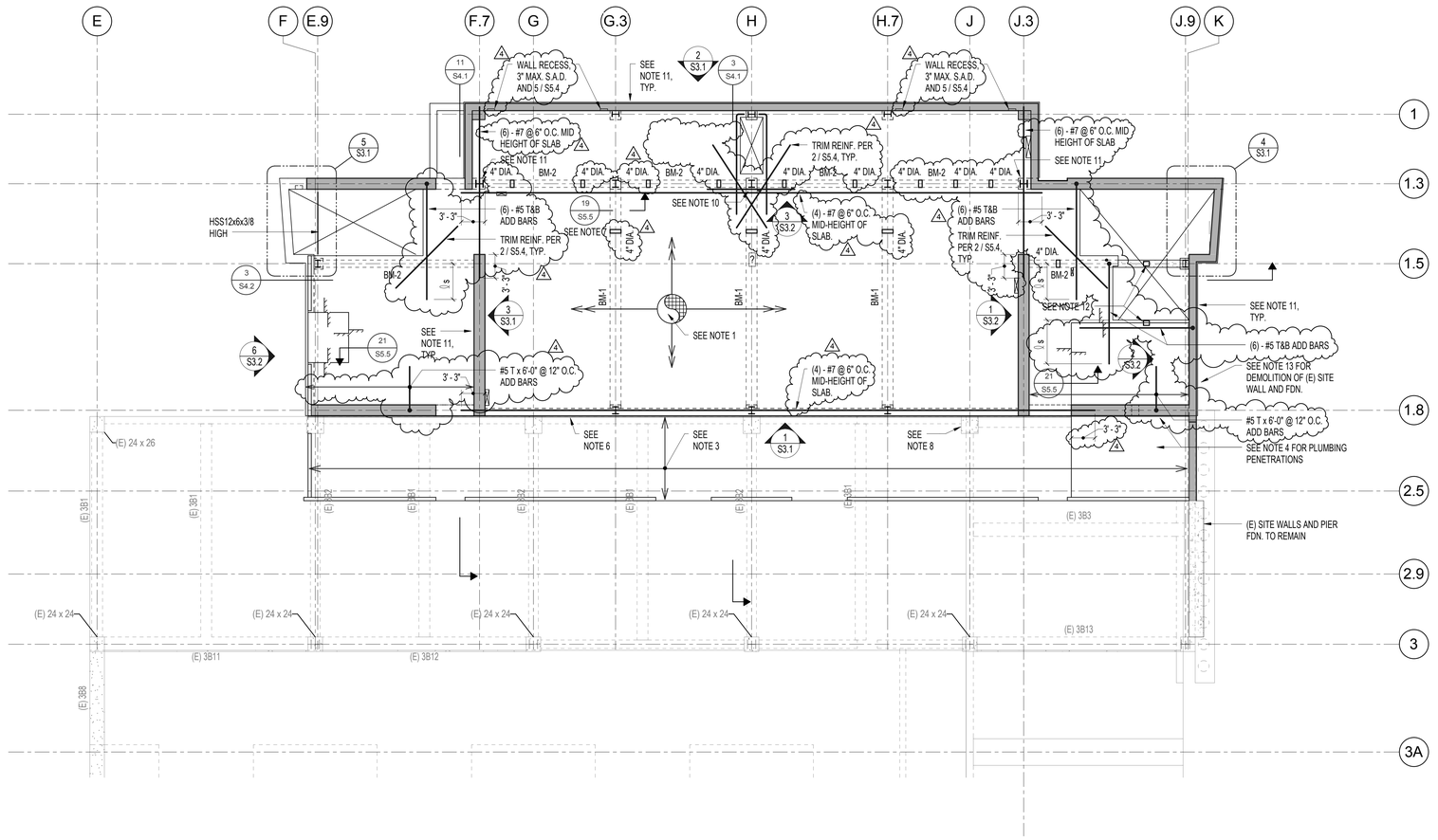
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
BASEMENT FRAMING PLAN

SHEET No
S2.0



1ST STORY FRAMING PLAN

1/8" = 1'-0" (1 / S2.1)

N

PLAN NOTES

***REFER TO S0.1 FOR TYPICAL PLAN NOTES**

1. 8" CONCRETE SLAB w/ #5 @ 12" O.C., E.W., T&B. T.O.S. ELEVATION = **355'-3"**. EAST-WEST REINFORCEMENT IS PRIORITY REINF., SEE 24 / S5.5 FOR LAYERING. REFER TO 16 / S5.5 FOR SLAB REINF. LAYOUT.
2. REFER TO 13 / S5.5 FOR BEAM SCHEDULE.
3. 4" TOPPING SLAB w/ WWF4x4-W4xW4, S.A.D. FOR EXTENTS. PROVIDE #3 VERTICAL R.D. INTO EXISTING ETCHEVERRY SLAB AT 2'-0" OC AROUND PERIMETER AND ALONG EXISTING ETCHEVERRY SLAB SUPPORT BEAMS BELOW.
4. PENETRATIONS REQUIRED IN ETCHEVERRY LEVEL 3 SLAB AND EXTERIOR BASEMENT WALL BELOW LEVEL 3. MAXIMUM SIZE IS 6" DIA. USE NON-DESTRUTIVE METHODS ON THE SLAB AND WALL TO LOCATE AND AVOID (E) REINF. PROVIDE 1" CLEAR BETWEEN PENETRATION AND REINF.
5. NOT USED.
6. PROVIDE 1" MIN. JOINT BETWEEN EDGE OF NEW SLAB AND EXISTING STRUCTURE, REFER TO 11 / S5.5. JOINT TO BE MAINTAINED THROUGH TO BASEMENT LEVEL.
7. DETAIL PROVIDES TYPICAL BEAM REINF. LAYERING. NORTH - SOUTH BEAMS TAKE PRIORITY AND EAST - WEST BEAM REINF. SHALL BE OFFSET TO ACCOMODATE.
8. DEMO EXISTING 1'-4" CONCRETE PEDESTALS ON ETCHEVERRY SLAB AND 6" CONCRETE PROTRUSIONS NORTH FACE OF ETCHEVERRY BASEMENT WALL. TYPICAL AT GRIDLINES F, G, H, J, AND K. EXPOSED CUT ENDS OF (E) REINFORCEMENT SHALL BE GROUND BACK 1-1/2" AND PATCHED WITH NON-SHRINK GROUT.
9. ALLOW (12) 6" DIA. CONCRETE BEAM PENETRATIONS FOR PLUMBING & ELECTRICAL & FIRE SPRINKLER NOT SHOWN, THIS FLOOR. REFER TO 4 / S5.5 FOR DETAILING AND LOCATION REQUIREMENTS. SUBMIT PROPOSED LAYOUT FOR APPROVAL.
10. SEE 2/S5.5 FOR COLUMN SCHEDULE.
11. REFER TO FRAME ELEVATIONS FOR FRAME COLUMN SIZES AND DETAILS FOR CONNECTION TO CONCRETE SHEAR WALLS.
12. HSS8X10X3/8 GUIDERAIL SUPPORT TUBES, SEE 5 AND 10/S6.3 FOR CONNECTION DETAILS.
13. DEMO EXISTING SITE WALL, CONVENTIONAL SHALLOW FOOTING, AND FIRST DRILLED PIER NORTH OF GRIDLINE 1.8 TO ALLOW FOR CONSTRUCTION OF (N) BUILDING. EXISTING FOUNDATION AND PIERS REMAIN BETWEEN GRIDLINE 1.8 AND 2.5 TO SUPPORT A (N) CONCRETE RETAINING WALL WITHIN THE FOOTPRINT OF THE NEW BUILDING. EXISTING PIERS AND RETAINING WALL SOUTH OF GRIDLINE 2.5 REMAIN. REFER TO 2/S3.2 FOR FURTHER CLARIFICATION.

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JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

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	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
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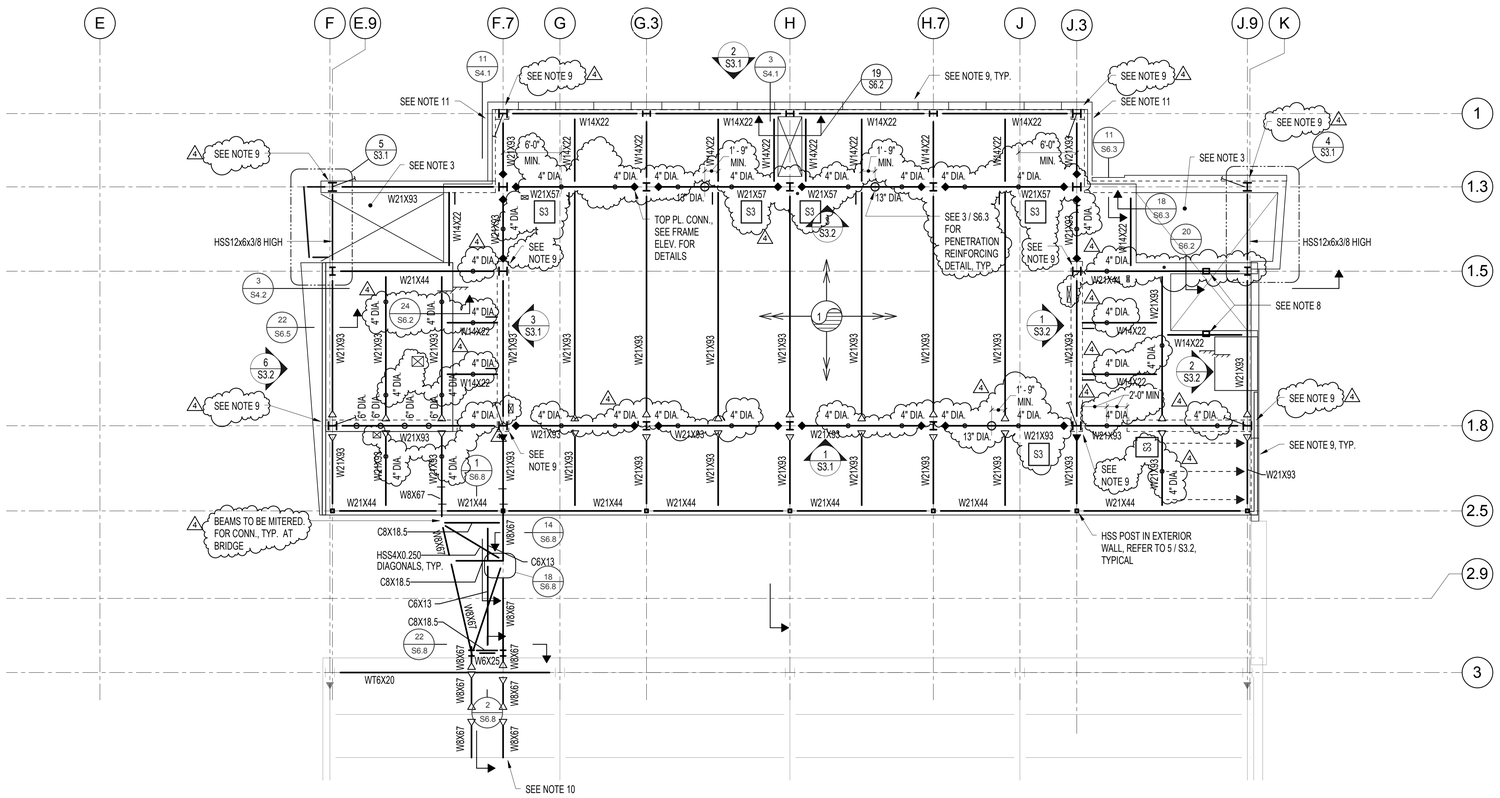
SCALE:

SHEET TITLE
1ST STORY FRAMING PLAN

SHEET No
S2.1



2ND STORY FRAMING PLAN

1/8" = 1'-0" (1 / S2.2)

N

PLAN NOTES

* REFER TO S0.1 FOR TYPICAL PLAN NOTES.

1. TYPICAL TOP OF SLAB ELEVATION: **369'-6 1/2"**
2. TYPICAL TOP OF STEEL ELEVATION: **368'-11"**
3. SEE DETAIL 6 / S6.3 FOR DESIGN BUILD STAIR REQUIREMENTS.
4. FIRE SPRINKLER AND ELECTRICAL CONDUIT TO PASS THROUGH BEAM WEBS. S.E.D. AND FIRE-LIFE SAFETY DWGS. FOR LOCATIONS. REFER TO 17 / S6.2 FOR DETAIL REQUIREMENTS.
5. NOT USED.
6. ALLOW (12) 6" DIA. STEEL PENETRATIONS FOR PLUMBING & FIRE SPRINKLER NOT SHOWN, THIS FLOOR. REFER TO 17 / S6.2 FOR DETAILING AND LOCATION REQUIREMENTS. SUBMIT PROPOSED LAYOUT FOR APPROVAL. (A)
7. ALLOW (30) - ELECTRICAL CONDUIT DECK FLUTE PENETRATIONS PER DETAIL 24 / S6.5, THIS FLOOR.
8. HSS8X10X3/8 GUIDERAIL SUPPORT TUBES, SEE 5/S6.3 FOR CONNECTION DETAILS. (A)
9. REFER TO FRAME ELEVATIONS FOR FRAME COLUMN SIZES AND DETAILS FOR CONNECTION TO CONCRETE SHEAR WALLS.
10. (N) BEAM WITHIN (E) SODA HALL SPACE. PROVIDE DEMO OF (E) FINISHES AND (E) FIREPROOFING TO FACILITATE ERECTION AND WELDING OF (N) FRAMING. PATCH FIREPROOFING AS NECESSARY.
11. BLOCKOUT INSIDE FACE OF WALL CONCRETE PLACEMENT TO ALLOW FOR BRACE AND GUSSET INSTALLATION AS NECESSARY. SUBMIT BLOCKOUT PLAN TO ENGINEER AND ARCHITECT FOR REVIEW.

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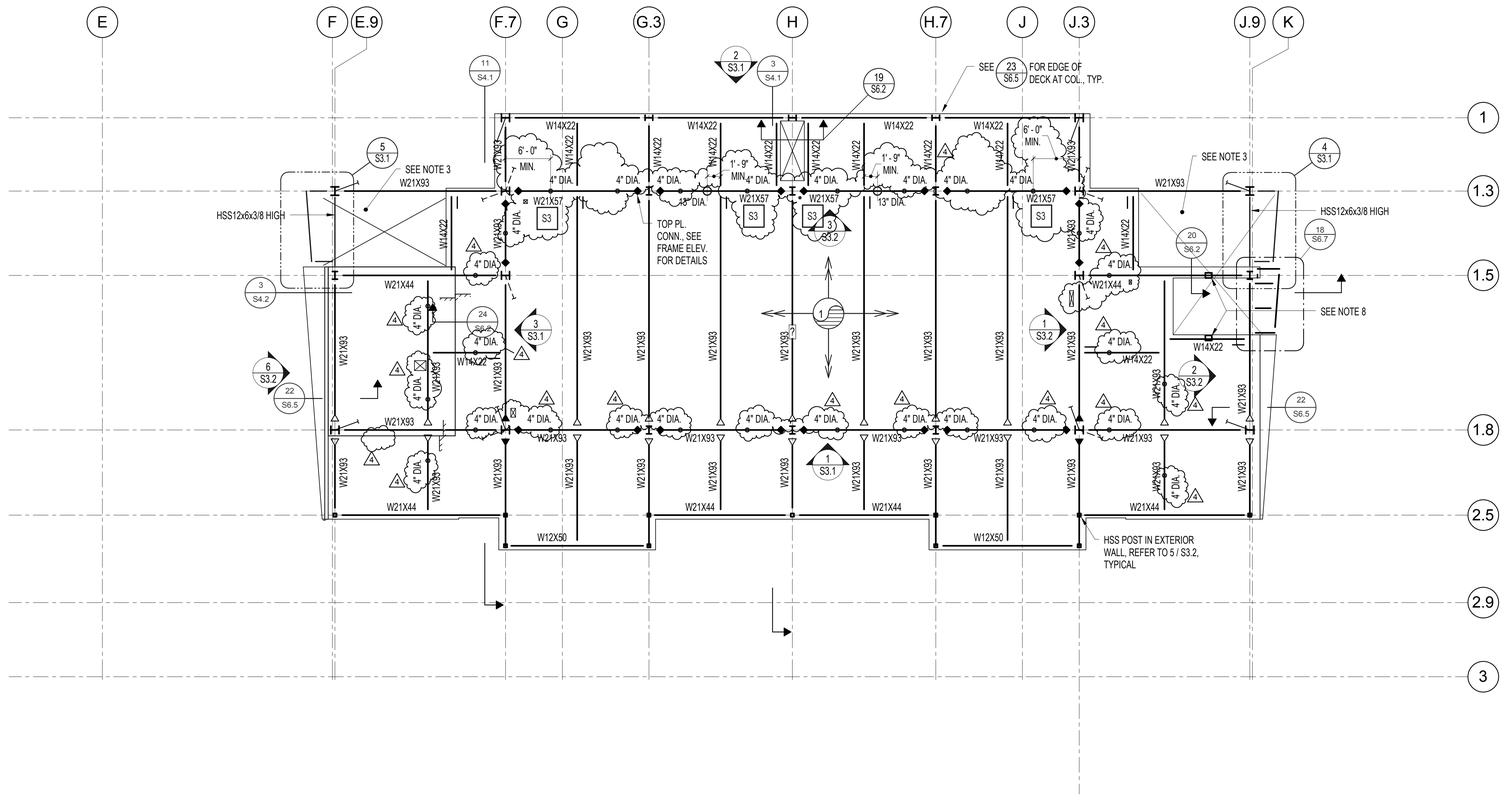
SCALE:

SHEET TITLE
2ND STORY FRAMING PLAN

SHEET No
S2.2



3RD STORY FRAMING PLAN

1/8" = 1'-0" (1 / S2.3)

N

PLAN NOTES

* REFER TO S0.1 FOR TYPICAL PLAN NOTES.

1. TYPICAL TOP OF SLAB ELEVATION: **383'-10"**
2. TYPICAL TOP OF STEEL ELEVATION: **383'-2 1/2"**
3. SEE DETAIL 6 / S6.3 FOR DESIGN BUILD STAIR REQUIREMENTS.
4. FIRE SPRINKLER AND ELECTRICAL CONDUIT TO PASS THROUGH BEAM WEBS. S.E.D. AND FIRE-LIFE SAFETY DWGS. FOR LOCATIONS. REFER TO 17 / S6.2 FOR DETAIL REQUIREMENTS.
5. NOT USED.
6. ALLOW (12) - 6" DIA. STEEL PENETRATIONS FOR PLUMBING & FIRE SPRINKLER NOT SHOWN, THIS FLOOR. REFER TO 17 / S6.2 FOR DETAILING AND LOCATION REQUIREMENTS.
4. SUBMIT PROPOSED LAYOUT FOR APPROVAL.
7. ALLOW (30) - ELECTRICAL CONDUIT DECK FLUTE PENETRATIONS PER DETAIL 24 / S6.5, THIS FLOOR.
8. HSS8X10X3/8 GUIDERAIL SUPPORT TUBES, SEE 5/S6.3 FOR CONNECTION DETAILS.
4.

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REGISTERED PROFESSIONAL ENGINEER — GARY L. WALTERS — No. S2996 Exp. 9/30/15 — STRUCTURAL — STATE OF CALIFORNIA

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PROJECT

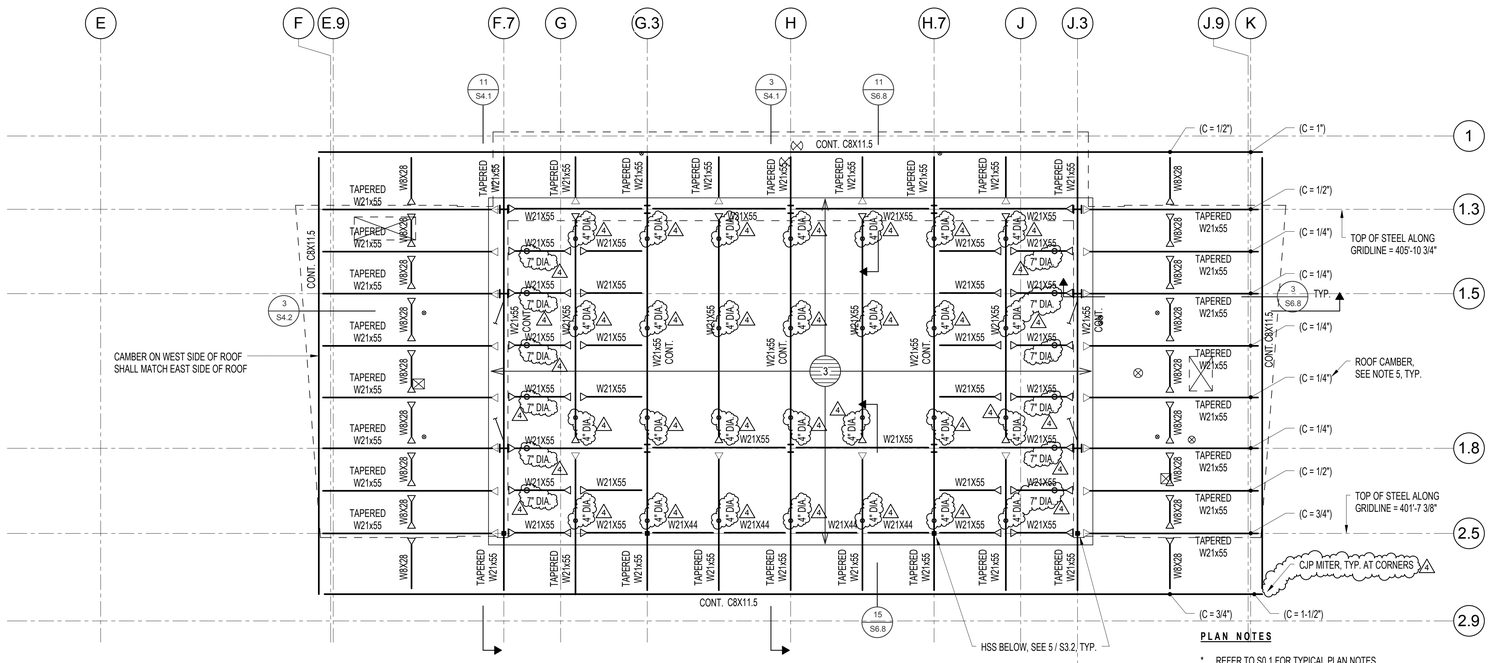
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% SD Pricing	09/11/13
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / V.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
3RD STORY FRAMING PLAN

SHEET No
S2.3



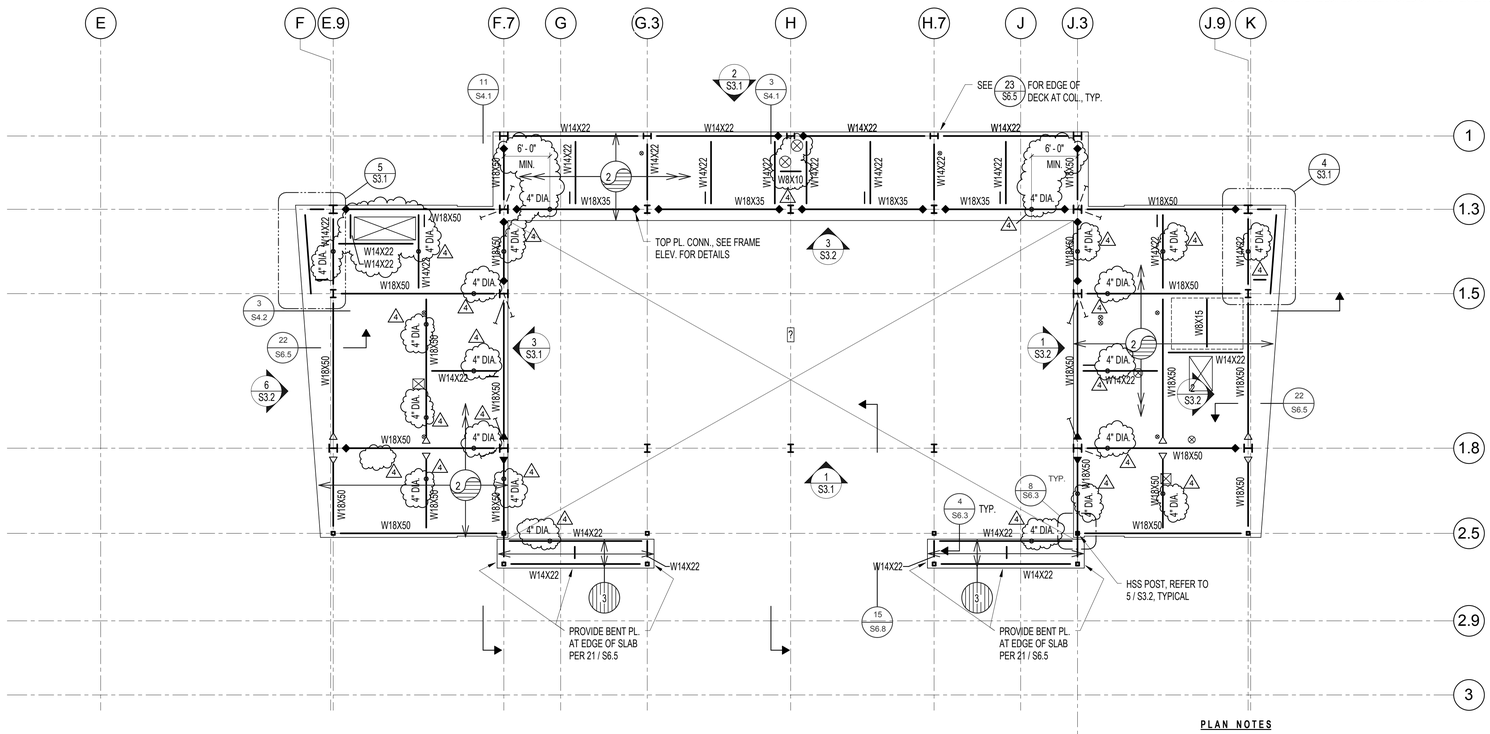
HIGH ROOF FRAMING PLAN

1/8" = 1'-0" — 1 / S2.4

PLAN NOTES

* REFER TO S0.1 FOR TYPICAL PLAN NOTES.

1. TOP OF STEEL VARIES, REFER TO PLAN. FOR EAST-WEST BEAMS SEE 16 / S6.3
2. S.A.D. FOR NUMBER AND LOCATION OF ROOF TOP FALL RESTRAINTS, REFER TO 15/S6.2 FOR CONNECTION DETAIL.
3. NOT USED.
4. ALLOW (24)-ELECTRICAL CONDUIT DECK FLUTE PENETRATIONS PER DETAIL 24 / S6.5, THIS FLOOR.
5. CAMBER THE ENDS OF THE CANTILEVERED W21x SECTIONS AS NOTED ON PLAN. CONTRACTOR TO DETERMINE APPROPRIATE MEMBERS TO CAMBER TO ACHIEVE REQUIRED CAMBER NOTED ON PLAN. EXTERIOR C8 SHALL BE CONTINUOUS.



LOW ROOF FRAMING PLAN

1/8" = 1'-0" — 2 / S2.4

PLAN NOTES

* REFER TO S0.1 FOR TYPICAL PLAN NOTES.

1. TYPICAL TOP OF SLAB ELEVATION: **398'-0 1/4"**
2. TYPICAL TOP OF STEEL ELEVATION: **397'-6"**
3. S.A.D. FOR NUMBER AND LOCATION OF ROOF TOP FALL RESTRAINTS, REFER TO 15/S6.2 FOR CONNECTION DETAIL.
4. ALLOW (12) 6" DIA. STEEL PENETRATIONS FOR PLUMBING & FIRE SPRINKLER NOT SHOWN, THIS FLOOR. REFER TO 17 / S6.2 FOR DETAILING AND LOCATION REQUIREMENTS.
5. ALLOW (18) - ELECTRICAL CONDUIT DECK FLUTE PENETRATIONS PER DETAIL 24 / S6.5, THIS FLOOR.

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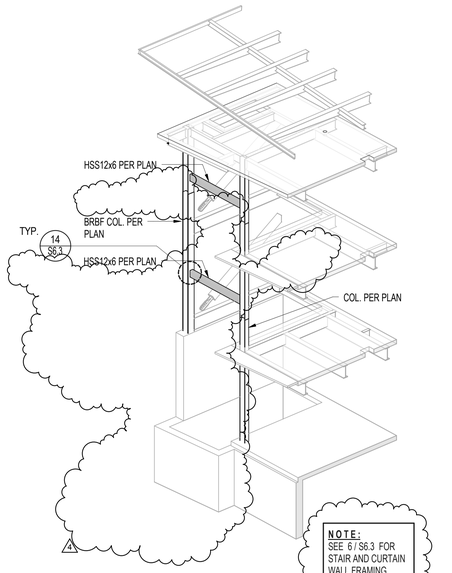
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

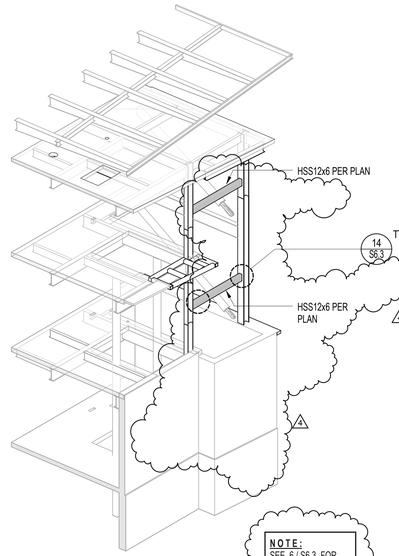
SHEET TITLE
LOW ROOF/HIGH ROOF FRAMING PLAN

SHEET No
S2.4



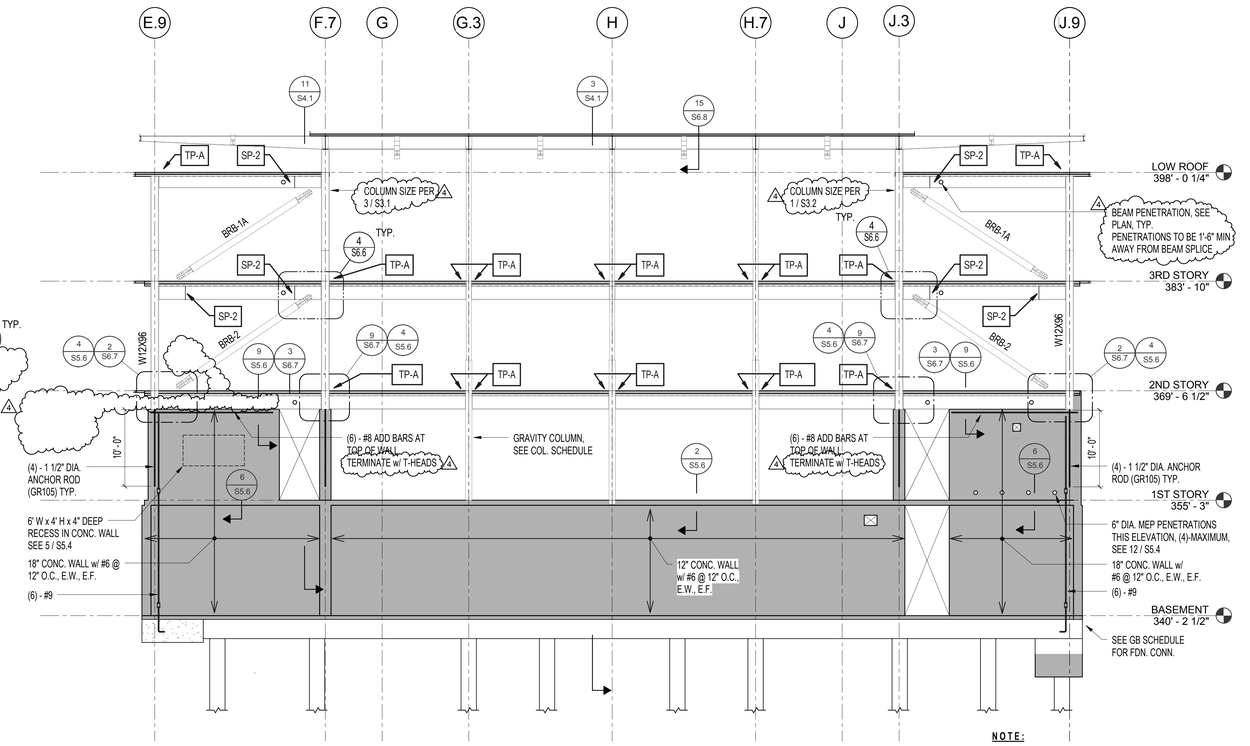
3D ISOMETRIC VIEW OF NORTH-WEST CORNER

5 S3.1



3D ISOMETRIC VIEW OF NORTH-EAST CORNER

4 S3.1

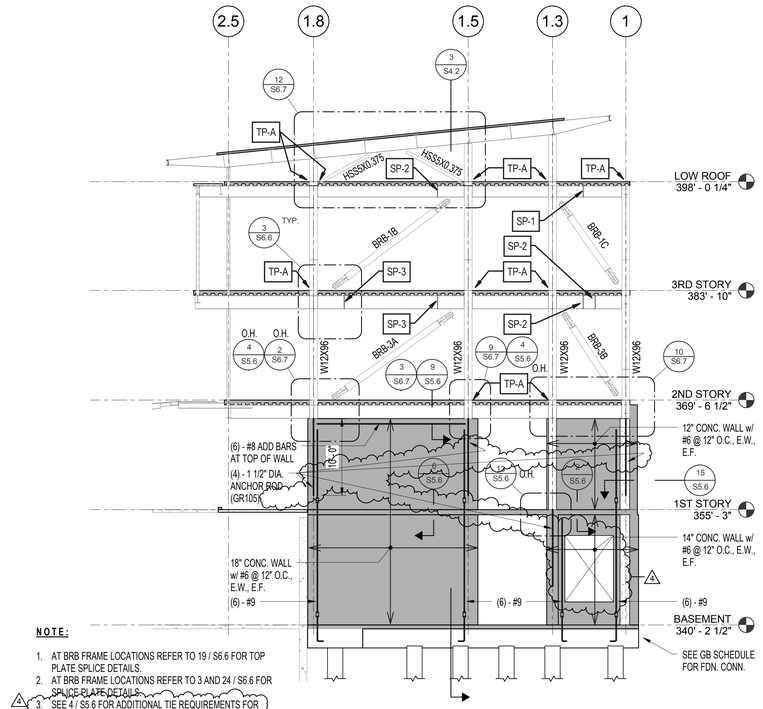


BRACED FRAME & WALL ELEVATION AT GRIDLINE 1.8

1/8" = 1'-0" 1 S3.1

NOTE:

1. AT BRB FRAME LOCATIONS REFER TO 19 / S6.6 FOR TOP PLATE SPLICE DETAILS.
2. AT BRB FRAME LOCATIONS REFER TO 3 AND 24 / S6.6 FOR SPLICE PLATE DETAILS.
4 3. SEE 4 / S5.6 FOR ADDITIONAL TIE REQUIREMENTS FOR SHEAR WALL BOUNDARY ZONES.

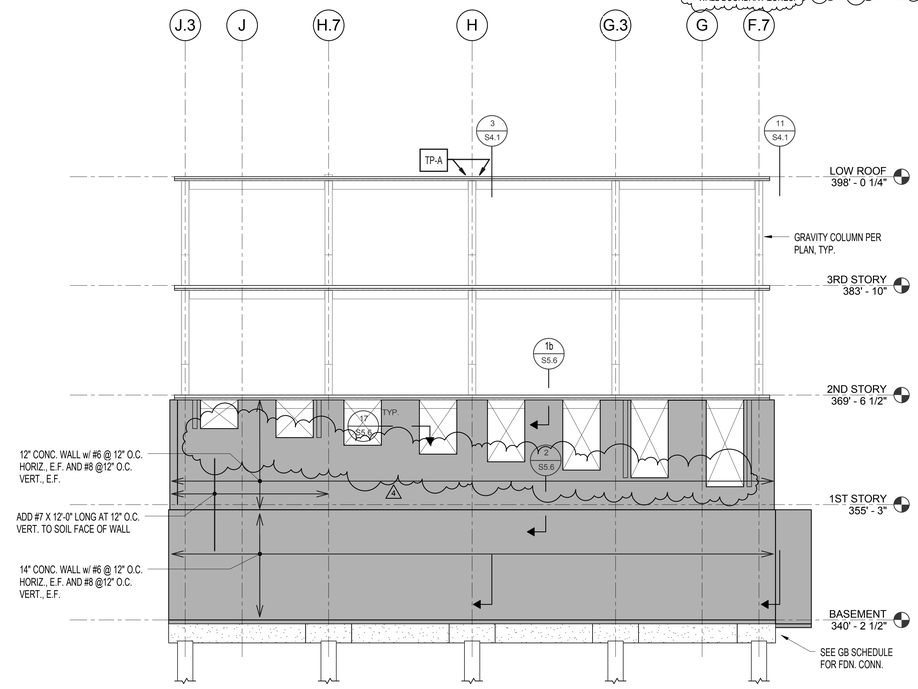


NOTE:

1. AT BRB FRAME LOCATIONS REFER TO 19 / S6.6 FOR TOP PLATE SPLICE DETAILS.
2. AT BRB FRAME LOCATIONS REFER TO 3 AND 24 / S6.6 FOR SPLICE PLATE DETAILS.
4 3. SEE 4 / S5.6 FOR ADDITIONAL TIE REQUIREMENTS FOR SHEAR WALL BOUNDARY ZONES.

BRACED FRAME AND WALL ELEVATION AT GRIDLINE F.7

1/8" = 1'-0" 3 S3.1



WALL ELEVATION AT GRIDLINE 1

1/8" = 1'-0" 2 S3.1

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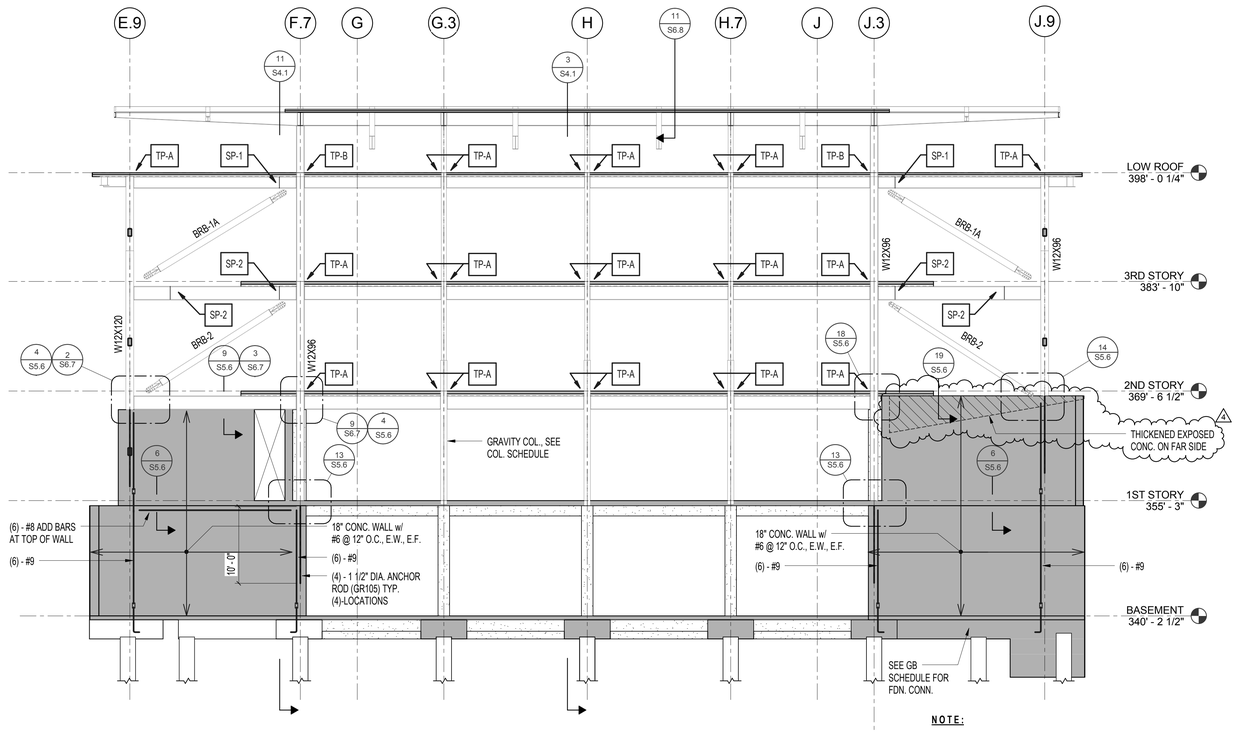
SHEET TITLE
ELEVATIONS

SHEET No
S3.1

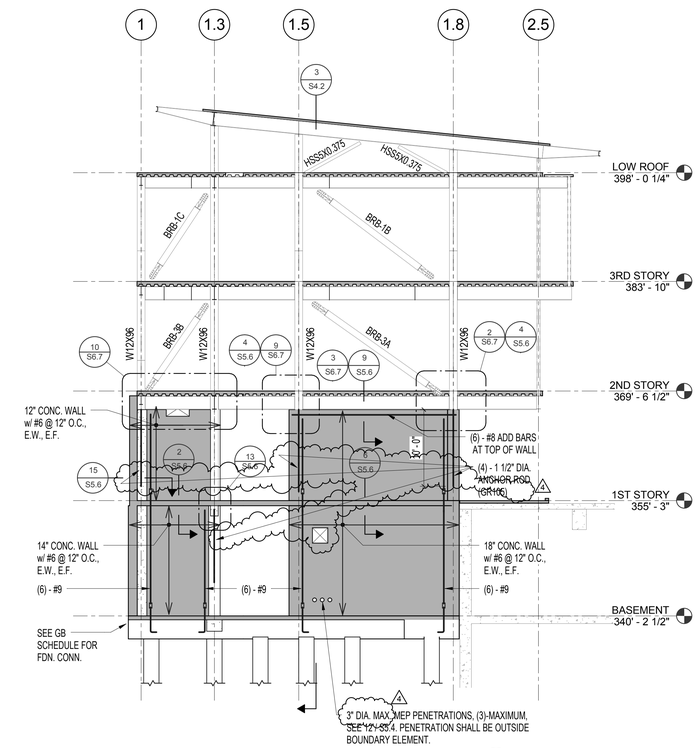


BRACED FRAME AND WALL ELEVATION AT GRIDLINE 1.3

1/8" = 1'-0" — 3 / S3.2

NOTE:

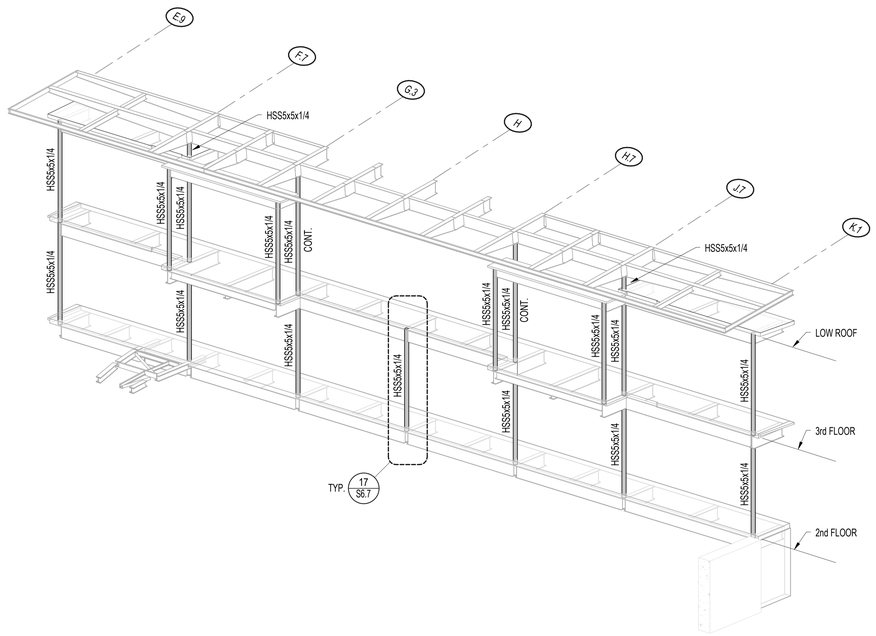
1. AT BRB FRAME LOCATIONS REFER TO 19 / S6.6 FOR TOP PLATE SPLICE DETAILS.
2. AT BRB FRAME LOCATIONS REFER TO 3 AND 24 / S6.6 FOR SPLICE PLATE DETAILS.
3. SEE 4 / S5.6 FOR ADDITIONAL TIE REQUIREMENTS FOR SHEAR WALL BOUNDARY ZONES.



WALL ELEVATION AT GRIDLINE J.3

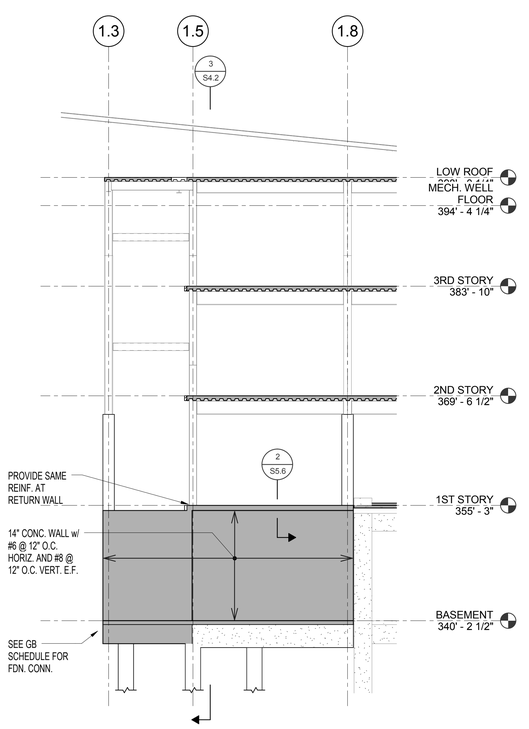
FOR INFO NOT SHOWN OR NOTED , SEE 3 / S3.1

1/8" = 1'-0" — 1 / S3.2



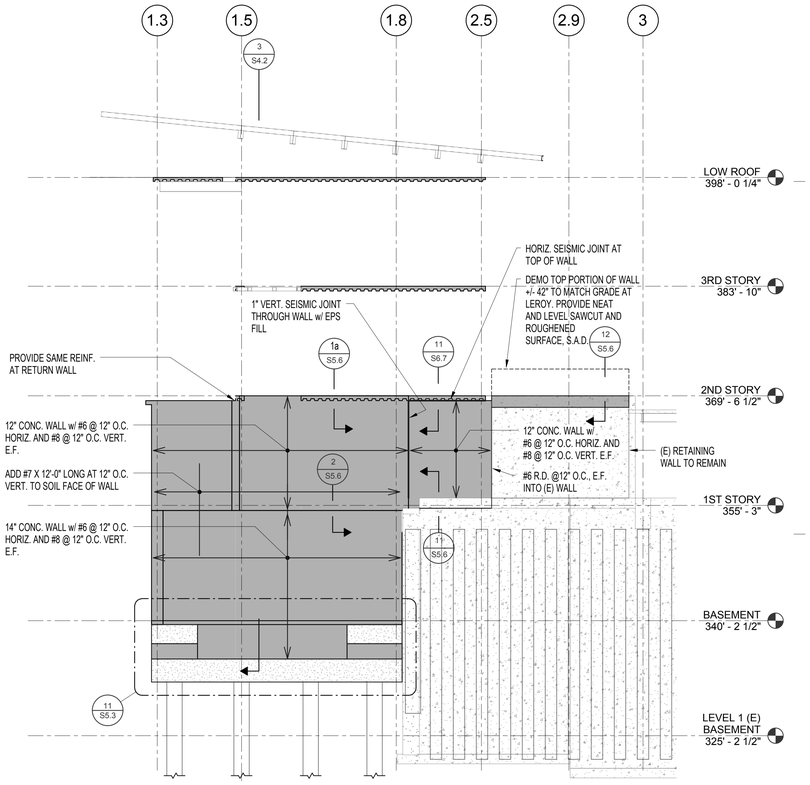
3d ISOMETRIC VIEW OF SOUTH ELEVATION

5 / S3.2



WALL ELEVATION AT GRIDLINE F

6 / S3.2



WALL ELEVATION AT GRIDLINE K

2 / S3.2

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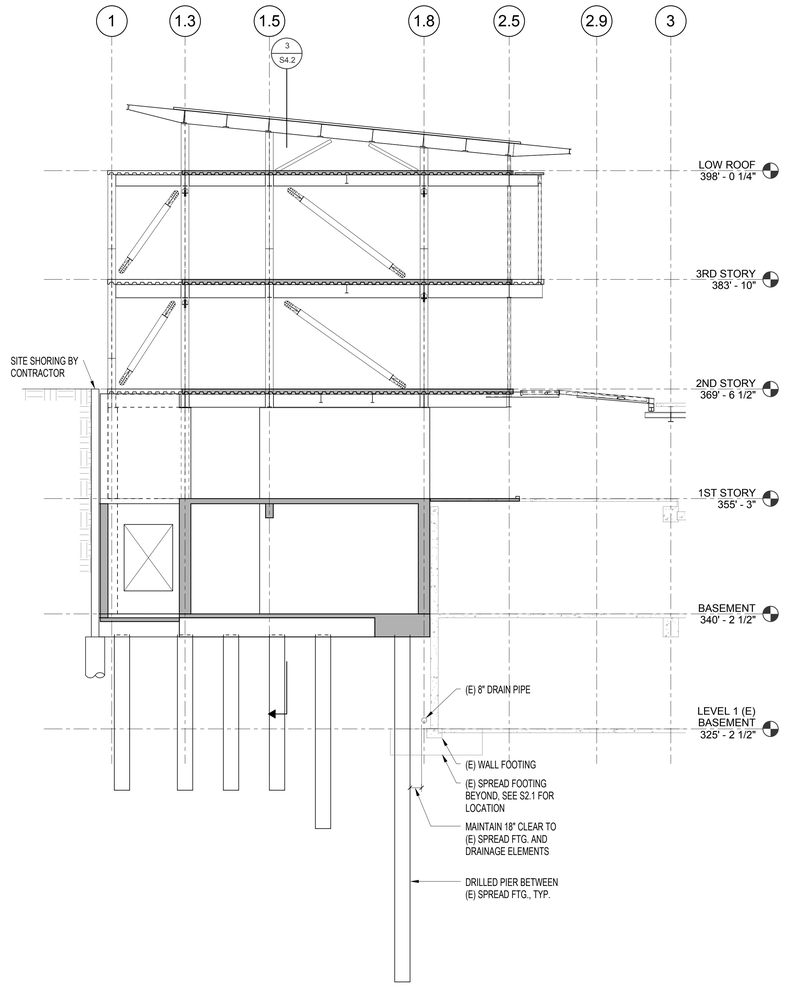
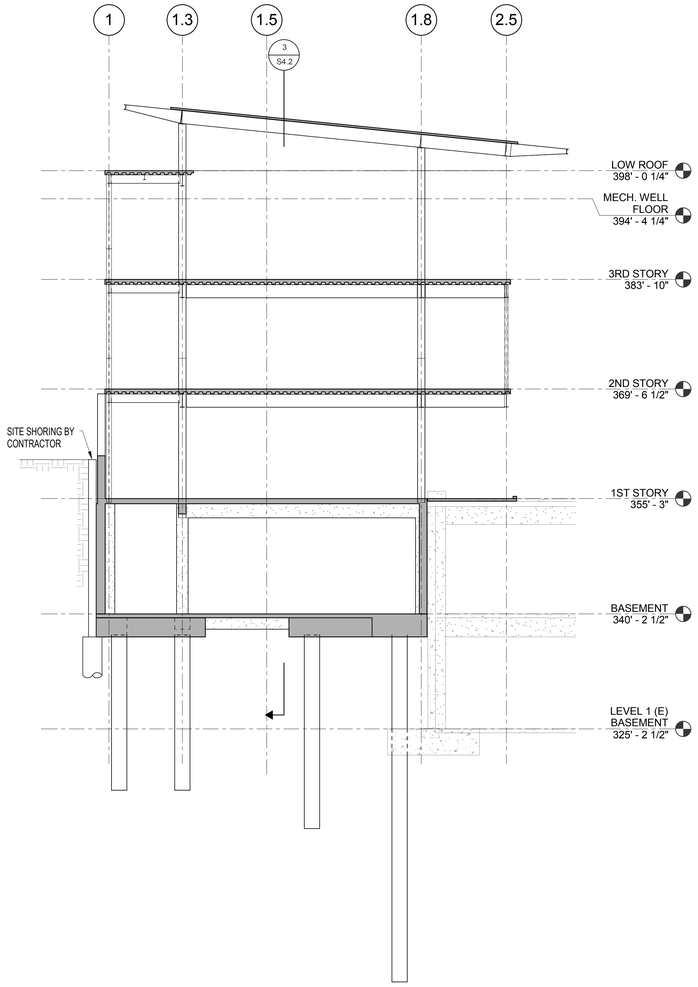
SCALE:

SHEET TITLE
ELEVATIONS

SHEET No
S3.2



SECTION 11 S4.1
1/8" = 1'-0"



SECTION 3 S4.1
1/8" = 1'-0"

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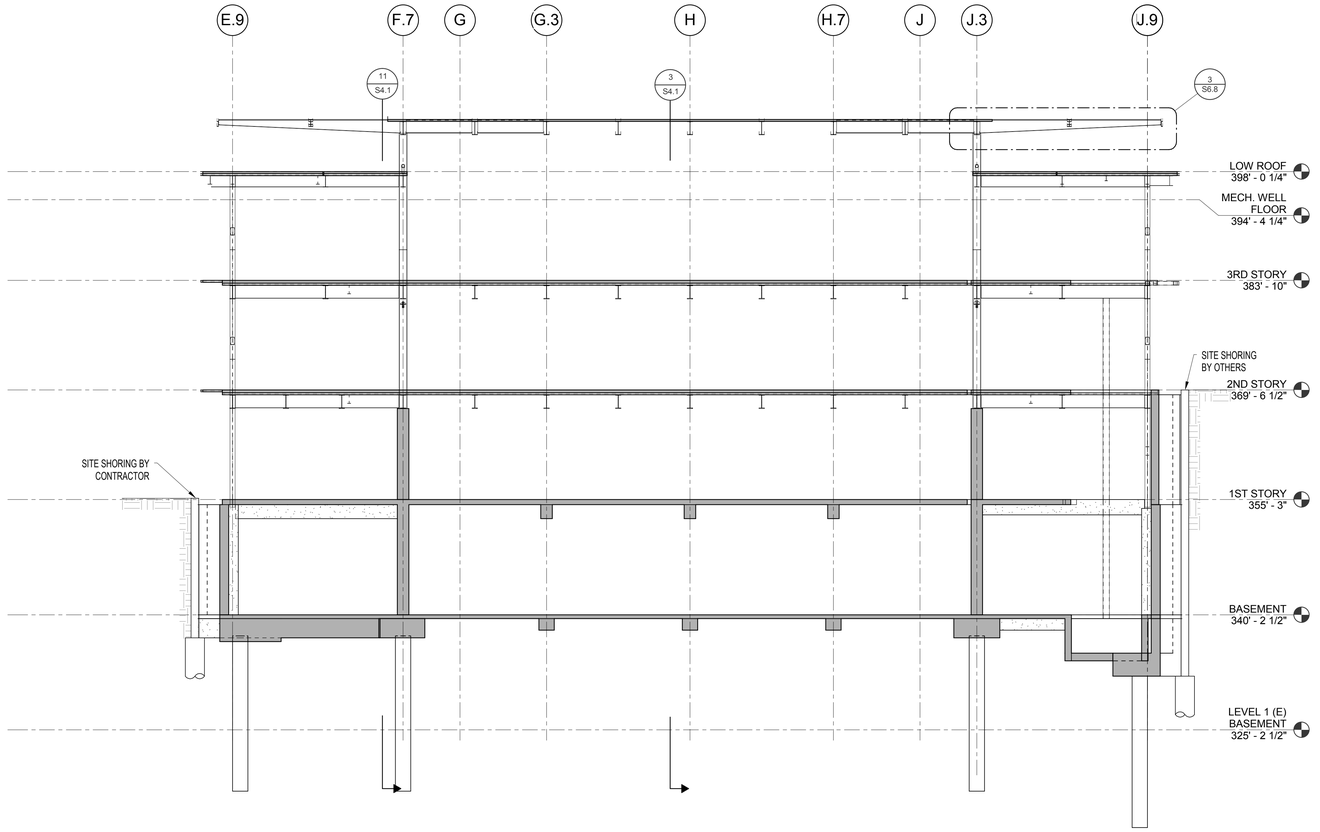
SHEET TITLE
BUILDING AND WALL SECTIONS

SHEET No
S4.1



SECTION

1/8" = 1'-0" — 3 / S4.2

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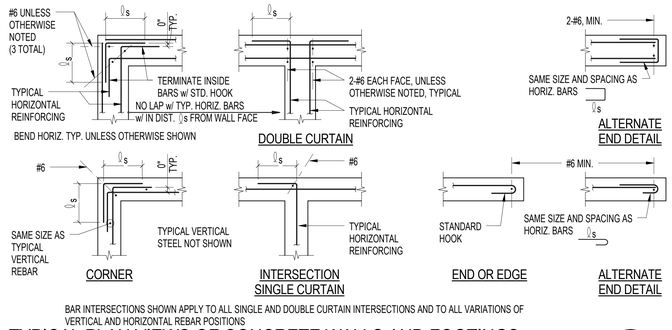
SHEET TITLE

BUILDING AND WALL SECTIONS

SHEET No

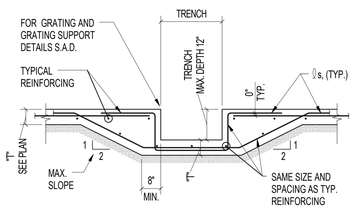
S4.2



TYPICAL PLAN VIEWS OF CONCRETE WALLS AND FOOTINGS

17 S5.1

1" = 1'-0"



TYPICAL TRENCH AT SLAB ON GRADE

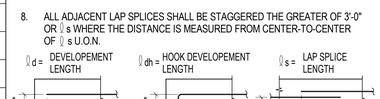
13 S5.1

REBAR		75ksi REBAR									60ksi REBAR								
CONCRETE		3,000 PSI CONC.			4,000 PSI CONC.			5,000 PSI CONC.			3,000 PSI CONC.			4,000 PSI CONC.			5,000 PSI CONC.		
BAR SIZE	POSITION	◊ dh	◊ d	◊ s	◊ dh	◊ d	◊ s	◊ dh	◊ d	◊ s	◊ dh	◊ d	◊ s	◊ dh	◊ d	◊ s	◊ dh	◊ d	◊ s
4	TOP (NOTE 4)	14"	36" 27"	46" 36"	12"	31" 24"	40" 31"	11"	28" 21"	36" 28"	11"	29" 22"	37" 29"	10"	25" 19"	32" 25"	9"	22" 17"	29" 22"
	OTHER																		
5	TOP	17"	45" 34"	58" 45"	15"	39" 30"	50" 39"	13"	34" 27"	45" 34"	14"	36" 28"	47" 36"	12"	31" 24"	40" 31"	11"	28" 22"	36" 28"
	OTHER																		
6	TOP	21"	53" 41"	69" 53"	18"	46" 36"	60" 46"	16"	41" 32"	54" 41"	17"	43" 33"	56" 43"	15"	37" 29"	48" 37"	13"	33" 26"	43" 33"
	OTHER																		
7	TOP	24"	78" 60"	101" 78"	21"	67" 52"	88" 67"	19"	60" 46"	78" 60"	19"	63" 48"	81" 63"	17"	54" 42"	70" 54"	15"	49" 37"	63" 49"
	OTHER																		
8	TOP	27"	89" 68"	116" 89"	24"	77" 59"	100" 77"	21"	69" 53"	90" 69"	22"	72" 55"	93" 72"	19"	62" 48"	80" 62"	17"	55" 43"	72" 55"
	OTHER																		
9	TOP	31"	100" 77"	131" 100"	27"	87" 67"	113" 87"	24"	78" 60"	101" 78"	25"	81" 62"	105" 81"	22"	70" 54"	91" 70"	19"	63" 48"	81" 63"
	OTHER																		
10	TOP	35"	113" 87"	*	30"	98" 75"	127" 98"	27"	88" 67"	114" 88"	28"	91" 70"	*	24"	79" 61"	*	22"	70" 54"	*
	OTHER																		
11	TOP	39"	125" 97"	*	33"	109" 84"	*	30"	97" 75"	*	31"	101" 78"	*	27"	87" 67"	*	24"	78" 60"	*
	OTHER																		
14	TOP	46"	151" 116"	*	40"	130" 100"	*	36"	117" 90"	*	37"	121" 93"	*	32"	105" 81"	*	29"	94" 72"	*
	OTHER																		

* SEE NOTE 5

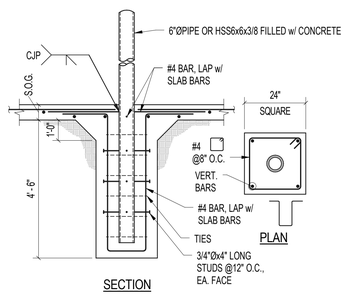
NOTES:

1. DEVELOPMENT LENGTH, (◊ d) WHERE REQUIRED IN DRAWINGS AND FOR SPLICE CALCULATION SHALL BE CALCULATED PER ACI 318R.
2. CLASS "B" SPLICES (◊ s) SHALL BE USED TYPICALLY, U.O.N. ON DRAWINGS.
3. ALL WALL HORIZ. REINF. ARE TOP BARS.
4. ALL BARS ARE TOP BARS UNLESS DIMENSION "A" IS LESS THAN 12".
5. USE MECHANICAL COUPLERS TO SPLICE BAR SIZES NO. 10 AND GREATER. MECHANICAL COUPLERS OPTIONAL FOR NO. 7 - NO. 9 BARS.
6. MULTIPLY ◊ dh BY 1.4 WHERE 2" COVER NOT MAINTAINED.
7. MULTIPLY TABULATED VALUES BY 1.3 FOR LIGHTWEIGHT CONCRETE.
8. ALL ADJACENT LAP SPLICES SHALL BE STAGGERED THE GREATER OF 3'-0" OR ◊ s WHERE THE DISTANCE IS MEASURED FROM CENTER-TO-CENTER OF ◊ s U.O.N.



TYPICAL REINFORCING BAR LAP LENGTH SCHEDULE AND NOTES

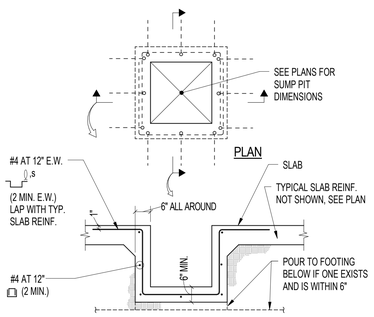
1 S5.1



TYPICAL CONSTRAINED BOLLARD

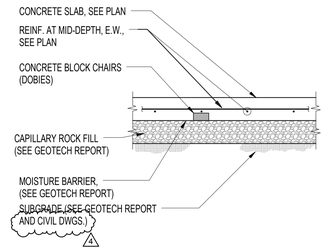
22 S5.1

1/2"=1'-0"



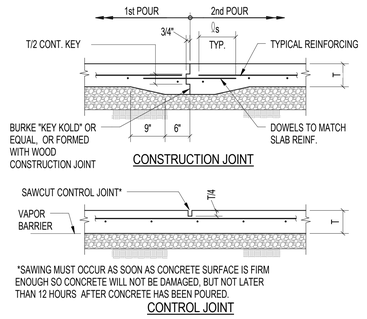
TYPICAL SUMP PIT DETAIL

18 S5.1



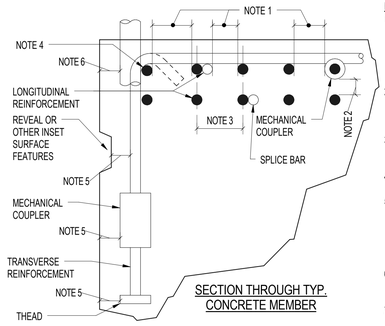
TYPICAL SLAB ON GRADE

14 S5.1



TYPICAL INTERIOR SLAB ON GRADE JOINTS

10 S5.1



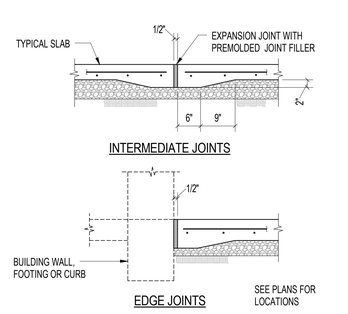
NOTES:

1. CLEAR SPACE BETWEEN ADJACENT REINFORCEMENT SHALL NOT BE LESS THAN 1 OF THE LARGER OF THE BARS, 1" (11/2" IN COLUMNS), AND 1 AGGREGATE SIZE. CLEAR SPACE BETWEEN REINFORCEMENT SHALL BE MAINTAINED AT CONTACT LAP SPLICES. MECHANICAL COUPLERS SHALL BE CONSIDERED AS PART OF THE REINFORCEMENT.
2. CLEAR SPACING BETWEEN PARALLEL LAYERS OF REINFORCEMENT INCLUDING LAP SPLICES AND MECHANICAL COUPLERS SHALL BE A MINIMUM OF 1" OR GREATER UNLESS OTHERWISE SHOWN.
3. MAINTAIN VERTICAL ALIGNMENT OF LAYERED PARALLEL REINFORCEMENT IN BEAMS AND SLAB.
4. NEST LONGITUDINAL BARS IN TRANSVERSE BAR BENDS AND HOOKS.
5. CONCRETE COVER SHALL BE MEASURED FROM FACE OF CONCRETE INCLUDING REVEALS OR OTHER SURFACE FEATURES TO FACE OF REINFORCEMENT, MECHANICAL COUPLERS, OR HEADED BARS. ADHERE TO THE SCHEDULE IN THE GENERAL NOTES FOR MINIMUM CONCRETE COVERS FOR CAST-IN-PLACE CONCRETE.
6. ADJUST CAGE SIZE WHERE COVER IS CONTROLLED BY REINFORCEMENT BAR OF LARGER SIZE THAN TIE SET REINFORCEMENT.
7. THIS CONDITION INCLUDES CONCRETE CAST AGAINST WATERPROOFING MEMBRANES.

TYPICAL CONCRETE REINFORCEMENT COVER, CLEARANCE AND ALIGNMENT REQUIREMENTS

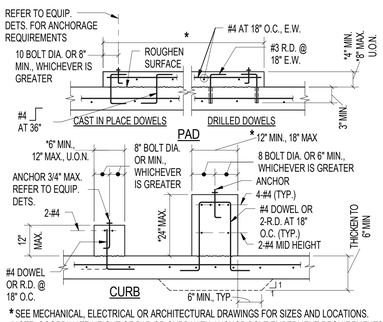
2 S5.1

1" = 1'-0"



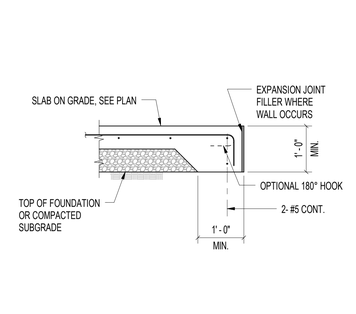
TYPICAL EXTERIOR PAVING SLAB ON GRADE EXPANSION JOINTS

23 S5.1



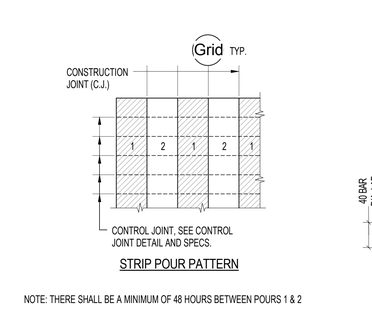
TYPICAL CONCRETE EQUIPMENT SUPPORTS

19 S5.1



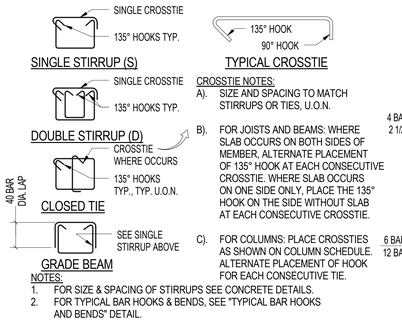
TYPICAL SLAB ON GRADE EDGE

15 S5.1



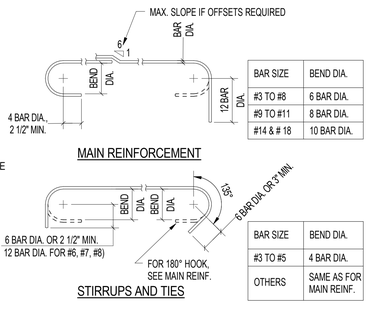
SLAB ON GRADE POUR PATTERN

11 S5.1



TYPICAL STIRRUPS AND TIES

7 S5.1

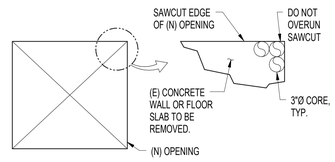


BAR SIZE	BEND DIA.
#3 TO #8	6 BAR DIA.
#9 TO #11	8 BAR DIA.
#14 & # 18	10 BAR DIA.

BAR SIZE	BEND DIA.
#3 TO #5	4 BAR DIA.
OTHERS	SAME AS FOR MAIN REINF.

TYPICAL BAR HOOKS, BENDS AND OFFSET

3 S5.1

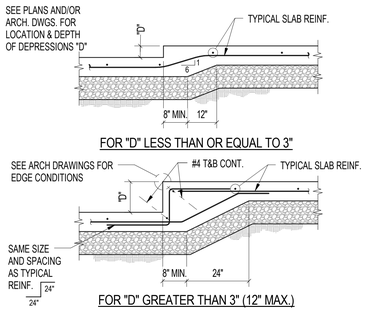


NOTES:

1. CUT (N) OPENINGS AS FOLLOWS:
   a. CORE HOLES AT EACH CORNER.
   b. SAWCUT BETWEEN CORNERS.
   c. CHIP AWAY REMAINING CONCRETE AT CORED HOLES.
2. AT EXTERIOR LOCATIONS, CHIP AWAY CONCRETE TO 1/2" DEPTH ALL AROUND. CUT REINF. AND FILL w/ EPOXY.
3. DO NOT CUT FOR (N) OPENINGS THRU (E) BEAMS, JOISTS, COLUMNS OR PILASTERS, UNLESS SPECIFICALLY SHOWN AND NOTED ON STRUCTURAL DRAWINGS.

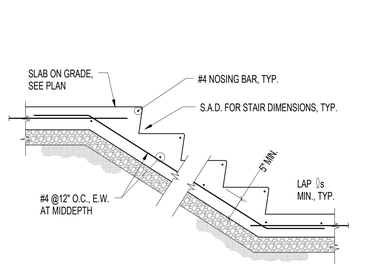
(N) OPENINGS IN (E) CONC.

20 S5.1



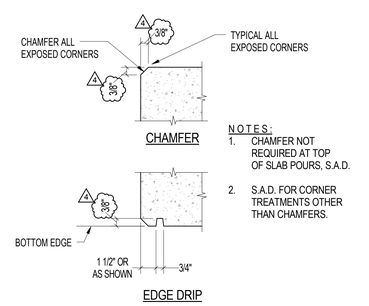
TYPICAL DEPRESSED SLAB ON GRADE DETAILS

16 S5.1



TYPICAL CONCRETE STAIR ON GRADE

12 S5.1



NOTES:

1. CHAMFER NOT REQUIRED AT TOP OF SLAB POURS, S.A.D.
2. S.A.D. FOR CORNER TREATMENTS OTHER THAN CHAMFERS.

TYPICAL CONCRETE EDGE DETAILS

4 S5.1

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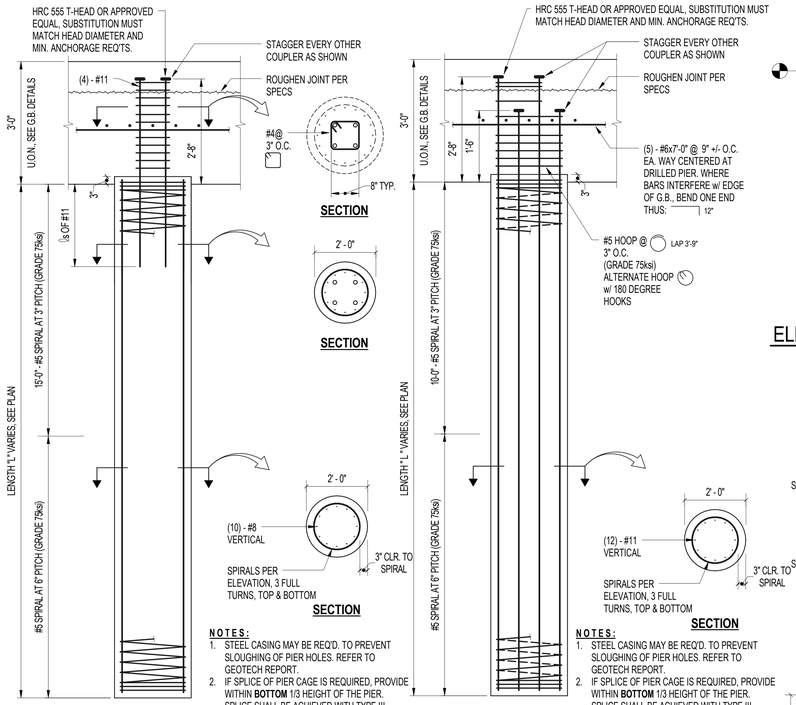
SCALE:

SHEET TITLE

TYPICAL CONCRETE DETAILS

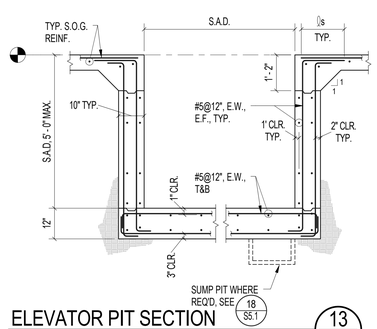
SHEET No

S5.1

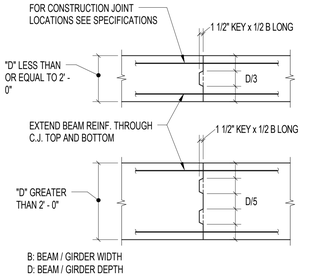


DRILLED PIER DETAIL - TYPE B — 22 / S5.2

DRILLED PIER DETAIL - TYPE A — 18 / S5.2



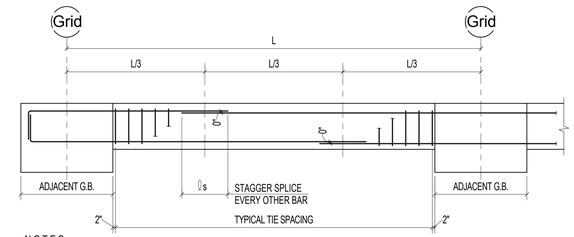
ELEVATOR PIT SECTION — 13 / S5.2



TYPICAL BEAM, GIRDER & GRADE BEAM CONSTRUCTION JOINTS — 9 / S5.2

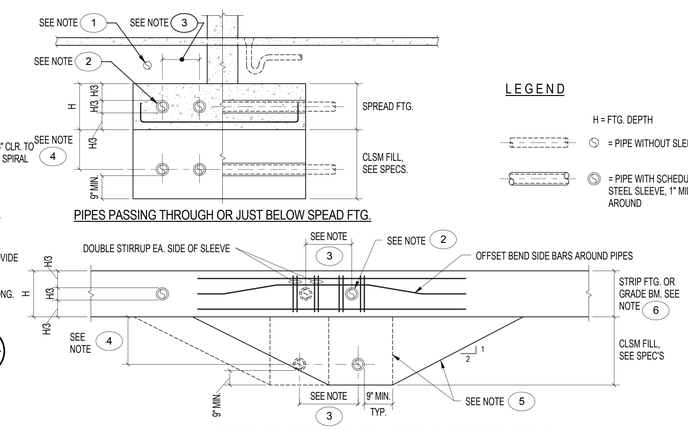
GRADE BEAM SCHEDULE									
MARK	H	W	LONGITUDINAL BARS		TRANSVERSE BARS	TIES	SIDE BARS	REMARKS	SECTION DETAIL
			BOTTOM	TOP					
GB1	2'-0"	2'-0"	(3) - #8	(3) - #8	#5 @ 9"	1L - #5 @ 9"	(2) - #8, E.S.	TRANSVERSE BAR SHALL BE CLOSED HOOP	4 / S5.2
GB2	3'-0"	6'-0"	(14) - #9	(14) - #9	#6 @ 9"	2L - #6 @ 9"	(6) - #9, E.S.	TRANSVERSE BAR SHALL BE CLOSED HOOP	8 / S5.2
GB3	3'-0"	7'-2"	(12) - #9	(12) - #9	#6 @ 5"	2L - #6 @ 5"	(10) - #9, E.S.	TRANSVERSE BAR SHALL BE CLOSED HOOP	3 / S5.2
GB4	3'-0"	4'-0"	(4) - #9	(4) - #9	#6 @ 6"	2L - #6 @ 6"	(5) - #9, E.S.	TRANSVERSE BAR SHALL BE CLOSED HOOP	3 / S5.2
GB5	3'-0"	6'-0"	(10) - #9	(10) - #9	#6 @ 5"	2L - #6 @ 5"	(8) - #9, E.S.	TRANSVERSE BAR SHALL BE CLOSED HOOP	3 / S5.2
GB5A	3'-0"	8'-0"	(8) - #9	(8) - #9	#6 @ 5"	2L - #6 @ 5"	(10) - #9, E.S.	TRANSVERSE BAR SHALL BE CLOSED HOOP	3 / S5.2
GB5B GB5C	3'-0"	VARIES	(8) - #9	(8) - #9	#6 @ 5"	2L - #6 @ 5"	(10) - #9, E.S.	TRANSVERSE BAR SHALL BE CLOSED HOOP	3 / S5.2 and 7 / S5.3
GB6	3'-0"	6'-0"	(8) - #9	(8) - #9	#5 @ 9"	2L - #5 @ 9"	(2) - #5, E.S.		1 / S5.3
GB7	3'-0"	6'-0"	(10) - #9	(10) - #9	#5 @ 9"	4L - #5 @ 9"	(2) - #5, E.S.		1 / S5.3 SIM.

GRADE BEAM SCHEDULE — 1 / S5.2 — 1" = 1'-0"



NOTES:
1. MAKE LONGITUDINAL BARS AS LONG AS PRACTICAL, STAGGER LAP SPLICES.
2. LOCATE GRADE BEAM REINFORCING TO CLEAR PIER REINFORCING, ANCHOR BOLTS AND PIPE SLEEVES. SEE STRUCTURAL DETAILS AND PLUMBING DRAWINGS, TYPICAL.

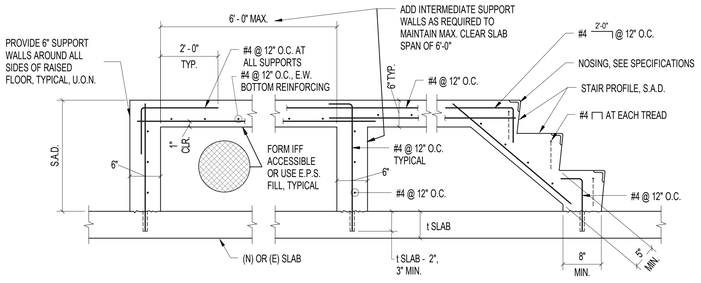
TYPICAL GRADE BEAM ELEVATION — 2 / S5.2 — 1" = 1'-0"



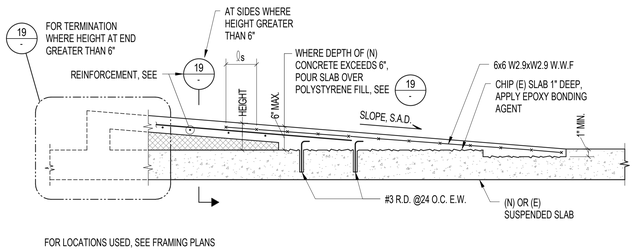
LEGEND
- H = FTG. DEPTH
- = PIPE WITHOUT SLEEVE
- = PIPE WITH SCHEDULE 40 STEEL SLEEVE, 1" MIN. CLR. ALL AROUND

NOTES:
1. FOR SIZE AND LOCATION OF PIPES, SEE OTHER DWGS.
2. O.D. OF SLEEVE ≤H/3. LOCATION OF SLEEVE MUST BE WITHIN CENTER 1/3 OF DEPTH OF FTG. SLEEVE MUST PASS THROUGH FTG IN A STRAIGHT LINE. DO NOT CUT OR INTERRUPT REINFORCING.
3. MINIMUM SPACING = 3x MAX. SLEEVE DIA.
4. IF PIPE IS ≤3'-0" BELOW FTG., EMBED IN CLSM FILL AS SHOWN.
5. CLSM FILL MAY BE CAST ON SLOPE OR, IF SOIL CONDITIONS PERMIT, MAY BE CAST IN VERTICAL CUT TRENCH.
6. PIPES SHALL NOT RUN LONGITUDINALLY IN STRIP FTGS. OR GRADE BMS.
7. FOR DEEP FOUNDATIONS, USE PIPE SLEEVE FOR DEPTH ≤6'-0". NO SLEEVE REQUIRED FOR DEPTH >6'-0".
8. PIPES PARALLEL TO STRIP FTGS OR GRADE BEAMS SHALL BE ABOVE 1:2 INFLUENCE LINE.
9. FOOTING INFLUENCE LINE MAY BE LOWERED BY ADDING CLSM FILL.
10. PIPES SHALL NOT SLEEVE VERTICALLY THROUGH SPREAD FTGS., STRIP FTGS., OR GRADE BMS.
11. NOTE NOT USED.
12. WHERE PIPE INSULATION IS ACCEPTED BY THE ENGINEER AS AN ALTERNATE TO A PIPE SLEEVE, PROVIDE PIPE INSULATION THAT MAINTAINS THE REQUIRED CLEARANCE AROUND THE PIPE DURING CONCRETE / CLSM PLACEMENT AND ALSO PROVIDES FLEXIBILITY FOR PIPE MOVEMENT IN HARDENED CONCRETE / CLSM.

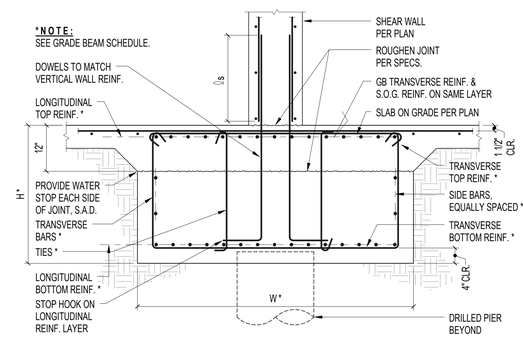
TYP. PIPES PASSING THROUGH OR BLW. FTGS., GRADE BMS. & MAT FNDS. — 12 / S5.2 — 1" = 1'-0"



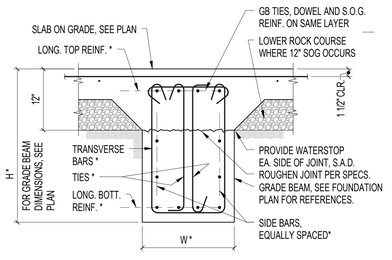
TYPICAL RAISED FLOOR AND/OR MISCELLANEOUS CONCRETE STEPS — 19 / S5.2 — 1" = 1'-0"



TYPICAL SLOPED CONCRETE FILL AT INTERIOR RAMP TRANSITIONS — 20 / S5.2 — 1" = 1'-0"



SECTION AT GRADE BEAM w/ SHEAR WALL — 8 / S5.2



TYPICAL SLAB ON GRADE AT GRADE BEAM — 4 / S5.2

TYPICAL PERIMETER GRADE BEAM SECTION — 3 / S5.2

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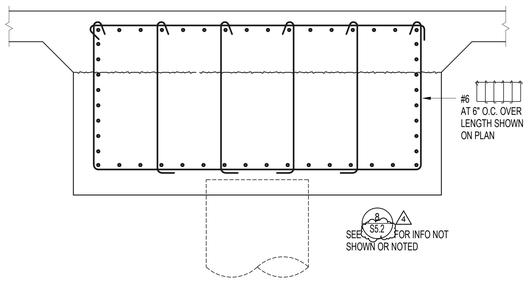
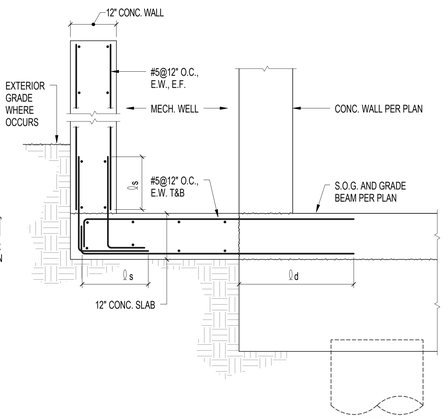
TYPICAL CONCRETE DETAILS

SHEET No
S5.2



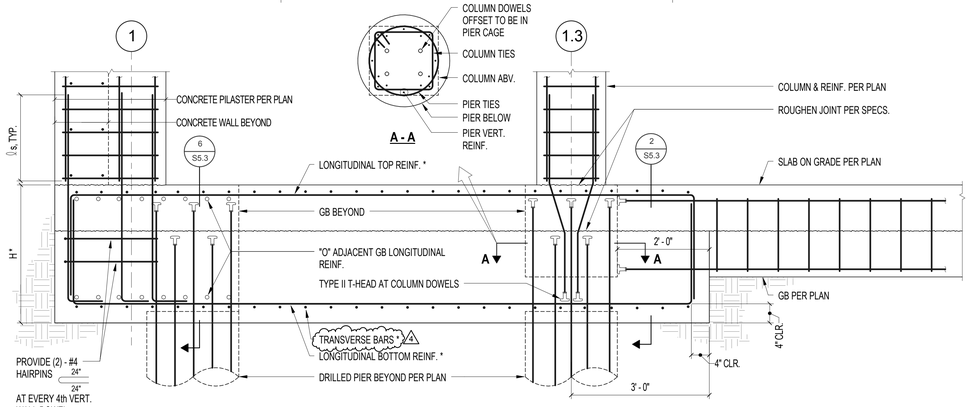
SECTION

1" = 1'-0" — 13 / S5.3



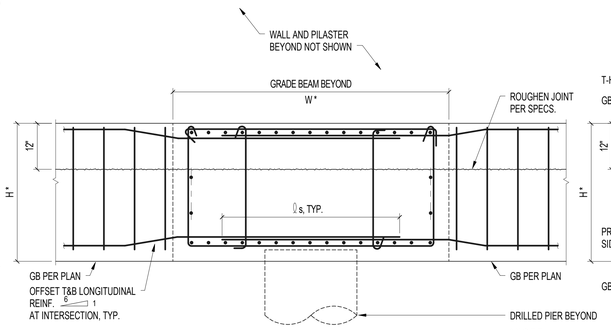
SECTION AT MECHANICAL WELL

3/4" = 1'-0" — 9 / S5.3



SECTION AT GB6

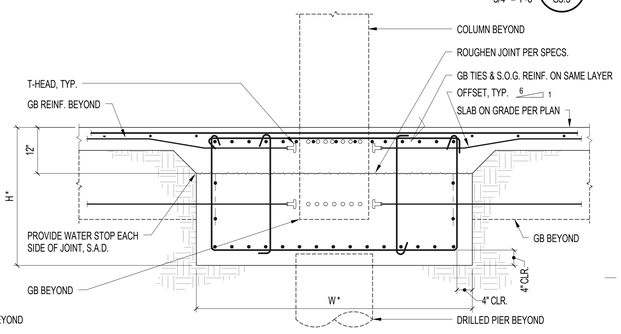
3/4" = 1'-0" — 1 / S5.3



REINF. AT GRADE BEAM INTERSECTION

3/4" = 1'-0" — 6 / S5.3

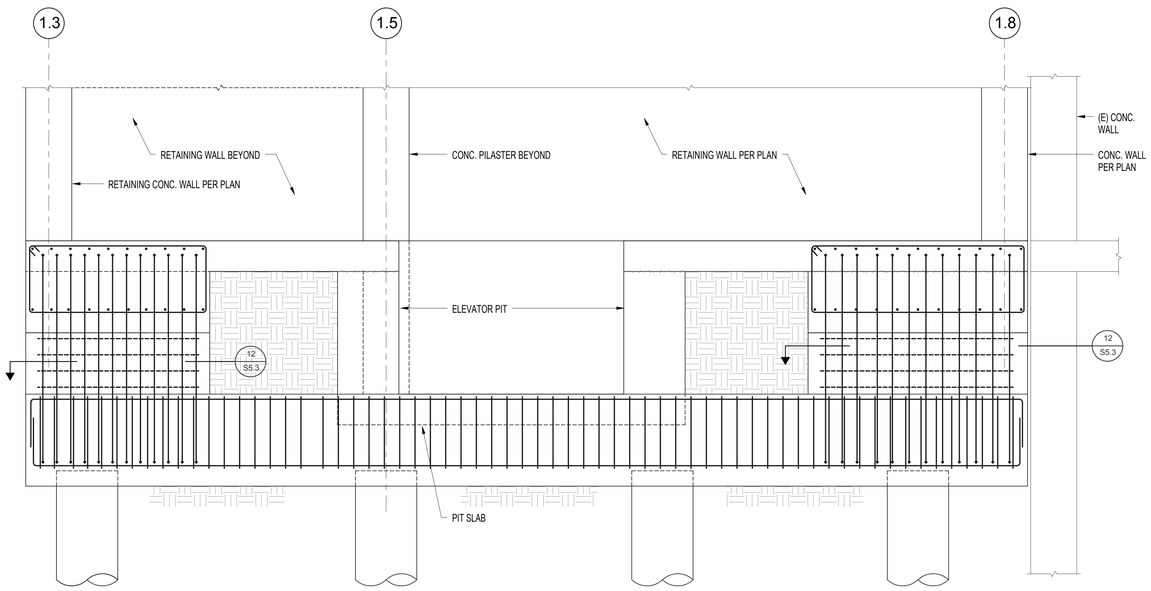
*NOTE:
SEE GRADE BEAM SCHEDULE.



REINF. AT GRADE BEAM INTERSECTION

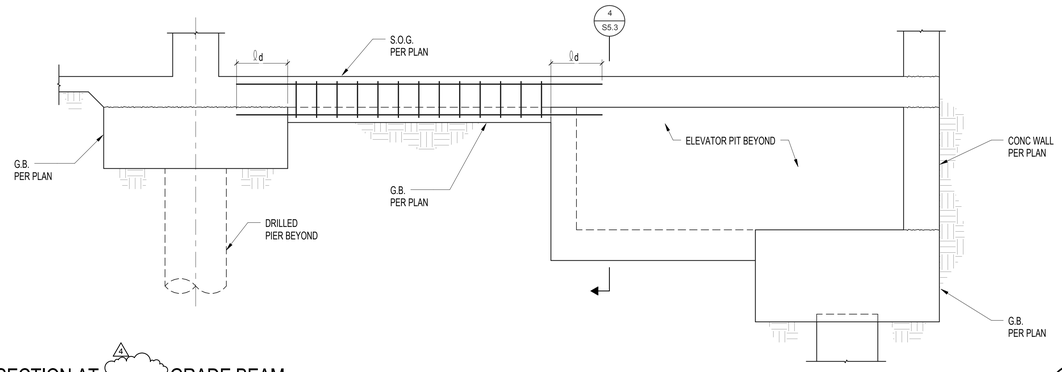
3/4" = 1'-0" — 2 / S5.3

*NOTE:
SEE GRADE BEAM SCHEDULE.



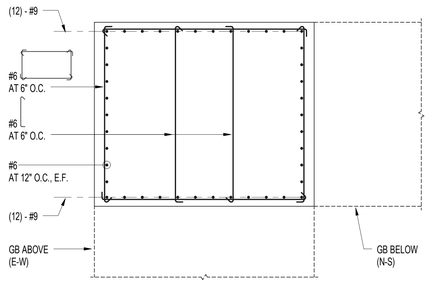
REINF. AT GRADE BEAM INTERSECTION

1/2" = 1'-0" — 11 / S5.3



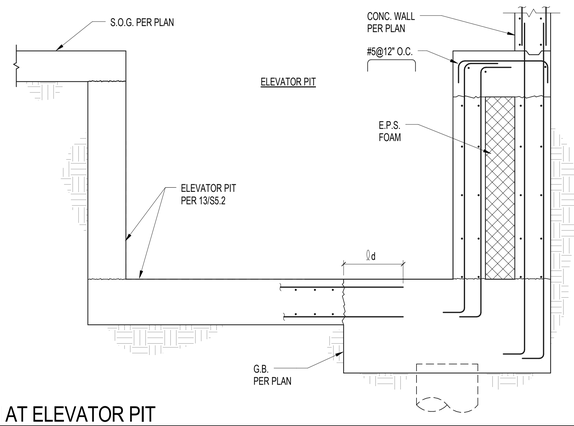
SECTION AT GRADE BEAM

1/2" = 1'-0" — 3 / S5.3



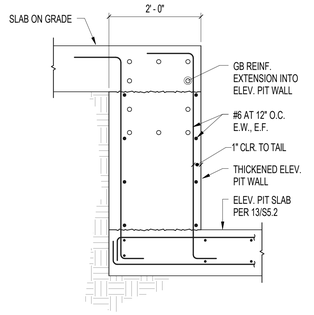
PLAN AT GB TRANSITION

1/2" = 1'-0" — 12 / S5.3



SECTION AT ELEVATOR PIT

1/2" = 1'-0" — 5 / S5.3



ELEVATOR PIT SECTION

3/4" = 1'-0" — 4 / S5.3

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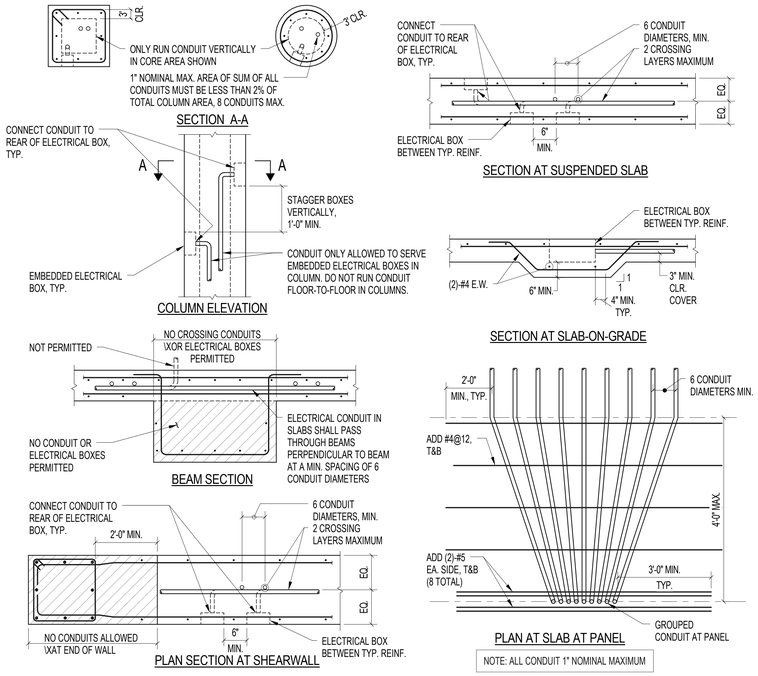
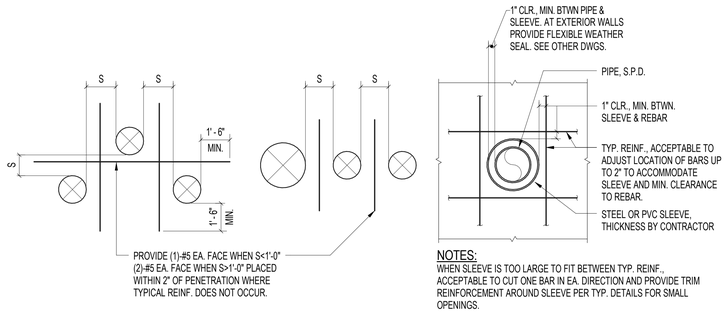
S5.3



TYPICAL ELECTRICAL CONDUIT EMBEDDED IN CONCRETE

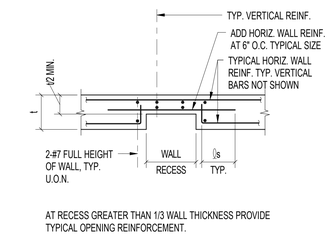
1" = 1'-0" — 18 / S5.4



NOTES:
WHEN SLEEVE IS TOO LARGE TO FIT BETWEEN TYP. REINF., ACCEPTABLE TO CUT ONE BAR IN EA. DIRECTION AND PROVIDE TRIM REINFORCEMENT AROUND SLEEVE PER TYP. DETAILS FOR SMALL OPENINGS.

TYPICAL PIPE SLEEVES AT WALL OR SLAB

1" = 1'-0" — 9 / S5.4



AT RECESS GREATER THAN 1/3 WALL THICKNESS PROVIDE TYPICAL OPENING REINFORCEMENT.

TYPICAL WALL RECESS DETAIL

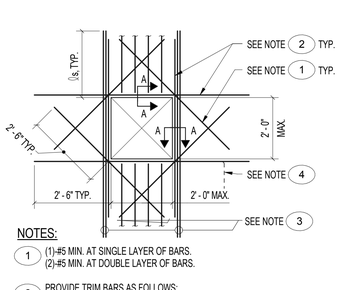
5 / S5.4

MINIMUM CONCRETE WALL REINFORCING		
WALL THICKNESS	BARS EACH WAY	POSITION
6"	#4 AT 12" o.c.	SINGLE CURTAIN
7"	#4 AT 10" o.c.	SINGLE CURTAIN
8"	#4 AT 10" o.c.	SINGLE CURTAIN
8"	#4 AT 18" o.c.	DOUBLE CURTAIN
9"	#4 AT 16" o.c.	DOUBLE CURTAIN
10"	#4 AT 16" o.c.	DOUBLE CURTAIN
12"	#4 AT 12" o.c.	DOUBLE CURTAIN
14"	#4 AT 10" o.c.	DOUBLE CURTAIN

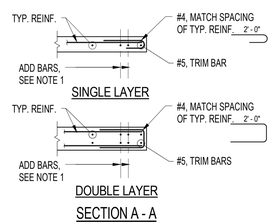
ABOVE REINFORCING SHALL APPLY UNLESS OTHERWISE NOTED.

MINIMUM CONCRETE WALL REINFORCING

1 / S5.4



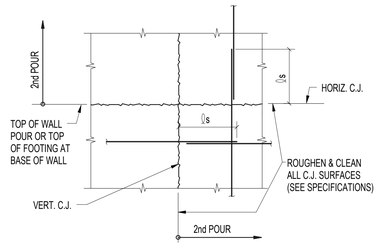
NOTES:
1. (1)-#5 MIN. AT SINGLE LAYER OF BARS. (2)-#5 MIN. AT DOUBLE LAYER OF BARS.
2. PROVIDE TRIM BARS AS FOLLOWS: (1)-#5 MIN. AT SINGLE LAYERS OF BARS. (2)-#5 MIN. AT DOUBLE LAYER OF BARS TRIM BARS MAY BE OMITTED WHERE ADD BARS ARE REQUIRED BY NOTE 3



3. WHERE MORE THAN TWO BARS ARE CUT AT A SLAB OPENING, PROVIDE A TOTAL NUMBER OF BARS, DISTRIBUTED EQUALLY BETWEEN BOTH SIDES, EQUAL TO THE NUMBER OF BARS CUT.
4. WHERE BAR EXTENSION CANNOT BE OBTAINED, EXTEND BARS AS FAR AS POSSIBLE AND TERMINATE w/ STD. HOOK.

TYPICAL SMALL OPENINGS IN WALL OR SLAB

1" = 1'-0" — 10 / S5.4



TYPICAL WALL CONSTRUCTION JOINTS

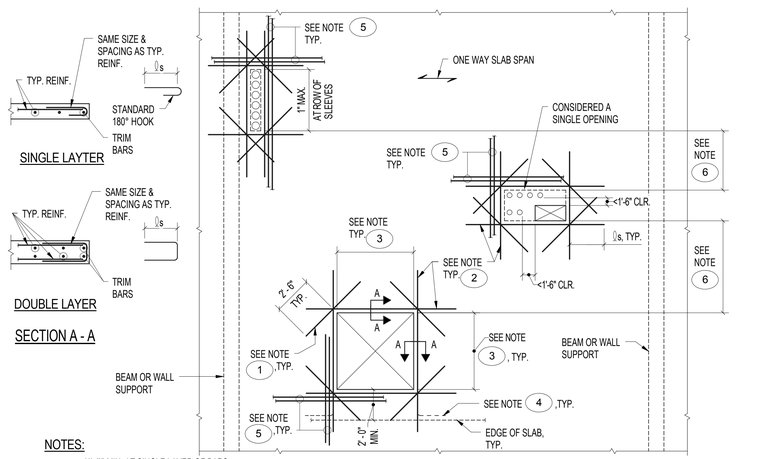
6 / S5.4

OPENING PATTERN	CLASSIFICATION/ DETAIL
3x DIA. OF LARGER OPENING, MIN. (C.L. C.L. C.L. C.L.)	INDIVIDUAL SLEEVE — SEE 9 / S5.4
LESS THAN 3 DIA. OF LARGER OPENING; CONSIDERED A SINGLE OPENING; C.L. C.L.; 2' - 0" MAX.	
<1'-0" CLEAR; CONSIDERED A SINGLE OPENING; <1'-0" CLEAR; 2' - 0" MAX.; 2' - 0" MAX.	INDIVIDUAL OPENING — SEE 10 / S5.4
2' - 0" MAX.; 2' - 0" MAX.	
FOR WALLS SEE 16 / S5.4; FOR ONE-WAY SLABS SEE 2 / S5.4	LARGE OPENING

NOTES:
CHECK FIRST IF OPENING(S) MEET THE CRITERIA FOR INDIVIDUAL SLEEVES.
IF NOT, CHECK IF OPENING(S) MEET THE CRITERIA FOR SMALL OPENINGS.
IF NOT, CHECK IF OPENING(S) MEET THE CRITERIA FOR LARGE OPENINGS.
IF NOT, CONSULT ENGINEER FOR DIRECTION.

CLASSIFICATION OF OPENINGS IN CONCRETE SLABS AND WALLS

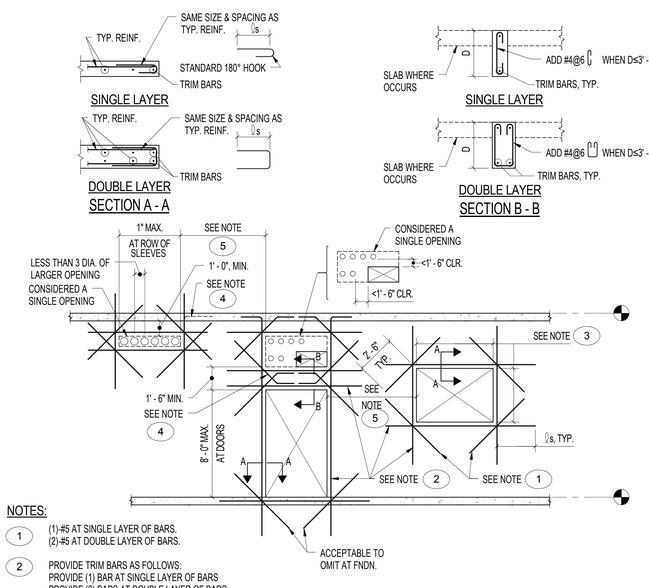
12 / S5.4



NOTES:
1. (1)-#5 MIN. AT SINGLE LAYER OF BARS. (2)-#5 MIN. AT DOUBLE LAYER OF BARS.
2. PROVIDE TRIM BARS AS FOLLOWS: PROVIDE (1) BAR AT SINGLE LAYER OF BARS PROVIDE (2) BARS AT DOUBLE LAYER OF BARS TRIM BAR SIZE SHALL MATCH TYP. REINF. EXTEND TRIM BARS BEYOND EDGES OF OPENING A LAP SPLICE LENGTH. TRIM BARS MAY BE OMITTED WHERE ADD BARS ARE REQUIRED BY NOTE 5
3. DIMENSION OF ANY OPENING SHALL NOT EXCEED 6'-0", U.O.N. FOR LARGER OPENING DIMENSIONS, CONSULT ENGINEER FOR DIRECTION.
4. WHERE BAR EXTENSION CANNOT BE OBTAINED, EXTEND BARS AS FAR AS POSSIBLE AND TERMINATE w/ STD. HOOK.
5. IN EACH DIRECTION PROVIDE A TOTAL NUMBER OF BARS, EVENLY DISTRIBUTED BETWEEN BOTH SIDES OF THE OPENING, EQUAL TO THE TOTAL NUMBER OF BARS CUT. THESE ADDED BARS SHALL HAVE THE SAME LENGTH AND SPLICE LOCATION AS THE TYPICAL REINFORCING WOULD HAVE WHEN NOT INTERRUPTED BY AN OPENING. ADD BARS MAY BE OMITTED WHEN SPECIFIC BEAMS FRAME AN OPENING.
6. SPACING BETWEEN OPENINGS PERPENDICULAR TO SLAB SPAN DIRECTION SHALL BE 6'-0" MIN. FOR CLOSER SPACING, CONSULT ENGINEER FOR DIRECTION.

TYPICAL LARGE OPENINGS IN ONE-WAY SLABS

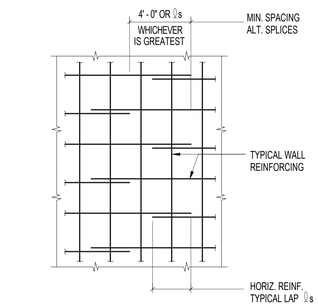
1" = 1'-0" — 2 / S5.4



NOTES:
1. (1)-#5 AT SINGLE LAYER OF BARS. (2)-#5 AT DOUBLE LAYER OF BARS.
2. PROVIDE TRIM BARS AS FOLLOWS: PROVIDE (1) BAR AT SINGLE LAYER OF BARS PROVIDE (2) BARS AT DOUBLE LAYER OF BARS TRIM BAR SIZE SHALL BE ONE BAR SIZE LARGER THAN TYP. REINF. EXTEND TRIM BARS BEYOND EDGES OF OPENING A LAP SPLICE LENGTH
3. DIMENSION OF ANY OPENING SHALL NOT EXCEED 6'-0", U.O.N. FOR LARGER OPENING DIMENSIONS, CONSULT ENGINEER FOR DIRECTION.
4. WHERE BAR EXTENSION CANNOT BE OBTAINED, EXTEND BARS AS FAR AS POSSIBLE AND HOOK.
5. HORIZONTAL SPACING BETWEEN OPENINGS SHALL BE 4'-0" MIN. FOR CLOSER SPACING, CONSULT ENGINEER FOR DIRECTION.

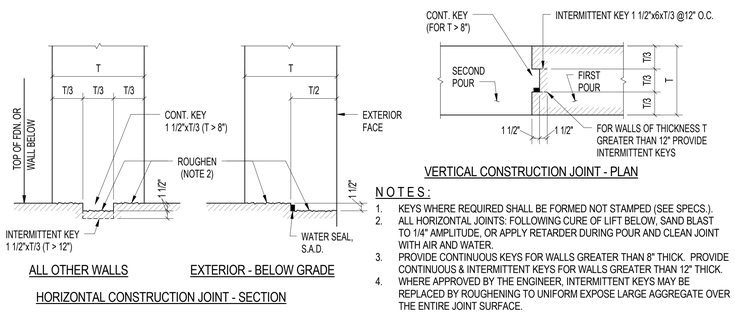
TYPICAL LARGE OPENINGS IN WALLS

1" = 1'-0" — 16 / S5.4



TYPICAL WALL REINFORCING

4 / S5.4



NOTES:
1. KEYS WHERE REQUIRED SHALL BE FORMED NOT STAMPED (SEE SPECS.).
2. ALL HORIZONTAL JOINTS: FOLLOWING CURE OF LIFT BELOW, SAND BLAST TO 1/4" AMPLITUDE, OR APPLY RETARDER DURING POUR AND CLEAN JOINT WITH AIR AND WATER.
3. PROVIDE CONTINUOUS KEYS FOR WALLS GREATER THAN 8" THICK. PROVIDE CONTINUOUS & INTERMITTENT KEYS FOR WALLS GREATER THAN 12" THICK.
4. WHERE APPROVED BY THE ENGINEER, INTERMITTENT KEYS MAY BE REPLACED BY ROUGHENING TO UNIFORM EXPOSE LARGE AGGREGATE OVER THE ENTIRE JOINT SURFACE.

TYPICAL CONSTRUCTION JOINTS AT CONCRETE WALLS

1" = 1'-0" — 3 / S5.4

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F/E Job #13-059

PROJECT

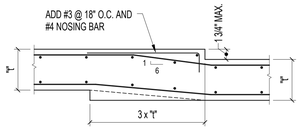
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
TYPICAL CONCRETE DETAILS

SHEET No
S5.4



TYPICAL SLAB DETAIL AT DEPRESSION

21 — 3/4" = 1'-0" — S5.5

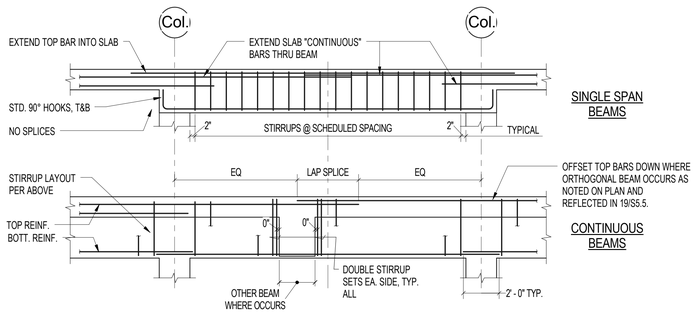
BEAM REINFORCING SCHEDULE														
MARK	WIDTH "B"	DEPTH "D"	TOP REINF.			SIDES	BOTTOM REINF.			STIRRUPS			NOTE	
			COVER (SEE NOTE 1)	UPPER LAYER	LOWER LAYER	EACH FACE (SEE NOTE 2)	COVER (SEE NOTE 1)	UPPER LAYER	LOWER LAYER	SIZE	TYPE	SPACING	SECTION DETAIL	REMARKS
BM-1	18"	30"	2"	(3) - #9	(2) - #9	-	2"	(2) - #9	(3)- #9	#4		12"	15 / -	-
BM-2	12"	24"	2"	(2) - #8	-	-	2"	-	(2) - #8	#4		12"	15 / -	-

N O T E S :

1. COVER SPECIFIED IS TO BEAM LONGITUDINAL BARS, THIS SCHEDULE.
2. REFER TO 19 / - FOR TYPICAL BEAM BAR LAYERING UNLESS SPECIFIC BEAM JOINT DETAILING IS SPECIFIED ON PLAN.

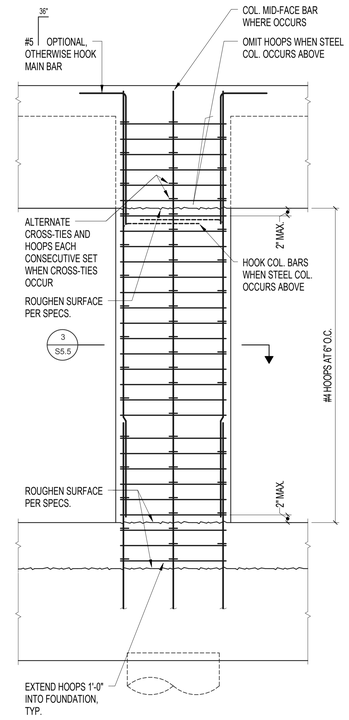
CONCRETE BEAM REINFORCING SCHEDULE

13 — 12" = 1'-0" — S5.5



TYPICAL FRAMED BEAM REINFORCING LAYOUT

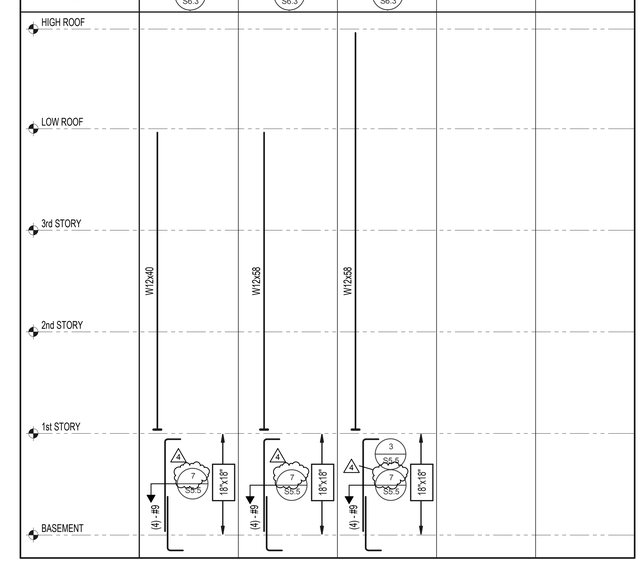
14 — 1" = 1'-0" — S5.5



TYPICAL COLUMN REINFORCING

10 — 12" = 1'-0" — S5.5

COLUMN MARK	C1	C2	C3		
LOCATION	G.3 / 1 H / 1 H.7 / 1	E.9 / 1.5 J.9 / 1.5	G.3 / 1.3 G.3 / 1.8 H / 1.3 H / 1.8 H.7 / 1.3 H.7 / 1.8		
STEEL BASE PL. DETAIL	2 S6.3	2 S6.3	1 S6.3		

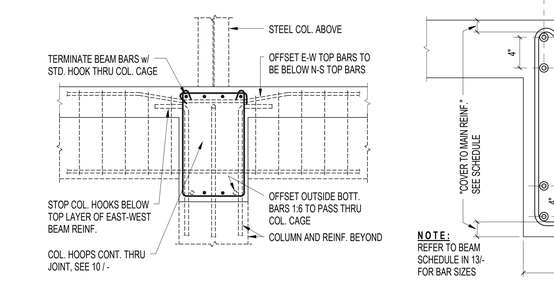


N O T E S :

1. CONCRETE COLUMN CONDITION AT BASEMENT. SOME LOCATIONS OCCUR AT WALL PILASTERS, REFER TO 7 / - FOR PILASTER REINF. LAYOUT.
2. REFER TO FRAME ELEVATIONS FOR FRAME COLUMN SIZES AND DETAILS FOR CONNECTION TO CONCRETE SHEAR WALLS.
3. SEE 1 S6.3 & 2 S6.3 FOR CONCRETE COLUMNS TO STEEL COLUMNS TRANSITION DETAILS.

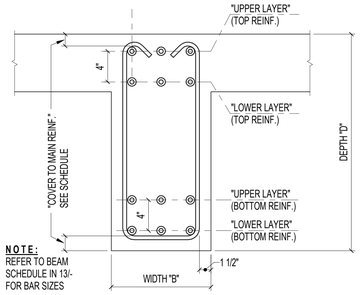
COLUMN SCHEDULE

2 — 12" = 1'-0" — S5.5



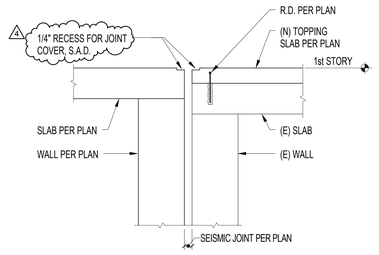
BEAM INTERSECTION LAYERING

19 — 3/4" = 1'-0" — S5.5



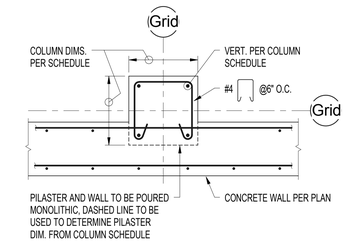
TYPICAL BEAM SECTION

15 — 1 1/2" = 1'-0" — S5.5



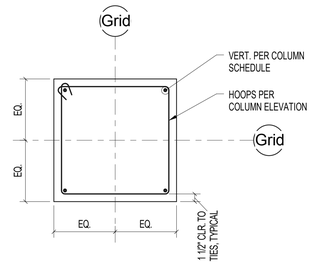
SECTION AT SEISMIC JOINT

11 — 3/4" = 1'-0" — S5.5



CONCRETE PILASTER PLAN

7 — 3/4" = 1'-0" — S5.5



COLUMN PLAN DETAIL

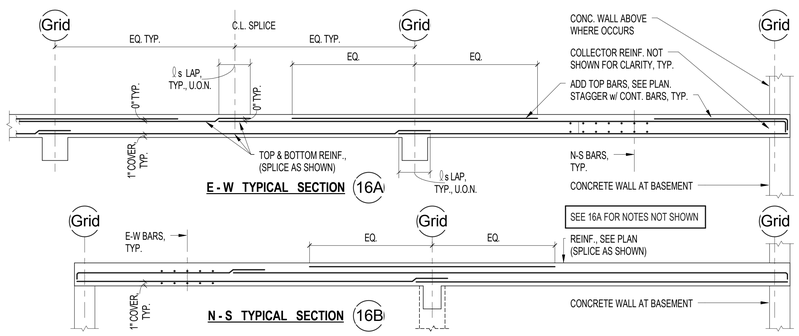
3 — 1" = 1'-0" — S5.5

TYPICAL FLOOR SLAB - EAST - WEST DIRECTION

TYPICAL FLOOR SLAB - NORTH - SOUTH DIRECTION

TYPICAL SLAB BAR PLACEMENT

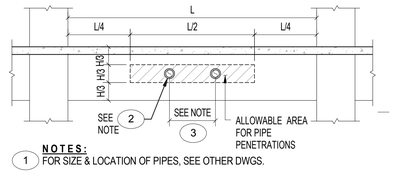
24 — 12" = 1'-0" — S5.5



N O T E :
1. AT LEAST TWO OF BOTTOM BARS IN EACH DIRECTION SHALL PASS WITHIN THE COLUMN CORE AND SHALL BE ANCHORED AT EXTERIOR SUPPORTS.

TYPICAL SLAB SECTIONS

16 — 12" = 1'-0" — S5.5



N O T E S :

1. FOR SIZE & LOCATION OF PIPES, SEE OTHER DWGS.
2. PIPE WITH SCHEDULE 40 STEEL SLEEVE, 1" MIN. CLR. ALL AROUND. O.D. OF SLEEVE ≤H/3. LOCATION OF SLEEVE MUST BE WITHIN ALLOWABLE AREA SHOWN. SLEEVE MUST PASS THROUGH BEAM IN A STRAIGHT LINE. DO NOT CUT OR INTERRUPT REINFORCING. OFFSET BEND CONFLICTING SIDE BARS. PLACE DOUBLE STIRRUP EA. SIDE OF SLEEVE.
3. MIN. SPACING = 3x MAX. SLEEVE DIA.
4. PIPES SHALL NOT RUN LONGITUDINALLY IN BEAMS.
5. PENETRATIONS ARE NOT ALLOWED IN POST-TENSIONED BEAMS.

TYPICAL PIPE PENETRATIONS IN NON POST-TENSIONED CONC. BEAMS

4 — 1" = 1'-0" — S5.5

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PROJECT

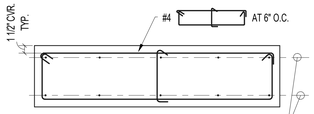
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

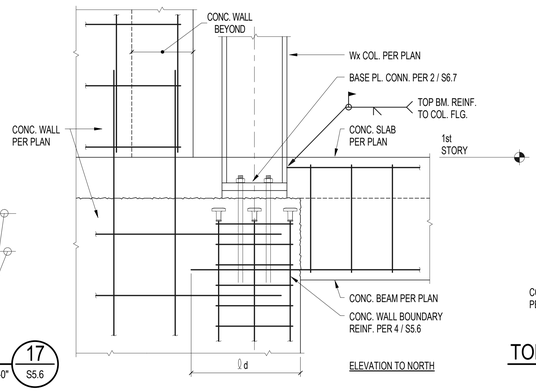
SHEET TITLE
TYPICAL CONCRETE DETAILS

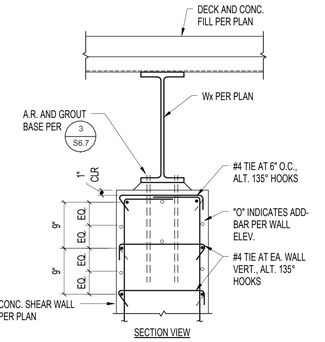
SHEET No
S5.5



PLAN AT CONC PIER

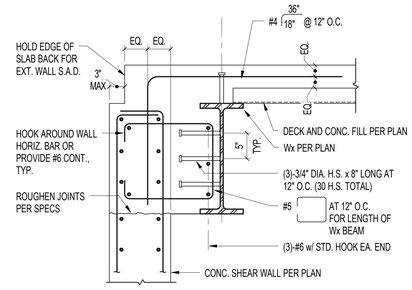
1" = 1'-0" — 17 / S5.6





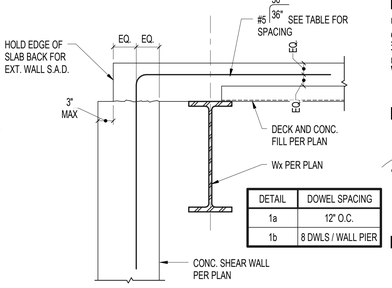
TOP OF SHEAR WALL REINF.

1" = 1'-0" — 9 / S5.6



SHEAR WALL CONNECTION AT BRACED FRAME

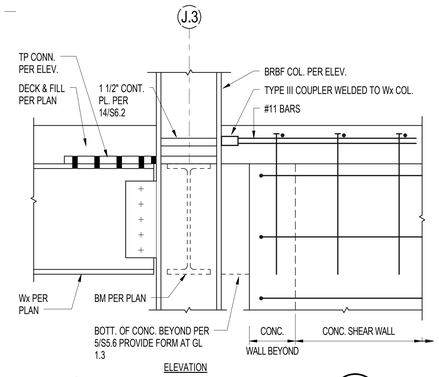
1" = 1'-0" — 5 / S5.6



DETAIL	DOWEL SPACING
1a	12" O.C.
1b	8 DWLS / WALL PIER

WALL CONNECTION AT DECK AND FILL

1" = 1'-0" — 1 / S5.6

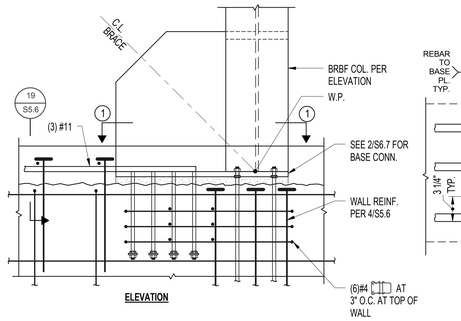


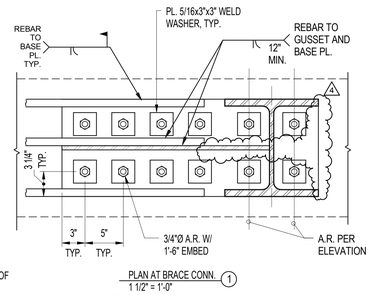
DETAIL

1" = 1'-0" — 18 / S5.6

BRACED FRAME COL. TRANSITION

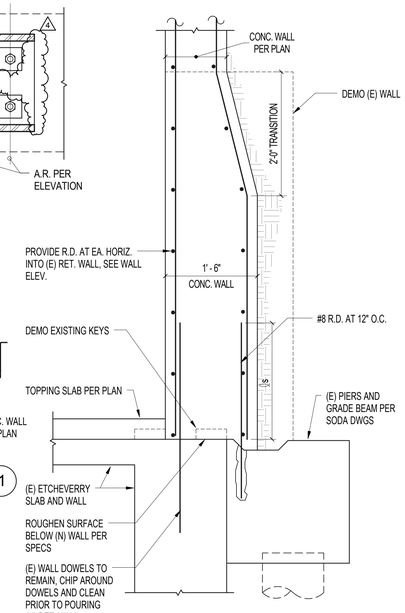
1" = 1'-0" — 13 / S5.6





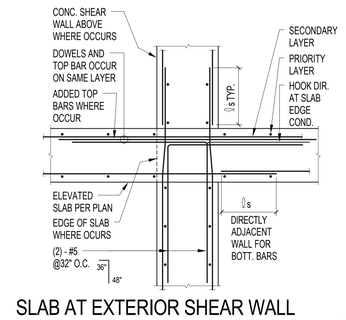
DETAIL

1" = 1'-0" — 14 / S5.6



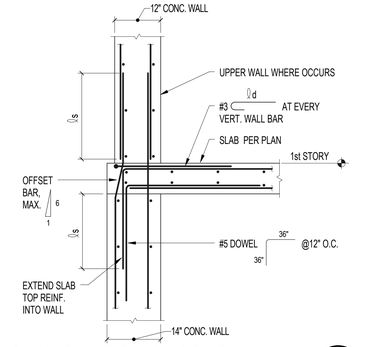
DETAIL

1" = 1'-0" — 11 / S5.6



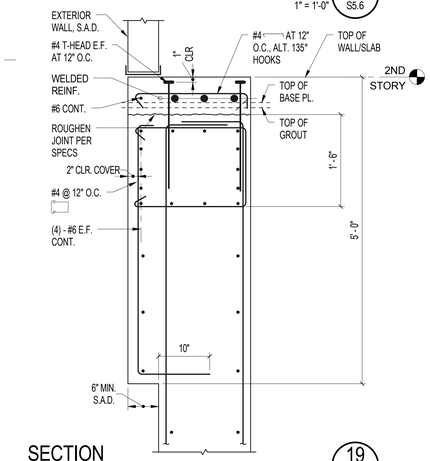
SLAB AT EXTERIOR SHEAR WALL CONNECTION

3/4" = 1'-0" — 6 / S5.6



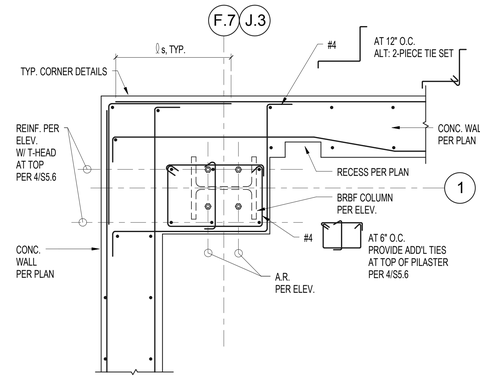
SECTION AT SLAB / CONC. WALL

3/4" = 1'-0" — 2 / S5.6



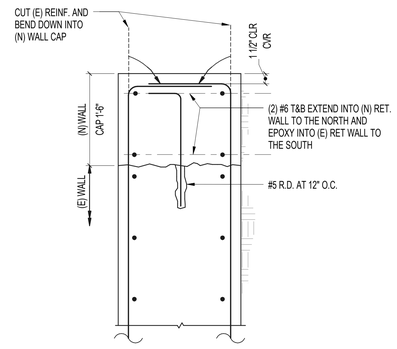
SECTION

1" = 1'-0" — 19 / S5.6



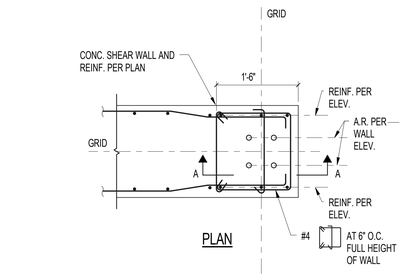
PLAN AT CORNER PILASTER

1" = 1'-0" — 15 / S5.6

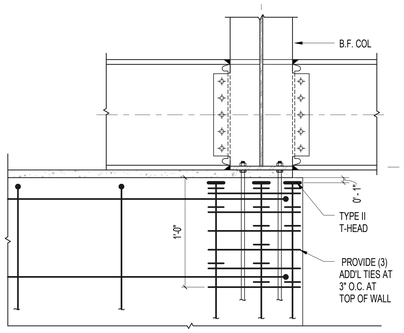


(N) WALL CAP AT (E) RET. WALL

1" = 1'-0" — 12 / S5.6



PLAN



ELEVATION A

SHEAR WALL BOUNDARY ZONE

1" = 1'-0" — 4 / S5.6

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www.forell.com
F/E Job #13-059

PROJECT

JACOBS HALL

UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

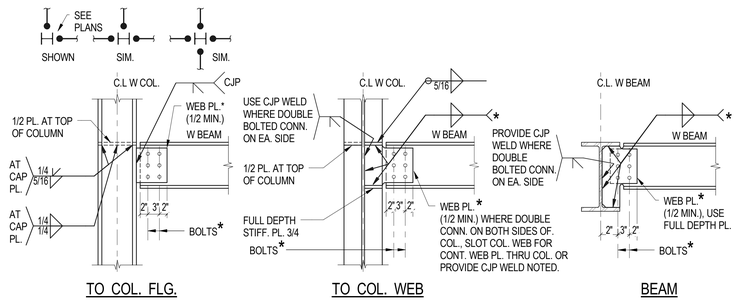
DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE

CONCRETE DETAILS

SHEET No

S5.6

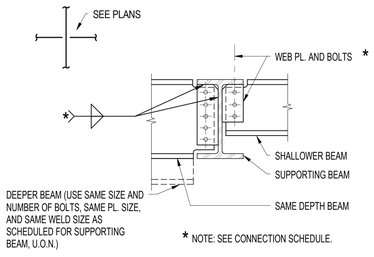


* NOTE: SEE CONNECTION SCHEDULE.

TYPICAL DOUBLE BOLTED CONNECTION AT FLOOR OR ROOF (SLRS)

17 S6.1

1" = 1'-0"



* NOTE: SEE CONNECTION SCHEDULE.

TYPICAL BEAM TO BEAM SIMPLE CONNECTION

9 S6.1

1" = 1'-0"

BEAM WEB CONNECTION SCHEDULE

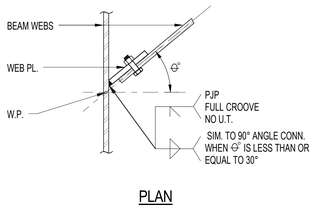
BEAM SIZE	NO. OF BOLTS (PER ROW)	MIN. TOP OF BEAM TO C.L. 1st BOLT	SINGLE ROW OF BOLTS			DOUBLE ROW OF BOLTS		
			BOLT DIAM.	WEB PL. THICKNESS	WEB PL. WELD	BOLT DIAM.	WEB PL. THICKNESS	WEB PL. WELD
W8	2	2 1/2"	7/8" Ø	3/8"	1/4"	7/8" Ø	1/2"	5/16"
W10	2	2 1/2"	7/8" Ø	3/8"	1/4"	7/8" Ø	1/2"	5/16"
W12, W14	3	3"	7/8" Ø	3/8"	5/16"	7/8" Ø	1/2"	5/16"
W16, W18	4	3"	7/8" Ø	3/8"	5/16"	7/8" Ø	1/2"	3/8"
W21	5	4 1/2"	7/8" Ø	1/2"	5/16"	7/8" Ø	1/2"	3/8"
W24	6	4 1/2"	7/8" Ø	1/2"	5/16"	7/8" Ø	1/2"	3/8"
W27	7	4 1/2"	7/8" Ø	1/2"	5/16"	1" Ø	3/4"	1/2"
W30	8	4 1/2"	7/8" Ø	1/2"	5/16"	1" Ø	3/4"	1/2"
W33	9	4 1/2"	7/8" Ø	1/2"	5/16"	1" Ø	3/4"	1/2"
W36	10	4 1/2"	7/8" Ø	1/2"	5/16"	1" Ø	3/4"	1/2"
W40	11	4 1/2"	7/8" Ø	1/2"	5/16"	1" Ø	3/4"	1/2"

1. WELDING FOR WEB PL. SHALL BE AS SHOWN IN THE SCHEDULE, BUT NOT SMALLER THAN THE AISC MINIMUM WELD THICKNESS.
2. USE A325-N BOLTS TYPICAL, U.O.N. ALL BOLTS SHALL BE SNUG TIGHT U.O.N. IN DETAILS. USE A325-SC BOLTS FOR ALL MOMENT CONNECTIONS AND WHERE NOTED ON OTHER DETAILS.
3. BOLT SPACING AND EDGE DISTANCE SHALL CONFORM TO AISC SPECIFICATIONS.
4. USE SLOTTED HOLES FOR W27 AND DEEPER BEAMS AT COLUMNS.

BEAM WEB CONNECTION SCHEDULE

1 S6.1

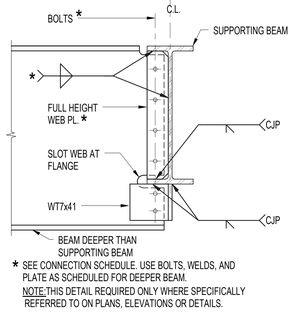
1" = 1'-0"



SEE BEAM TO BEAM CONNECTION DETAILS FOR INFO. NOT NOTED.

TYPICAL SKEWED BEAM WEB CONNECTION PLATE DETAIL

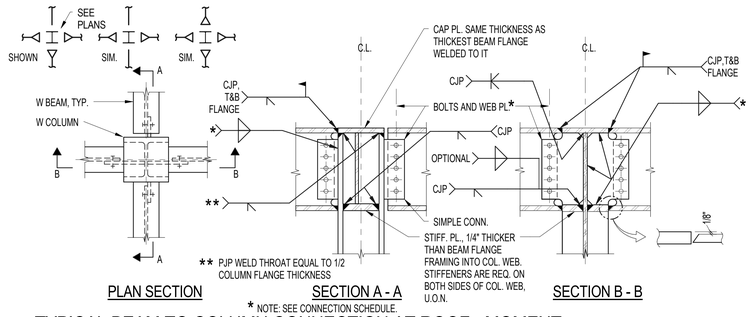
22 S6.1



* SEE CONNECTION SCHEDULE. USE BOLTS, WELDS, AND PLATE AS SCHEDULED FOR DEEPER BEAM.
NOTE: THIS DETAIL REQUIRED ONLY WHERE SPECIFICALLY REFERRED TO ON PLANS, ELEVATIONS OR DETAILS.

TYPICAL BEAM TO BEAM CONNECTION

18 S6.1

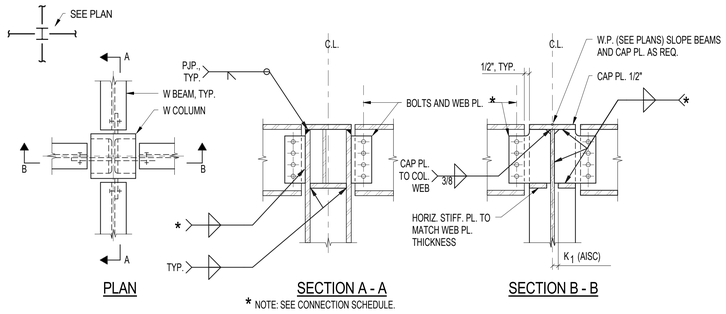


* NOTE: SEE CONNECTION SCHEDULE.

TYPICAL BEAM TO COLUMN CONNECTION AT ROOF - MOMENT CONNECTION TO COLUMN WEB, SIMPLE OR MOMENT CONNECTIONS TO COLUMN FLANGE

10 S6.1

1" = 1'-0"

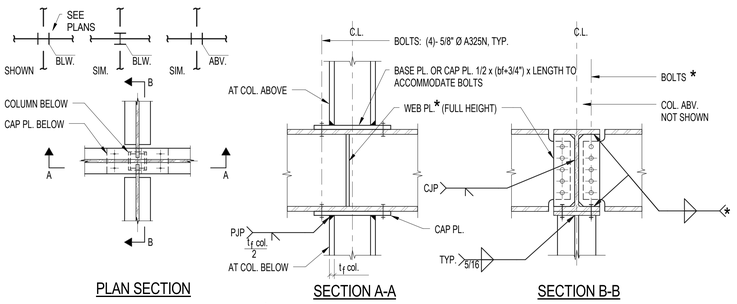


* NOTE: SEE CONNECTION SCHEDULE.

TYPICAL BEAM TO COLUMN ALL SIMPLE CONNECTIONS AT ROOF

2 S6.1

1" = 1'-0"

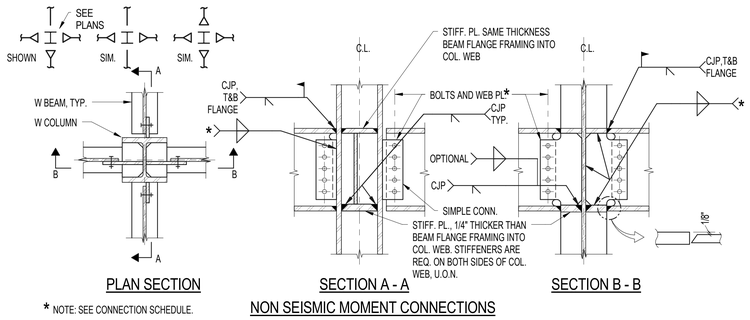


* NOTE: SEE CONNECTION SCHEDULE.

TYPICAL BEAM TO COLUMN CONNECTION - BEAM CONTINUOUS OVER OR UNDER COLUMN

19 S6.1

1" = 1'-0"

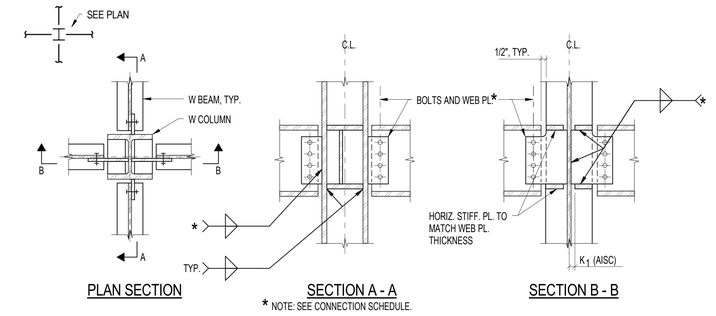


* NOTE: SEE CONNECTION SCHEDULE. NON SEISMIC MOMENT CONNECTIONS

TYPICAL BEAM TO COLUMN CONNECTION AT FLOOR - MOMENT CONNECTION TO COLUMN WEB. SIMPLE OR MOMENT CONNECTIONS TO COLUMN FLANGE

11 S6.1

1" = 1'-0"

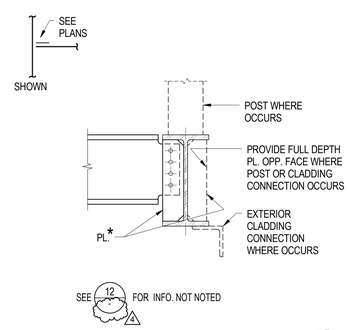


* NOTE: SEE CONNECTION SCHEDULE.

TYPICAL BEAM TO COLUMN ALL SIMPLE CONNECTIONS AT FLOOR

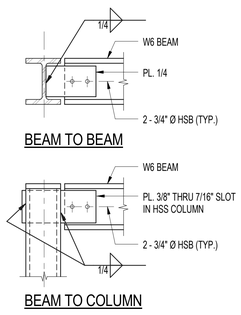
3 S6.1

1" = 1'-0"



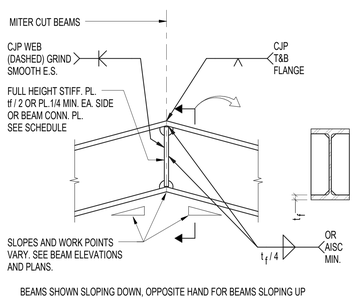
TYPICAL FULL DEPTH STIFFENER PLATE

25 S6.1



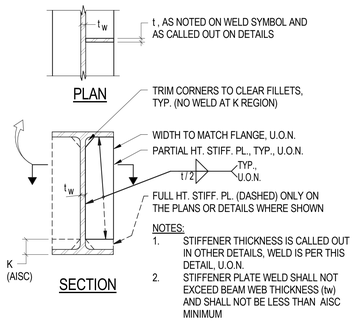
TYPICAL W6 SIMPLE CONNECTIONS

20 S6.1



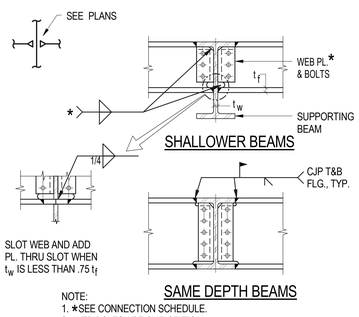
TYPICAL MITERED W BEAM BENT BEAM DETAIL

16 S6.1



TYPICAL BEAM WEB OR COLUMN STIFFENER PLATE DETAIL

12 S6.1



NOTE:
1. *SEE CONNECTION SCHEDULE.
2. WEB BOLTS ARE SLIP CRITICAL

TYPICAL BEAM TO BEAM MOMENT CONNECTION

8 S6.1

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www.forell.com
F/E Job #13-059

PROJECT

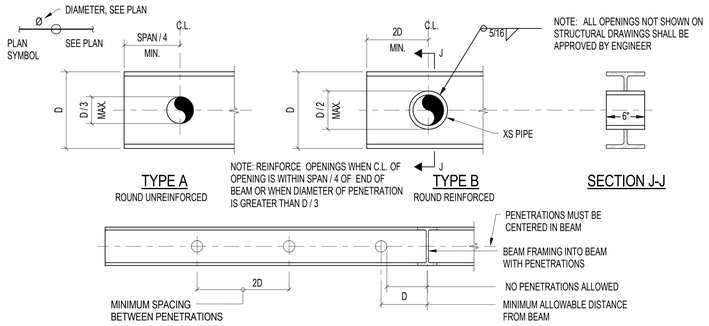
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

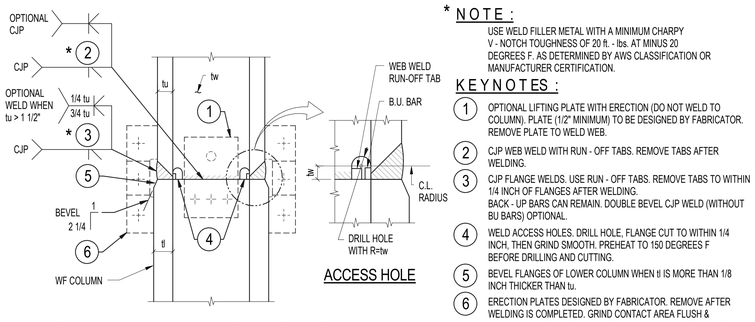
SHEET TITLE
TYPICAL STEEL DETAILS

SHEET No
S6.1



BEAM WEB PENETRATION LOCATION CRITERIA AND DETAILS FOR ROUND PENETRATIONS

17 — 1" = 1'-0" — S6.2



* NOTE :

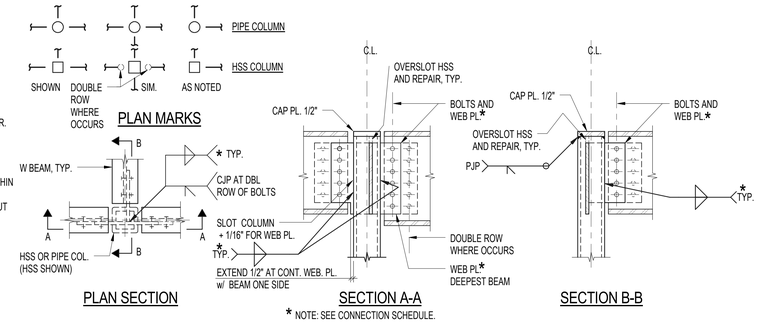
USE WELD FILLER METAL WITH A MINIMUM CHARPY V - NOTCH TOUGHNESS OF 20 ft. - lbs. AT MINUS 20 DEGREES F. AS DETERMINED BY AWS CLASSIFICATION OR MANUFACTURER CERTIFICATION.

KEYNOTES :

1. OPTIONAL LIFTING PLATE WITH ERECTION (DO NOT WELD TO COLUMN). PLATE (1/2" MINIMUM) TO BE DESIGNED BY FABRICATOR. REMOVE PLATE TO WELD WEB.
2. CJP WEB WELD WITH RUN - OFF TABS. REMOVE TABS AFTER WELDING.
3. CJP FLANGE WELDS. USE RUN - OFF TABS. REMOVE TABS TO WITHIN 1/4 INCH OF FLANGES AFTER WELDING. BACK - UP BARS CAN REMAIN. DOUBLE BEVEL CJP WELD (WITHOUT BU BARS) OPTIONAL.
4. WELD ACCESS HOLES. DRILL HOLE, FLANGE CUT TO WITHIN 1/4 INCH, THEN GRIND SMOOTH. PREHEAT TO 150 DEGREES F BEFORE DRILLING AND CUTTING.
5. BEVEL FLANGES OF LOWER COLUMN WHEN tl IS MORE THAN 1/8 INCH THICKER THAN tu.
6. ERECTION PLATES DESIGNED BY FABRICATOR. REMOVE AFTER WELDING IS COMPLETED. GRIND CONTACT AREA FLUSH & SMOOTH. CAN BE USED FOR LIFTING COLUMN IF SO DESIGNED.

TYPICAL W COLUMN SPLICE DETAIL (SLRS)

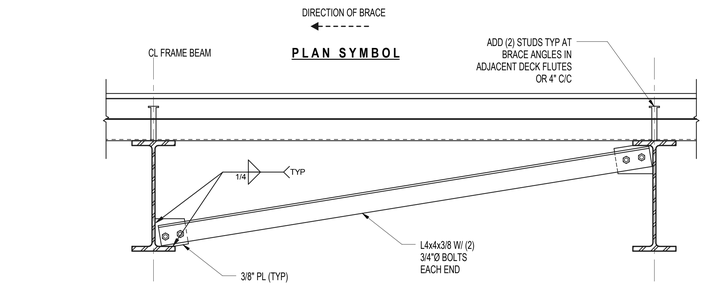
9 — 1" = 1'-0" — S6.2



* NOTE: SEE CONNECTION SCHEDULE.

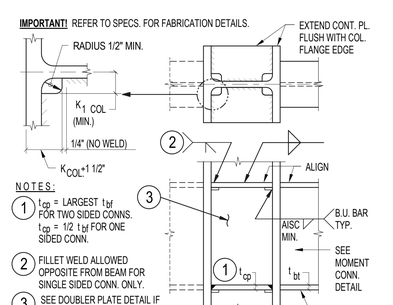
TYPICAL BEAM TO HSS COLUMN OR PIPE COLUMN, SIMPLE CONNECTION AT FLOOR

1 — 1" = 1'-0" — S6.2



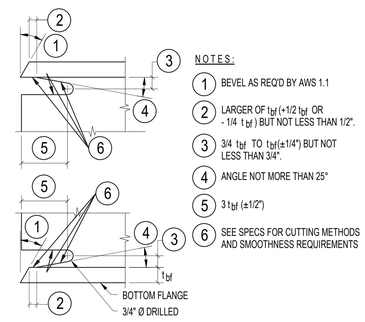
DETAIL

18 — 1" = 1'-0" — S6.2



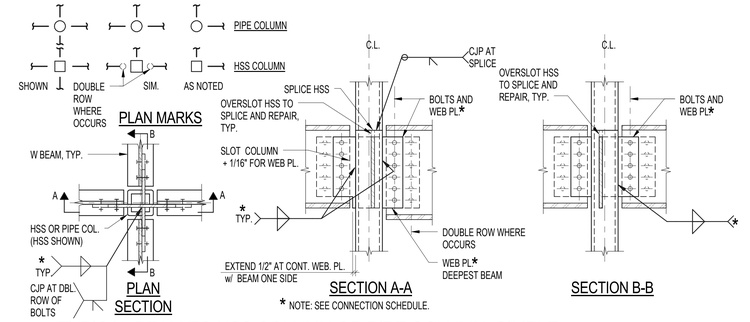
CONTINUITY PLATE DETAIL (SLRS)

14 — 1" = 1'-0" — S6.2



ACCESS HOLE DETAIL (SLRS)

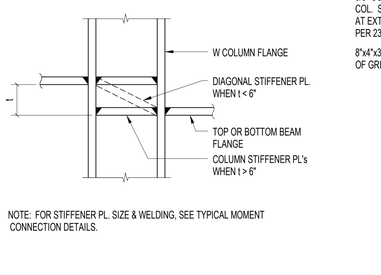
10 — 1" = 1'-0" — S6.2



* NOTE: SEE CONNECTION SCHEDULE.

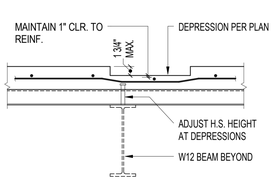
TYPICAL BEAM TO HSS COLUMN OR PIPE COLUMN, SIMPLE CONNECTION AT FLOOR

2 — 1" = 1'-0" — S6.2



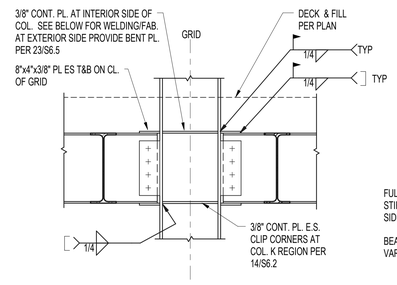
BEAM WEB PENETRATION LOCATION CRITERIA AND DETAILS FOR ROUND PENETRATIONS

17 — 1" = 1'-0" — S6.2



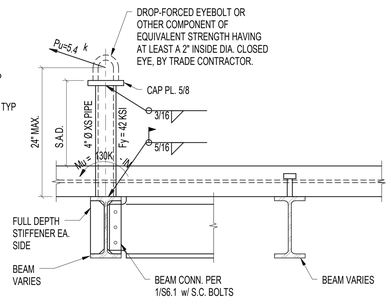
TYPICAL VERTICAL OFFSET OF COLUMN STIFFENER PLATES

23 — S6.2



COL. CONN. AT MECH SHAFT

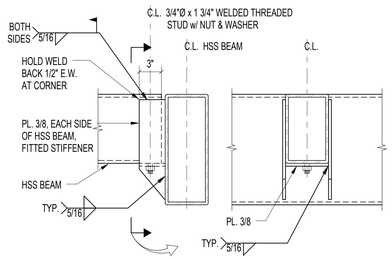
19 — S6.2



HOT DIP GALVANIZE ALL EXPOSED PIECES. FOR LOCATIONS, SEE FRAMING PLANS.

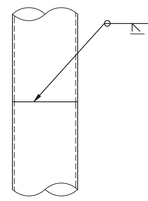
TIEBACK BASE

15 — S6.2



TYP. HSS BEAM TO HSS BEAM SIMPLE CONNECTION

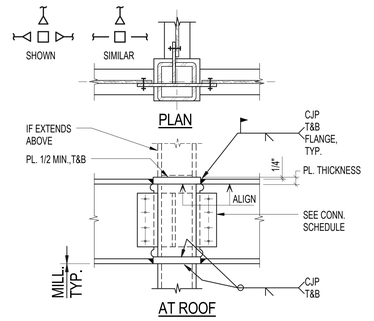
11 — S6.2



NOTE:
REMOVE ALL ERECTION AIDS AND GRIND FLUSH. WHERE EXPOSED TO VIEW, THE RESULTING SURFACE SHALL BE ACCEPTABLE TO THE ARCHITECT.

TYPICAL PIPE & ROUND HSS COLUMN SPLICE DETAIL

7 — S6.2

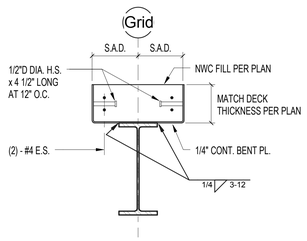


W BEAM TO HSS COLUMN MOMENT CONNECTION

3 — S6.2

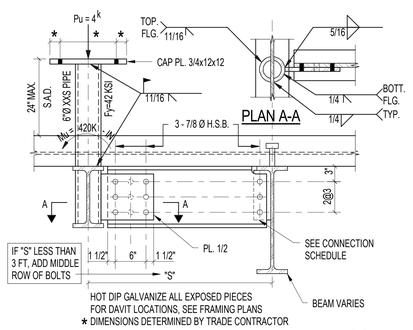
DEPRESSION AT DECK AND FILL

24 — S6.2



SLAB SECTION AT SHAFTS

20 — S6.2

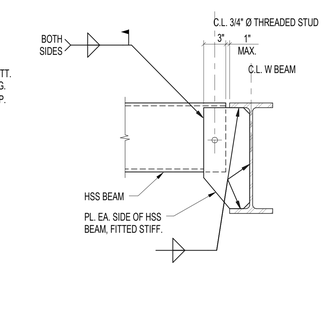


HOT DIP GALVANIZE ALL EXPOSED PIECES FOR DAVIT LOCATIONS, SEE FRAMING PLANS

* DIMENSIONS DETERMINED BY TRADE CONTRACTOR

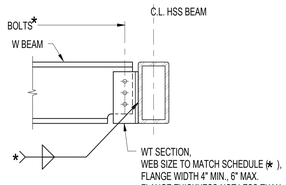
TYPICAL DAVIT PEDESTAL AND BRACE

16 — S6.2



TYPICAL HSS BEAM TO W BEAM SIMPLE CONNECTION

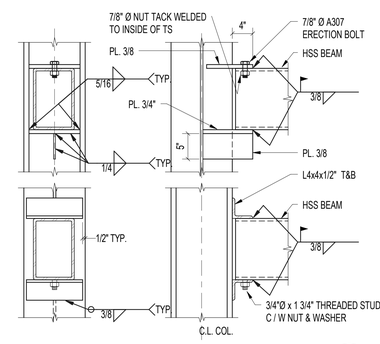
12 — S6.2



* NOTE: SEE CONNECTION SCHEDULE.

TYPICAL W BEAM TO HSS BEAM SIMPLE CONNECTION

8 — S6.2



HSS BEAM TO W COLUMN CONNECTION

4 — S6.2

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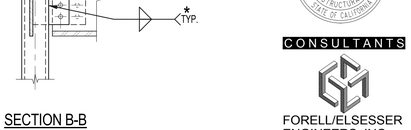
STAMP



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www.forell.com
F/E Job #13-059

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / V.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

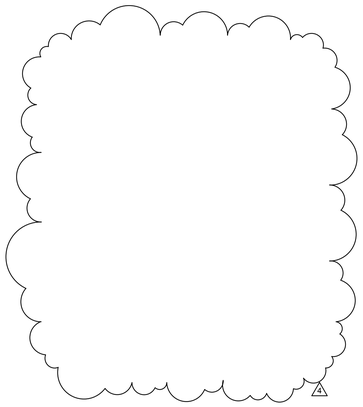
DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

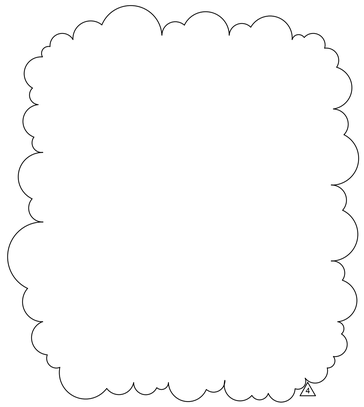
SHEET TITLE

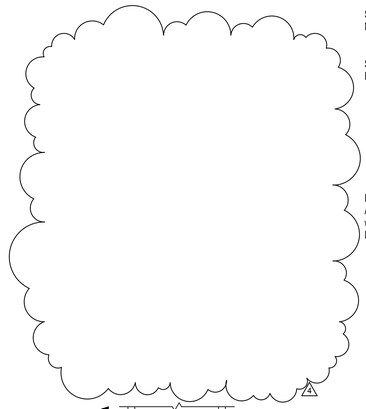
TYPICAL STEEL DETAILS

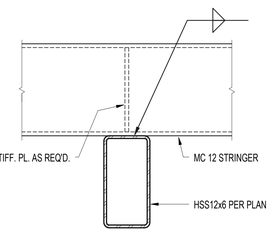
SHEET No

S6.2



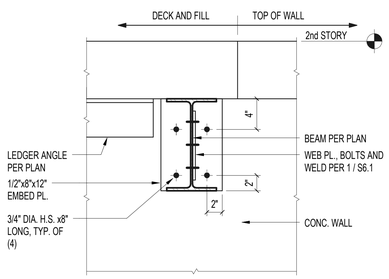




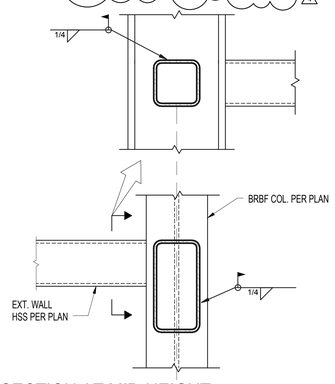


NOTE:
THIS IS A SUGGESTED DESIGN ONLY. STAIR ENGINEER TO FINALIZE CONNECTION DETAILS.

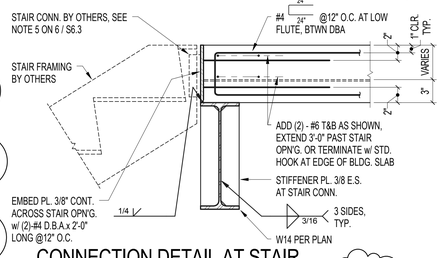
STRINGER CONNECTION
22 / S6.3 — 1 1/2" = 1'-0"



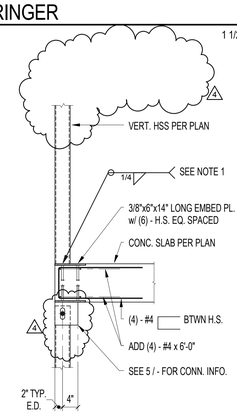
ELEVATION AT STEEL EMBED PL.
18 / S6.3 — 1 1/2" = 1'-0"



SECTION AT MID-HEIGHT CONNECTION
14 / S6.3 — 1 1/2" = 1'-0"

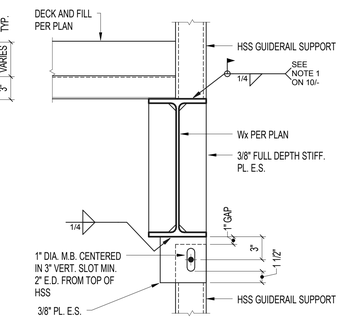


CONNECTION DETAIL AT STAIR STRINGER
9 / S6.3 — 1 1/2" = 1'-0"

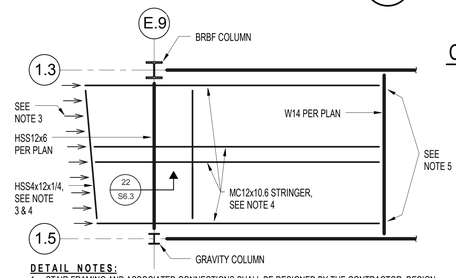


NOTE:
1. WHERE TUBE ALIGNS WITH EDGE OF EMBED PL., PROVIDE PARTIAL PENETRATION WELD WITH EQUIVALENT EFFECTIVE THROAT.

HHSS GUIDERAIL SUPPORT CONN. - CONC. FRAMING
10 / S6.3 — 3/4" = 1'-0"

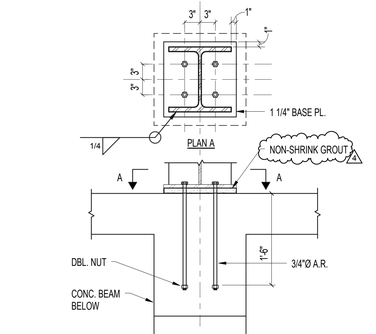


HSS GUIDERAIL SUPPORT CONN. - STEEL FRAMING
5 / S6.3 — 1 1/2" = 1'-0"

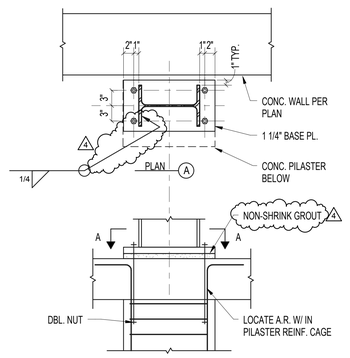


DETAIL NOTES:
1. STAIR FRAMING AND ASSOCIATED CONNECTIONS SHALL BE DESIGNED BY THE CONTRACTOR. DESIGN SHALL SATISFY THE REQUIREMENTS AS OUTLINED BELOW.
2. SIZES REFLECTED ARE MINIMUM SIZES AND SHOULD BE VERIFIED AND REVISED AS NECESSARY BY THE ENGINEEER OF RECORD FOR THE STAIR.
3. STAIR LANDING SHALL BE UTILIZED TO PROVIDE OUT-OF-PLANE BRACING OF THE EXTERIOR CURTAIN WALL SYSTEM FOR BOTH SEISMIC AND WIND LOADING. OUT-OF-PLANE LOADING SHALL BE PROVIDED BY THE EXTERIOR WALL DESIGNER. GC TO COORDINATE DESIGN EFFORTS TO ENSURE BOTH SYSTEMS ARE DESIGNED FOR THE PROPER LOADS. THIS APPROACH ASSUMES THE EXTERIOR WALL SUPPORTS ITS SELF WEIGHT DOWN TO THE BASEMENT WALL.
4. STRINGER SHALL BE CONTINUOUS OVER THE HSS SPECIFIED IN THE STRUCTURAL DRAWINGS. RIGID CONNECTION SHALL BE MADE TO THE HSS. SEE DETAIL 22 / S6.3 FOR GUIDELINES.
5. STAIR STRINGER CONNECTION SHALL BE LATERALLY SLIPPED AT THE FLOOR LEVELS AND SHALL BE ABLE TO ACCOMODATE +/- 2.5" OF LATERAL MOVEMENT. SEE DETAIL 9 / S6.3
6. EXTERIOR WALL SHALL BE CONNECTED TO THE STAIR LANDING FRAMING WITH VERTICALLY SLOTTED CLIPS TO ENSURE ONLY LATERAL LOAD TRANSFER. PROVIDE GAP BETWEEN EXTERIOR WALL FRAMING AND LANDING AS NECESSARY TO ACCOMODATE BUILDING LATERAL DRIFTS.

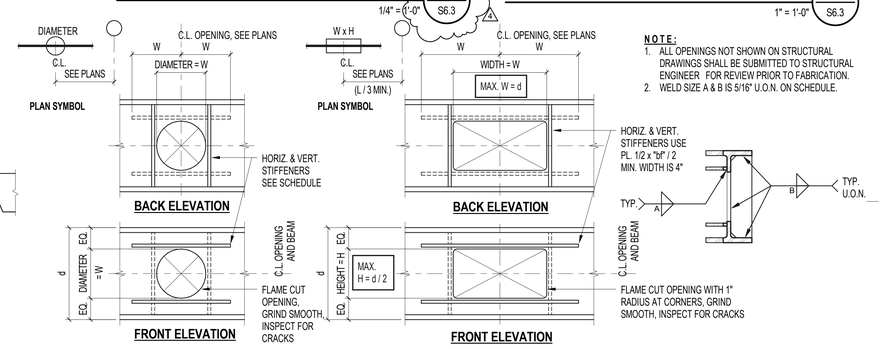
PARTIAL PLAN
6 / S6.3 — 1/4" = 1'-0"



COLUMN DETAIL
1 / S6.3 — 1" = 1'-0"



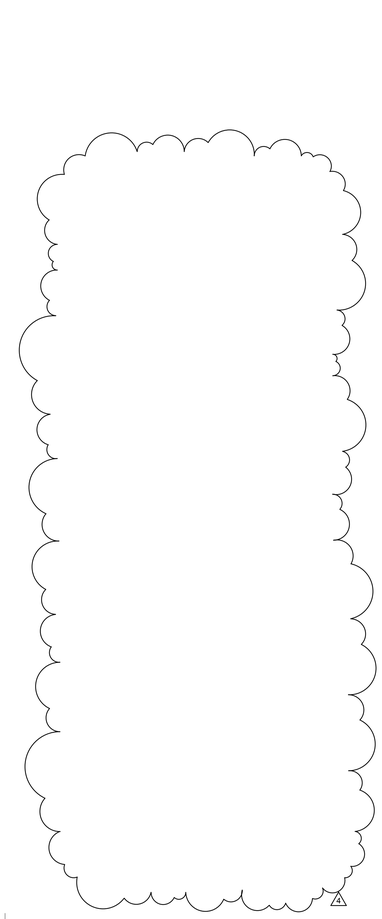
COLUMN DETAIL
2 / S6.3 — 1" = 1'-0"



NOTE:
1. ALL OPENINGS NOT SHOWN ON STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO STRUCTURAL ENGINEER FOR REVIEW PRIOR TO FABRICATION.
2. WELD SIZE A & B IS 5/16" U.O.N. ON SCHEDULE.

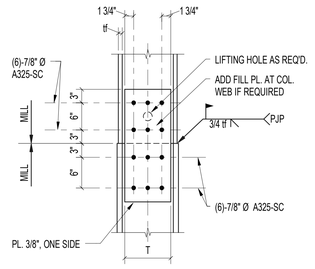
GL.	BEAM SIZE	HORIZ. STIFF.	VERT. STIFF.	WELD A	WELD B
1.3	W21x57	PL. 1/2"x3"	PL. 1/2"x3"	5/16"	5/16"
1.8	W21x93	PL. 7/8"x4 1/2"	PL. 1/2"x4"	5/16"	5/16"

BEAM OR GIRDER LARGE WEB PENETRATION REINF. DETAIL
3 / S6.3 — 12" = 1'-0"



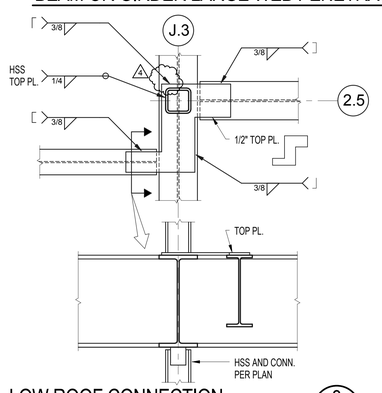
ANGLE LEDGER AT CONCRETE WALL
11 / S6.3 — 1" = 1'-0"

HIGH ROOF TOP OF STEEL
16 / S6.3 — 1" = 1'-0"

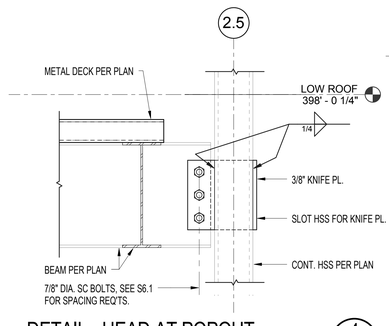


NOTE: DO NOT USE AT MOMENT FRAME COLUMNS.

TYPICAL W COLUMN SPLICE DETAIL (GRAVITY ONY, NON-SLRS)
12 / S6.3 — 1" = 1'-0"
SSS-13



LOW ROOF CONNECTION
8 / S6.3 — 1" = 1'-0"



DETAIL - HEAD AT POPOUT
4 / S6.3 — 1 1/2" = 1'-0"

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F/E Job #13-059

PROJECT

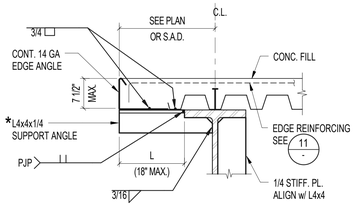
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
TYPICAL STEEL DETAILS

SHEET No
S6.3

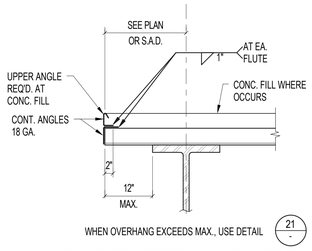


SUPPORT ANGLE SPACING	
L	SPACING
8" < L <= 12"	4'-0" O.C.
12" < L <= 18"	2'-0" O.C.

* SHORING MAY BE USED IN LIEU OF L's.

TYPICAL EDGE OF DECK AT LARGE OVERHANGS

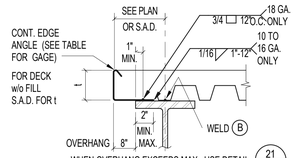
21 / S6.4



WHEN OVERHANG EXCEEDS MAX., USE DETAIL 21 / -

DECK FLUTES PERPENDICULAR TO BEAM

TYPICAL EDGE OF DECK DETAIL



WHEN OVERHANG EXCEEDS MAX., USE DETAIL 21 / -

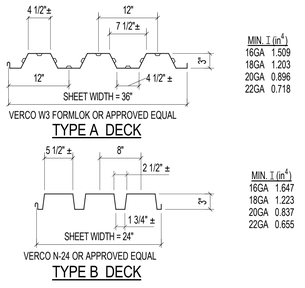
EDGE ANGLE THICKNESS (GAGE)							
	OVERHANG						
t	2"	3"	4"	5"	6"	7"	8"
4"	16	16	16	14	12	12	12
4 1/2"	16	16	16	14	12	12	12
5"	16	16	14	14	12	12	12
5 1/2"	16	16	14	12	12	12	10
6"	16	16	14	12	12	12	10
6 1/2"	16	14	14	12	12	12	10
7"	14	14	12	12	12	12	10
7 1/2"	14	12	12	12	12	10	10

DECK FLUTES PARALLEL TO BEAM
(USE FOR FLUTES SKEWED RELATIVE TO BEAM)

TYPICAL EDGE OF DECK DETAIL

13 / S6.4

1" = 1'-0"



VERCO W3 FORMLOK OR APPROVED EQUAL

TYPE A DECK

MIN. I (in⁴)
16GA 1.509
18GA 1.203
20GA 0.896
22GA 0.718

VERCO N-24 OR APPROVED EQUAL

TYPE B DECK

MIN. I (in⁴)
16GA 1.647
18GA 1.223
20GA 0.837
22GA 0.655

VERCO B FORMLOK OR APPROVED EQUAL

TYPE C DECK

MIN. I (in⁴)
16GA 0.377
18GA 0.302
20GA 0.216
22GA 0.175

VERCO HSB-36 OR APPROVED EQUAL

TYPE D DECK

MIN. I (in⁴)
16GA 0.377
18GA 0.302
20GA 0.216
22GA 0.175

VERCO W2 FORMLOK OR APPROVED EQUAL

TYPE E DECK

MIN. I (in⁴)
16GA 0.694
18GA 0.555
20GA 0.423
22GA 0.340

DECK AND FILL MARK (SEE PLAN)	DECK GAGE AND PROFILE TYPE, SEE 10 / -	DECK WELDS, SEE DETAIL(s) 3 / - , 4 / -						FILL THICKNESS ABOVE DECK - FILL TYPE	FILL REINFORCEMENT	REMARKS
		WELD A		WELD B		WELD C				
		SIZE AND TYPE	# PER SHEET	SIZE AND TYPE	SPACING	SIZE AND TYPE	SPACING			
1	A - 18 GA	3/4" Ø P.W.	3	3/4" Ø P.W.	12"	TSW	12"	4 1/2" NWC	#4@12"	FLOORS
2	A - 18 GA	3/4" Ø P.W.	3	3/4" Ø P.W.	12"	TSW	12"	3 1/4" LWC	#4@12"	LOW ROOF
3	B - 18 GA	3/4" Ø P.W.	3	3/4" Ø P.W.	12"	TSW	12"	-	-	ROOF, NO FILL

P.W. = PUDDLE WELD, TSW = TOP SEAM WELD (1 1/2" MIN.)

STEEL DECK AND FILL SCHEDULE

1 / S6.4

1" = 1'-0"

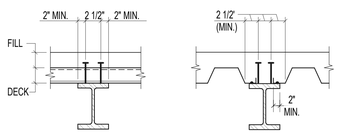
STEEL DECK NOTES

1. SEE ROOF AND FLOOR FRAMING PLANS FOR EXTENT OF DECK TYPES. NOT ALL DECK TYPES ARE SHOWN.
2. DECK SIDE LAPS SHALL BE CRIMPED TOGETHER AT WELD POINTS BEFORE MAKING TOP SEAM WELDS.
3. SEE TYPICAL DETAILS ON THIS SHEET FOR REINFORCEMENT REQUIRED FOR OPENINGS IN THE DECK. SEE ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS FOR MAJOR OPENING SIZES AND LOCATIONS. OTHER OPENINGS ARE NOT SHOWN AND ARE SUBJECT TO REVIEW AND APPROVAL BY THE ARCHITECT AND STRUCTURAL ENGINEER.
4. SEE ARCHITECTURAL AND/OR STRUCTURAL DRAWINGS FOR EDGE OF DECK DIMENSIONS.
5. ALL BEAMS COVERED BY STEEL DECK ARE TO HAVE DECK WELDED TO IT.
6. STEEL DECK AND STEEL MEMBER SURFACES COVERED BY STEEL DECK SHALL NOT BE PAINTED AND SHALL BE FREE OF MOISTURE, RUST, SCALE, DIRT, SAND AND OTHER MATERIALS THAT WILL INTERFERE WITH THE WELDING OPERATIONS. SEE SPECS.
7. CONTRACTOR SHALL PROVIDE AND INSTALL CLOSURE ANGLES, AND OTHER GAGE METAL SHAPES TO CLOSE ALL MISC. OPENINGS IN DECK AS NEEDED AROUND COLUMNS, VERTICAL DISCONTINUITIES, ETC.
8. ALL PUDDLE WELDS ARE 3/4"Ø OR EQUAL, REFER TO MANUFACTURER'S RECOMMENDATION.
9. STEEL DECK W/O CONCRETE MAY REQUIRE LIGHT GAGE EDGE ANGLES OR CLOSURE ANGLE, ETC. REFER TO ARCHITECTURAL DRAWINGS FOR EXTENT.
10. SHEAR STUDS MAY BE USED TO REPLACE PUDDLE WELD ON A ONE-TO-ONE BASIS.
11. LAYOUT OF DECK SHALL PROVIDE SHEETS OF SUFFICIENT LENGTH TO SPAN AT LEAST THREE SPANS. ENDS SHALL TERMINATE OVER A SUPPORT PERPENDICULAR TO THE DECK SPAN, EXCEPT AT OPENINGS OR BUILDING EDGES WHERE DECKS MAY BE CANTILEVERED AS SHOWN. SEE SPECIFICATIONS FOR COMPLETE REQUIREMENTS.
12. DO NOT PLACE CONDUITS OR PIPES IN CONCRETE FILL OVER METAL DECK WITHOUT THE APPROVAL OF THE ENGINEER.

STEEL DECK NOTES

2 / S6.4

1" = 1'-0"



DECK PERPENDICULAR

* DECK SPLIT

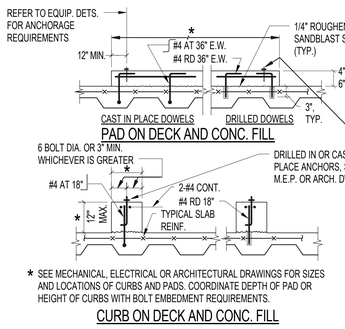
DECK EDGE

DIRECTION CHANGE

* SPLIT DECK REQUIRED FOR DOUBLE STUDS, U.O.N. ABOVE

TYPICAL DECK AND SHEAR STUD DOUBLE ROW OF STUDS

22 / S6.4



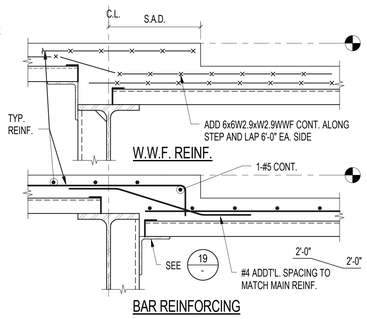
* SEE MECHANICAL, ELECTRICAL OR ARCHITECTURAL DRAWINGS FOR SIZES AND LOCATIONS OF CURBS AND PADS. COORDINATE DEPTH OF PAD OR HEIGHT OF CURBS WITH BOLT EMBEDMENT REQUIREMENTS.

PAD ON DECK AND CONC. FILL

CURB ON DECK AND CONC. FILL

TYPICAL CONCRETE EQUIPMENT SUPPORTS

18 / S6.4



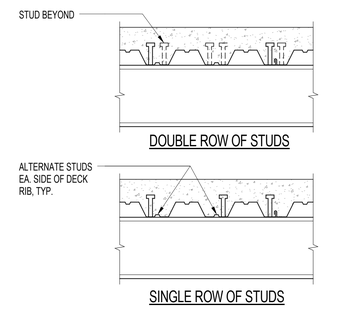
BAR REINFORCING

TYPICAL FILL REINFORCEMENT AT ELEVATION CHANGE

14 / S6.4

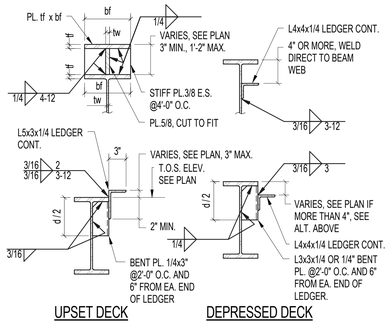
METAL DECK PROFILES AND MINIMUM PROPERTIES

10 / S6.4



TYPICAL STUD PLACEMENT AT DECK PERPENDICULAR TO BEAM

23 / S6.4

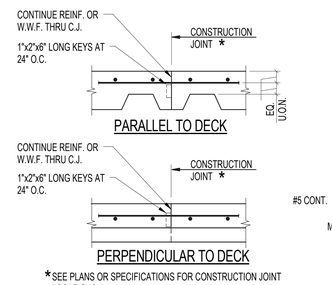


UPSET DECK

DEPRESSED DECK

TYPICAL LEDGER AT UPSET OR DEPRESSED DECK

19 / S6.4



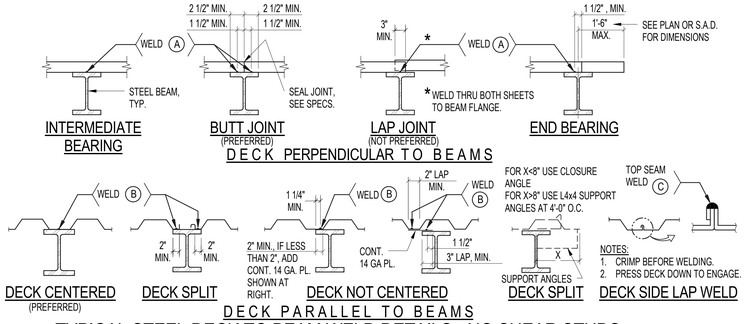
TYPICAL LAYOUT & CONSTRUCTION JOINTS

AT EDGES

TYPICAL REINFORCING DETAILS FOR CONCRETE FILLS ON METAL DECK

11 / S6.4

1" = 1'-0"



INTERMEDIATE BEARING

BUTT JOINT (PREFERRED)

LAP JOINT (NOT PREFERRED)

END BEARING

DECK PERPENDICULAR TO BEAMS

DECK CENTERED (PREFERRED)

DECK SPLIT

DECK NOT CENTERED

DECK SPLIT

DECK SIDE LAP WELD

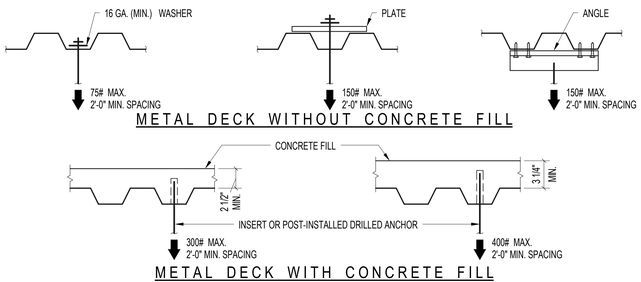
DECK PARALLEL TO BEAMS

TYPICAL STEEL DECK TO BEAM WELD DETAILS - NO SHEAR STUDS OR CONCRETE FILL

SEE STEEL DECK WELDING SCHEDULE, NOTES AND OTHER DETAILS

3 / S6.4

1" = 1'-0"



METAL DECK WITHOUT CONCRETE FILL

METAL DECK WITH CONCRETE FILL

DESIGN OF CONNECTIONS FOR SUSPENDED ITEMS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR UNLESS OTHERWISE NOTED.

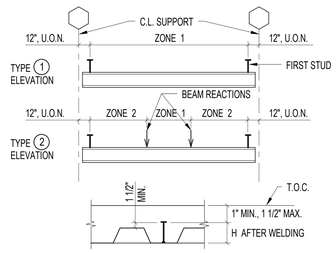
ALLOWABLE SUSPENDED LOADS TO METAL DECK BASED ON SLAB CAPACITY

20 / S6.4

1" = 1'-0"

MARK	SIZE	NUMBER OF ROWS AT STUD SPACING (IN.)		ELEVATION	SHORING REQUIRED
SEE PLAN	SEE NOTE 1	ZONE 1	ZONE 2	ELEVATION TYPE	SEE GENERAL NOTES
S1	3/4" Ø x H	1 @ 12" O.C.	-	1	NO
S2	3/4" Ø x H	1 @ 12" O.C.	2 @ 12" O.C.	2	NO
S3	3/4" Ø x H	2 @ 12" O.C.	2 @ 12" O.C.	2	NO
TYP.	3/4" Ø x H	1 @ 12" O.C.	-	1	NO

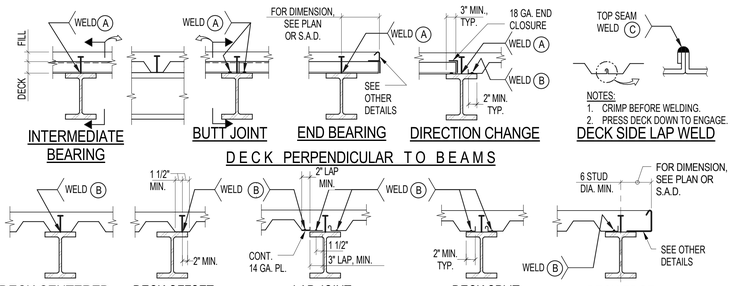
NOTES:
1. INDICATES STUD DIAMETER AND HEIGHT OF STUD ABOVE TOP OF STEEL AFTER WELDING.
2. FOR SINGLE ROW OF STUDS, SEE 4 / - FOR DOUBLE ROW OF STUDS, SEE 22 / -
3. FOR ALL BEAMS WITH NO STUDMARK, USE "TYP" STUD INFORMATION SHOWN ABOVE.
4. STUDS SHOULD BEGIN 6 INCHES FROM GUSSET PLATES AT BEAM ENDS WHERE APPLICABLE.
5. OMIT STUDS WHERE NO CONCRETE FILL IS PRESENT.
6. FOR DECKS WITH LESS THAN 2 1/2 IN. OF FILL, PROVIDE 3/4 IN. CLEAR TO TOP OF STUD.



TYPICAL SHEAR STUD AND LAYOUT SCHEDULE

12 / S6.4

1" = 1'-0"



DECK CENTERED (PREFERRED)

DECK OFFSET

LAP JOINT

DECK SPLIT

DECK EDGE

DECK PARALLEL TO BEAMS

TYPICAL SHEAR STUD AND DECK WELD DETAILS - SINGLE ROW OF STUDS WITH CONCRETE FILL

4 / S6.4

1" = 1'-0"

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F/E Job #13-059

PROJECT

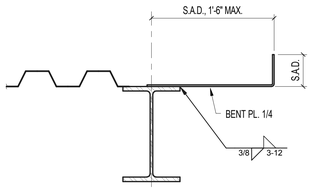
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

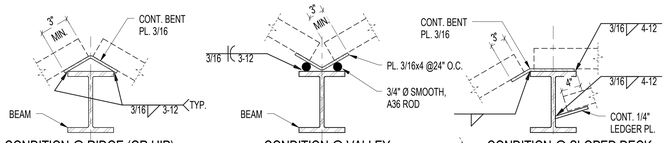
DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
TYPICAL METAL DECK DETAILS

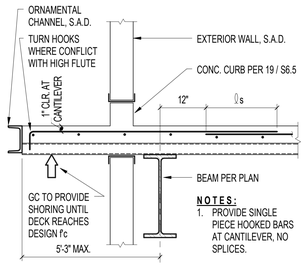
SHEET No
S6.4



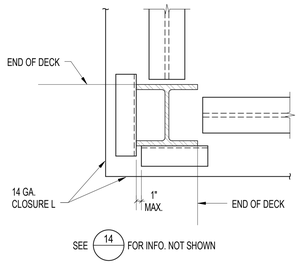
LOW ROOF EDGE — 21 / S6.5



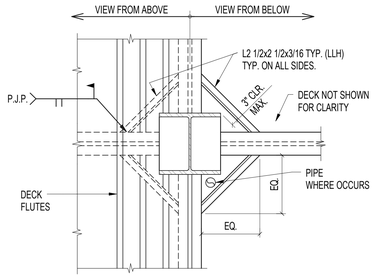
TYPICAL BENT PL. DETAILS AT SLOPED METAL DECK — 13 / S6.5 — 1" = 1'-0"



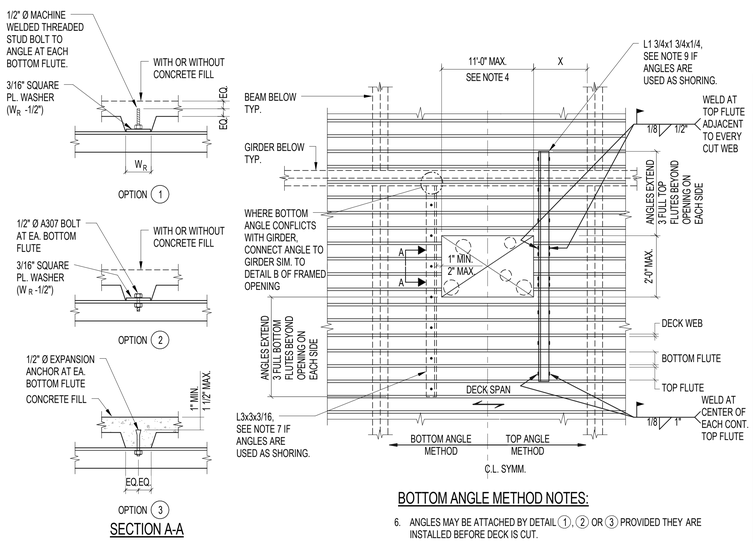
SECTION AT EDGE OF DECK w/ ARCHITECTURAL EXTENSION — 22 / S6.5



TYPICAL DECK SUPPORT AT CORNER COLUMN — 18 / S6.5



TYPICAL DECK SUPPORT DETAIL AT INTERIOR W COLUMNS — 14 / S6.5



GENERAL NOTES:

1. SEE ARCH., M, E, & P DRAWINGS FOR SIZE AND LOCATIONS OF OPENINGS.
2. IF X IS NOT GREATER THAN 1'-0" ANGLE MAY BE OMITTED ON SIDE CLOSEST TO BEAM.
3. OPENING SHALL BE BLOCKED OUT PRIOR TO CONCRETE POUR AND DECK LEFT INTACT UNTIL 14 DAYS AFTER CONCRETE POUR.
4. OPENING DIMENSION SHALL BE CONFINED TO CLEAR SPACE BETWEEN EDGES OF ADJACENT BEAMS.
5. PROVIDE TRIM BAR AROUND OPENING PER TYPICAL DETAILS.

BOTTOM ANGLE METHOD NOTES:

6. ANGLES MAY BE ATTACHED BY DETAIL (1), (2) OR (3) PROVIDED THEY ARE INSTALLED BEFORE DECK IS CUT.
7. AT CONTRACTOR'S OPTION, DECK MAY BE CUT AHEAD OF CONCRETE POUR PROVIDED THAT THE ANGLES ARE INSTALLED BY DETAIL (1) OR (2) BEFORE THE DECK IS CUT. ANGLES SHALL BE L4x4x3/8

TOP ANGLE METHOD NOTES:

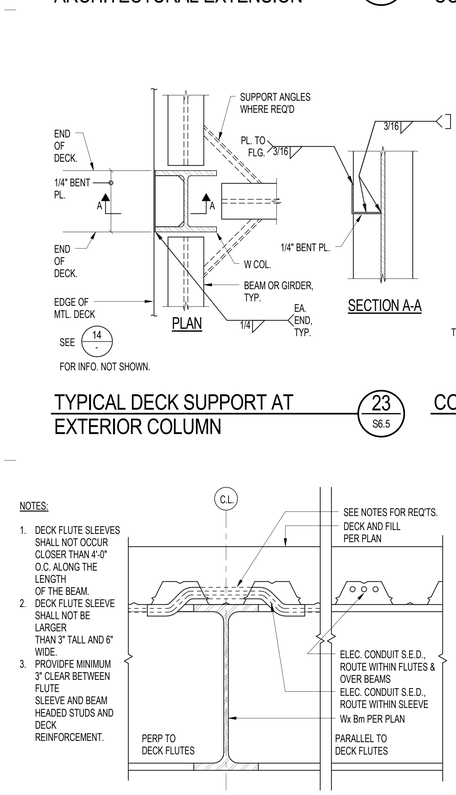
8. CONCRETE FILL MUST BE 4" MIN. TO USE TOP ANGLE REINFORCEMENT.
9. AT CONTRACTOR'S OPTION, DECK MAY BE CUT AHEAD OF CONCRETE POUR PROVIDED THAT THE ANGLES ARE INSTALLED BEFORE THE DECK IS CUT. ANGLES SHALL BE REPLACED BY FLAT HSS3x1 1/2 x1/8.

TYPICAL REINFORCED DECK OPENING WITH OR WITHOUT CONCRETE FILL — 6 / S6.5 — 1" = 1'-0"

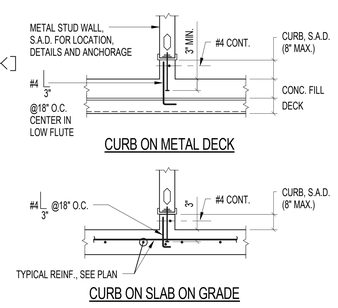
OPENING PATTERN	CLASSIFICATION / DETAIL
6 DIA. OF LARGER OPENING, MIN. 6 DIA. OF LARGER OPENING, MIN. NOT LESS THAN 18" C.L. C.L. C.L. C.L. 6" Ø MAX. FOR DECK WITH FILL, TYP FOR LIMITS OF OPENING SIZE FOR DECK WITHOUT FILL SEE 8 SPAN DIRECTION OF METAL DECK, TYP.	UNREINFORCED OPENING SEE 4 / 8
LESS THAN 6 DIA OF LARGER OPENING CONSIDERED A SINGLE OPENING C.L. C.L.	REINFORCED OPENING SEE 6 / 7
2'-0" MAX. LESS THAN 6 DIA OF LARGER OPENING OR 18" CONSIDERED A SINGLE OPENING	
<1'-6" CLEAR CONSIDERED A SINGLE OPENING 2'-0" MAX. 11'-0" MAX.	
11'-0" MAX. 2'-0" MAX.	
>2'-0" 8'-0" MAX. LESS THAN 6 DIA OF LARGER OPENING OR 18" CONSIDERED A SINGLE OPENING	
<1'-6" CLEAR CONSIDERED A SINGLE OPENING 2'-0" MAX. 8'-0" MAX. 11'-0" MAX.	FRAMED OPENING SEE 16
11'-0" MAX. 2'-0" MAX. 8'-0" MAX.	

NOTE:
CHECK FIRST IF OPENING(S) MEET THE CRITERIA FOR UNREINFORCED.
IF NOT, CHECK IF OPENING(S) MEET THE CRITERIA FOR REINFORCED.
IF NOT, THEN OPENING(S) SHALL BE FRAMED.

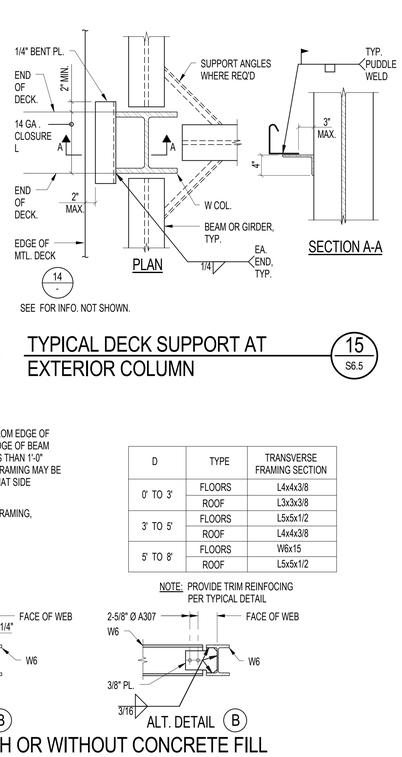
CLASSIFICATION OF OPENINGS IN DECK — 3 / S6.5



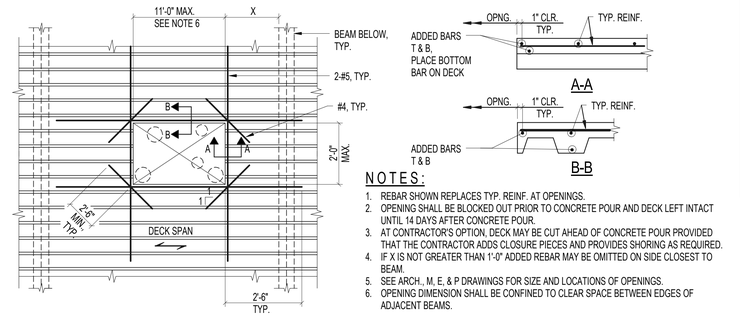
TYPICAL DECK SUPPORT AT EXTERIOR COLUMN — 23 / S6.5



CONCRETE CURB DETAILS — 19 / S6.5



TYPICAL DECK SUPPORT AT EXTERIOR COLUMN — 15 / S6.5

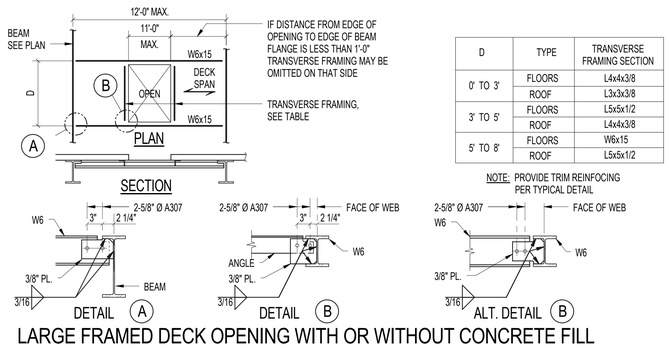


NOTES:

1. REBAR SHOWN REPLACES TYP. REINF. AT OPENINGS.
2. OPENING SHALL BE BLOCKED OUT PRIOR TO CONCRETE POUR AND DECK LEFT INTACT UNTIL 14 DAYS AFTER CONCRETE POUR.
3. AT CONTRACTOR'S OPTION, DECK MAY BE CUT AHEAD OF CONCRETE POUR PROVIDED THAT THE CONTRACTOR ADDS CLOSURE PIECES AND PROVIDES SHORING AS REQUIRED.
4. IF X IS NOT GREATER THAN 1'-0" ADDED REBAR MAY BE OMITTED ON SIDE CLOSEST TO BEAM.
5. SEE ARCH., M, E, & P DRAWINGS FOR SIZE AND LOCATIONS OF OPENINGS.
6. OPENING DIMENSION SHALL BE CONFINED TO CLEAR SPACE BETWEEN EDGES OF ADJACENT BEAMS.

TYPICAL REINFORCED DECK OPENING WITH CONCRETE FILL (APPLIES FOR FILL THICKNESS NOT LESS THAN 3") — 7 / S6.5 — 1" = 1'-0"

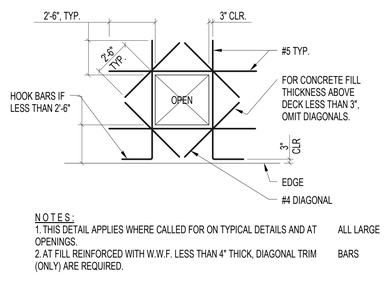
TYP. ELEC. ROUTING @ BEAM — 24 / S6.5



D	TYPE	TRANSVERSE FRAMING SECTION
0' TO 3'	FLOORS	L4x4x3/8
	ROOF	L3x3x3/8
3' TO 5'	FLOORS	L5x5x1/2
	ROOF	L4x4x3/8
5' TO 8'	FLOORS	W6x15
	ROOF	L5x5x1/2

NOTE: PROVIDE TRIM REINFOCING PER TYPICAL DETAIL

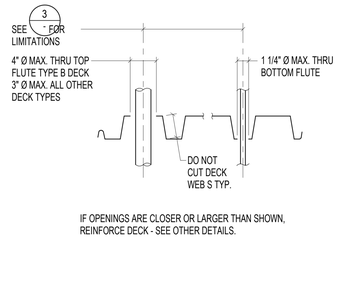
LARGE FRAMED DECK OPENING WITH OR WITHOUT CONCRETE FILL (OPENING UP TO 8 FEET WIDE) — 16 / S6.5 — 1" = 1'-0"



NOTES:
1. THIS DETAIL APPLIES WHERE CALLED FOR ON TYPICAL DETAILS AND AT OPENINGS.
2. AT FILL REINFORCED WITH W.W.F. LESS THAN 4" THICK, DIAGONAL TRIM (ONLY) ARE REQUIRED.

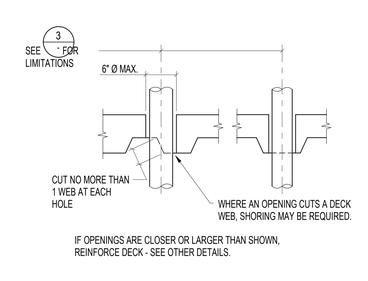
ALL LARGE BARS

TYPICAL TRIM REINFORCEMENT AT OPENINGS — 12 / S6.5



IF OPENINGS ARE CLOSER OR LARGER THAN SHOWN, REINFORCE DECK - SEE OTHER DETAILS.

TYPICAL UNREINFORCED OPENING AT DECK WITHOUT CONCRETE FILL — 8 / S6.5



IF OPENINGS ARE CLOSER OR LARGER THAN SHOWN, REINFORCE DECK - SEE OTHER DETAILS.

TYPICAL UNREINFORCED OPENING AT DECK WITH CONCRETE FILL — 4 / S6.5

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F/E Job #13-059

PROJECT

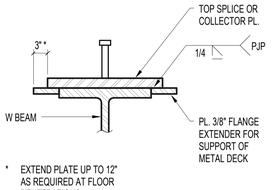
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

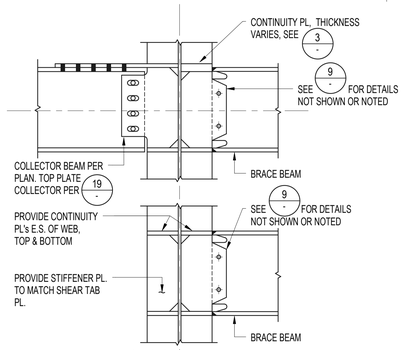
SHEET TITLE
TYPICAL METAL DECK DETAILS

SHEET No
S6.5



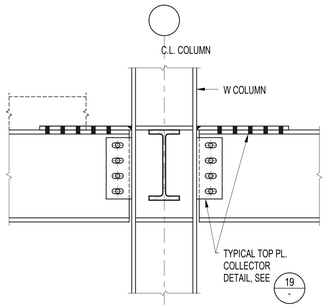
METAL DECK SUPPORT AT TOP SPLICE OR COLLECTOR PL.

21 / S6.6



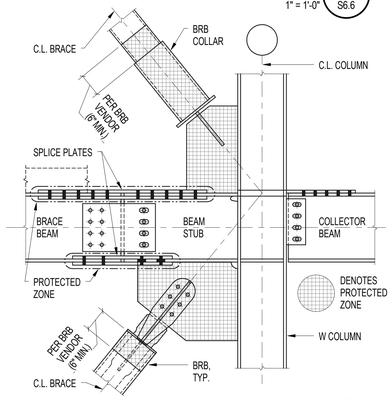
TYP. BEAM-TO-COLUMN WEB CONNECTION (SLRS)

17 / S6.6
1" = 1'-0"



DETAIL (SLRS)

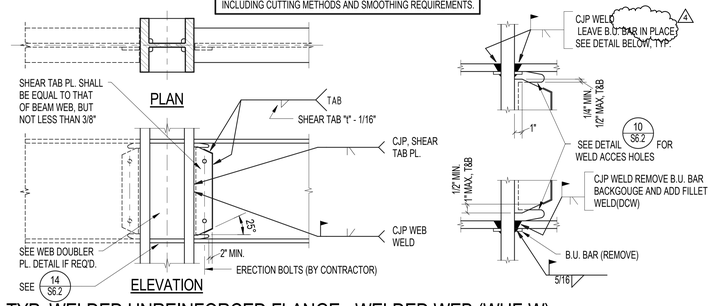
22 / S6.6
1" = 1'-0"



BRBF TYPICAL PROTECTED ZONE

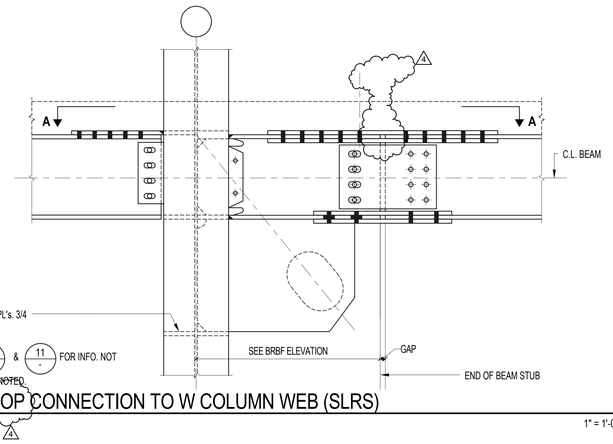
18 / S6.6
3/4" = 1'-0"

IMPORTANT: REFER TO STEEL SPECS. FOR FABRICATION DETAILS INCLUDING CUTTING METHODS AND SMOOTHING REQUIREMENTS.



TYP. WELDED UNREINFORCED FLANGE - WELDED WEB (WUF-W) CONN. AT FLOOR (SLRS)

15 / S-1
9 / S6.6
3/4" = 1'-0"



BRB TOP CONNECTION TO W COLUMN WEB (SLRS)

10 / S6.6
1" = 1'-0"

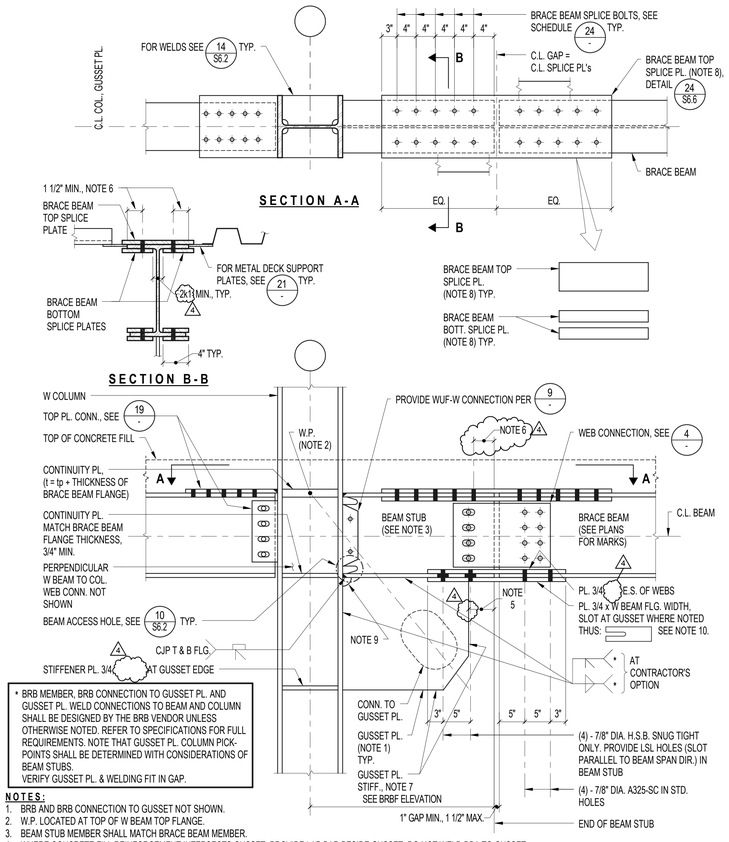
BUCKLING RESTRAINED BRACE SCHEDULE				
TYPE	DESIGN BRACE FORCE (kips) (NOTES 1, 2)	MAXIMUM ADJUSTED BRACE STRENGTH (kips) (NOTES 1, 3)	INITIAL BRACE STIFFNESS (k / in) (NOTE 4)	REMARKS
BRB-1A	150	275	504	
BRB-1B	150	275	541	
BRB-1C	150	275	786	
BRB-2	160	295	538	
BRB-3A	190	350	685	
BRB-3B	190	350	995	

NOTES:

1. 1 kip = 1000 POUNDS
2. DESIGN BRACE FORCE IS DETERMINED BASED ON Φ Fysc Asc, WHERE Φ = 0.90 AND Fysc = 38 KSI U.O.N.
3. MAXIMUM ADJUSTED BRACE STRENGTH IS DETERMINED BASED ON β ω Ry Fysc Asc, WHERE β = 1.04, ω = 1.31 AND Ry Fysc = 46 KSI.
4. THE ASSUMED INITIAL BRACE STIFFNESS AS SHOWN IN THE TABLE IS FROM WORK POINT TO WORK POINT. THE COMPUTED INITIAL STIFFNESS SHALL BE WITH IN +/- 10% OF THE VALUE NOTED. THE COMPUTATION OF INITIAL STIFFNESS SHALL BE BASED ON WORK POINT TO WORK POINT LENGTH AND SHALL INCLUDE THE STIFFNESS OF THE BRACE, CONNECTORS, GUSSET PLATES, AND SUPPORTING STRUCTURE.
5. BUCKLING-RESTRAINED BRACES SHALL BE ABLE TO ACCOMMODATE TWICE THE MAXIMUM DESIGN BUILDING DRIFT SHOWN ON S1-001 WHILE LIMITING CORE PLATE MATERIAL STRAINS BELOW THOSE DEMONSTRATED BY FULL SCALE PROTOTYPE TESTING.
6. MAXIMUM WIDTH OF BRACE ASSEMBLY INCLUDING CONNECTIONS SHALL BE 12".
7. MAXIMUM CROSS-SECTIONAL DIMENSION (HEIGHT OR WIDTH) OF BRACE CASING SHALL BE 12". CONTRACTOR TO VERIFY CLEARANCES WITH DOORS AND HALLWAY PARTITIONS.

BRB SCHEDULE (SLRS)

1 / S6.6
12" = 1'-0"



* BRB MEMBER, BRB CONNECTION TO GUSSET PL. AND GUSSET PL. WELD CONNECTIONS TO BEAM AND COLUMN SHALL BE DESIGNED BY THE BRB VENDOR UNLESS OTHERWISE NOTED. REFER TO SPECIFICATIONS FOR FULL REQUIREMENTS. NOTE THAT GUSSET PL. COLUMN PICK-POINTS SHALL BE DETERMINED WITH CONSIDERATIONS OF BEAM STUBS. VERIFY GUSSET PL. & WELDING FIT IN GAP.

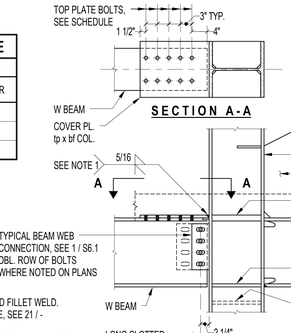
NOTES:

1. BRB AND BRB CONNECTION TO GUSSET NOT SHOWN.
2. W.P. LOCATED AT TOP OF W BEAM TOP FLANGE.
3. BEAM STUB MEMBER SHALL MATCH BRACE BEAM MEMBER.
4. WHERE CONCRETE FILL REINFORCEMENT INTERSECTS GUSSET, PROVIDE LAP BAR BESIDE GUSSET. DO NOT WELD DBA TO GUSSET.
5. END OF GUSSET SHALL BE 1" MINIMUM FROM END OF BEAM STUB.
6. SPACING OF SPLICE BOLTS SHALL MEET AISC MINIMUMS AND ALLOW FOR INSTALLATION TOLERANCES.
7. PROVIDE GUSSET PLATE THICKNESS SUFFICIENT TO RESIST BRB FORCE WITHOUT THE NEED FOR GUSSET STIFF. PL.
8. THE PROTECTED ZONE SHALL INCLUDE THE STEEL CORE PL's OF THE BRACING MEMBERS AND ELEMENTS THAT CONNECT THE PL's. TO BEAMS AND COLUMNS, BRACE BEAM TOP & BOTTOM SPLICE PLATES. SEE 18 / -
9. PROVIDE 1" RADIUS AT CORNER OF GUSSET PL.
10. END OF SLOT IN SPLICE PL. SHALL BE 1" FROM END OF GUSSET.
11. SEE DETAIL 14 / S6.2 FOR CONTINUITY PL. INFO NOT SHOWN.

BRB TOP CONNECTION TO W COLUMN FLANGE (SLRS)

3 / S6.6
1" = 1'-0"

TOP PLATE COLLECTOR SCHEDULE			
MARK SEE BRBF ELEVATIONS	TOP PLATE THICKNESS tp (3)	TOP PLATE BOLTS (4)	
		DIAMETER	NUMBER
TP-A	5/8"	7/8"	6
TB-B	5/8"	7/8"	10
TP-C	3/4"	7/8"	12

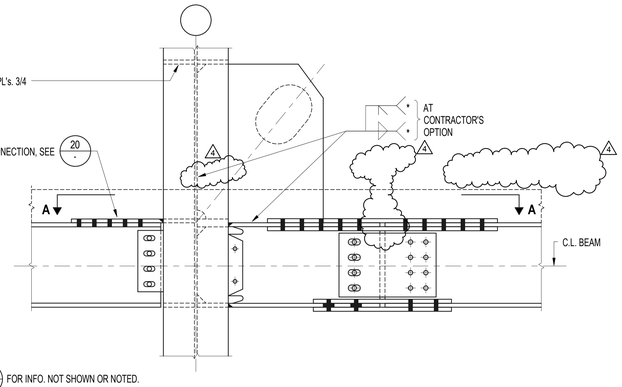


NOTES:

1. C.J.P. WELD. REMOVE B.U. BAR. BACKGOUGE AND ADD FILLET WELD.
2. FOR SUPPORT OF METAL DECK AT COLLECTOR PLATE, SEE 21 / -
3. TOP PLATES SHALL BE ASTM A572 GR50 STEEL.
4. BOLTS SHALL BE ASTM A325-X (SNUG TIGHT ONLY, THREADS EXCLUDED)
5. SEE 14 / S6.2 FOR CONTINUITY PLATE DETAIL.

TYPICAL TOP PLATE COLLECTOR DETAIL (SLRS) - COL. STRONG DIRECTION

19 / S6.6
3/4" = 1'-0"



NOTE:

SEE 3 FOR INFO. NOT SHOWN OR NOTED.

BRB BOTTOM CONNECTION TO W COLUMN WEB (SLRS)

11 / S6.6
1" = 1'-0"

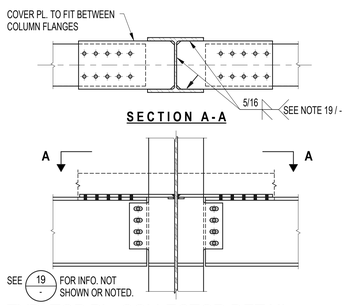
BRACE BEAM SPLICE PLATE CONN. SCHEDULE			
MARK SEE BRBF ELEVATIONS	TOP & BOTTOM SPLICE PLATE THICKNESS (1)	BRACE BEAM SPLICE BOLTS (2)	
		DIAMETER	NUMBER
SP-1	1/2"	7/8"	4
SP-2	3/4"	7/8"	6
SP-3	1"	7/8"	6

NOTES:

1. SPLICE PLATES SHALL BE ASTM A572 Gr.50 STEEL.
2. BOLTS SHALL BE ASTM A325-X (SNUG TIGHT ONLY, THREADS EXCLUDED) VALUES REPRESENT NUMBER OF BOLTS ON EACH SIDE OF SPLICE C.L. H.S. WASHERS AT BOLT HEAD & NUT, TYP.
3. SEE 3 / - FOR PL. WIDTH

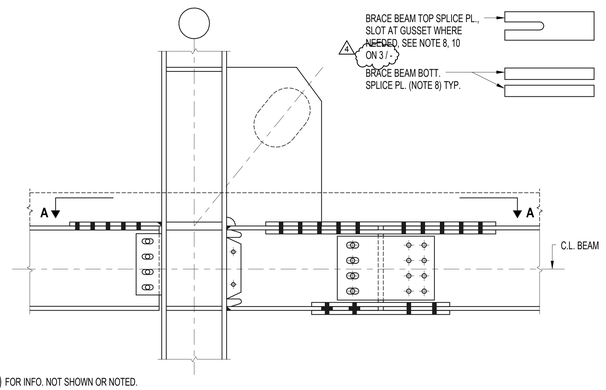
BRACE BEAM SPLICE CONNECTION SCHEDULE (SLRS)

24 / S6.6



TYP. TOP PL. COLLECTOR DETAIL (SLRS) - COL. WEAK DIRECTION

20 / S6.6
3/4" = 1'-0"

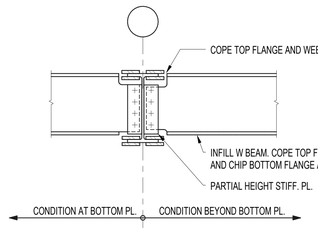


NOTE:

SEE 3 FOR INFO. NOT SHOWN OR NOTED.

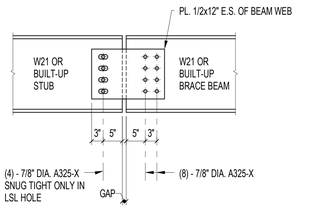
BRB BOTTOM CONNECTION TO W COLUMN FLANGE (SLRS)

12 / S6.6
1" = 1'-0"



INFILL W BEAM CONNECTION AT BRB SPLICE PLATES (SLRS)

8 / S6.6
3/4" = 1'-0"



WEB CONNECTION AT BRACE BEAM SPLICE (SLRS)

4 / S6.6
3/4" = 1'-0"

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F/E Job #13-059

PROJECT

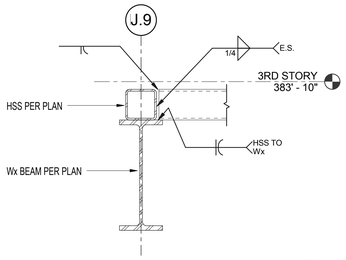
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshall Submission	12/20/13
	80% DD Pricing DRAFT	01/13/14
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

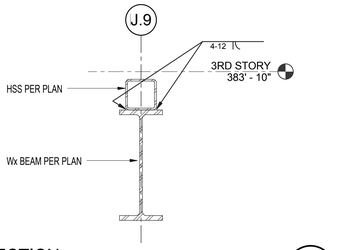
DATE: 15 August, 2014
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
BRACE FRAME DETAILS

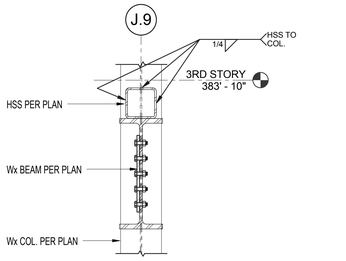
SHEET No
S6.6



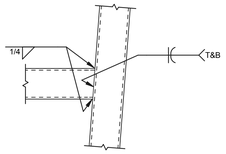
SECTION 21 S6.7
1" = 1'-0"



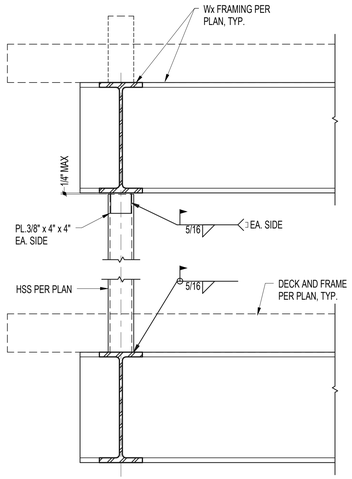
SECTION 22 S6.7
1" = 1'-0"



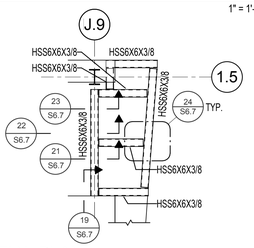
SECTION 23 S6.7
1" = 1'-0"



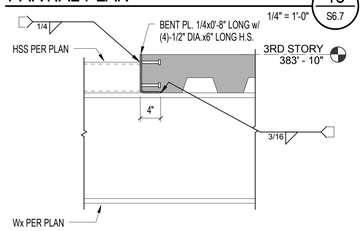
PLAN DETAIL 24 S6.7
1" = 1'-0"



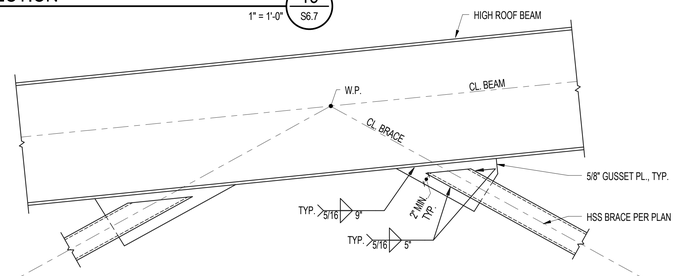
EXTERIOR FLOOR- FLOOR POST CONNECTION 17 S6.7
1" = 1'-0"

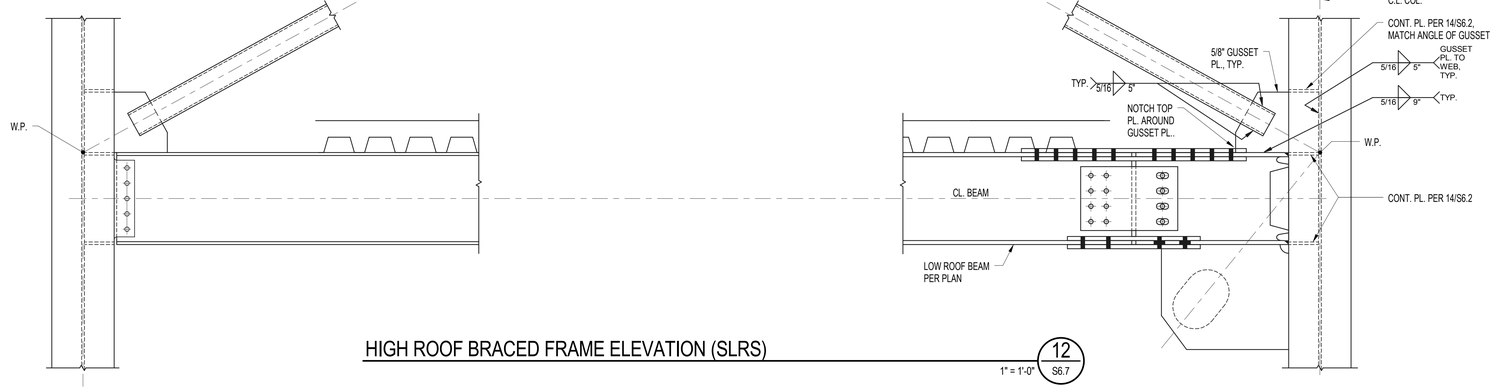


PARTIAL PLAN 18 S6.7
1/4" = 1'-0"

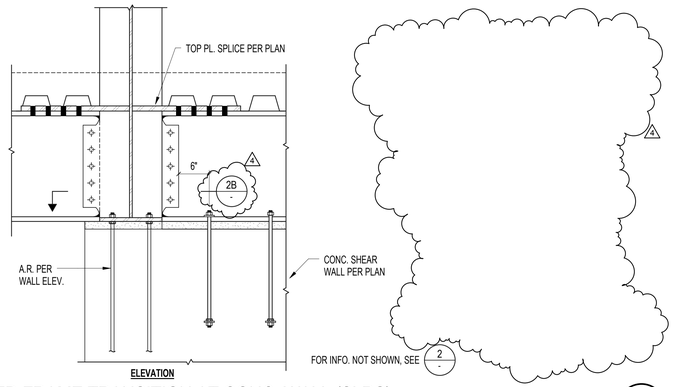


SECTION 19 S6.7
1" = 1'-0"

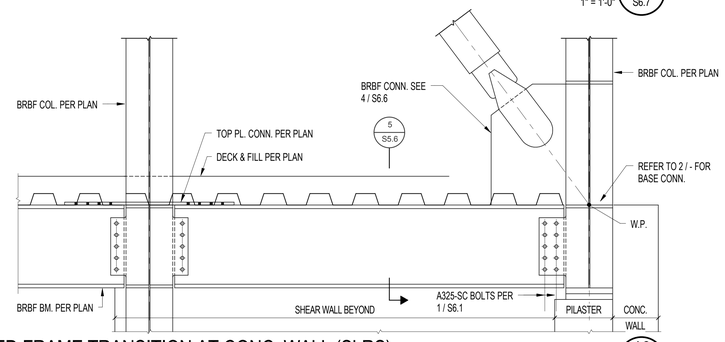




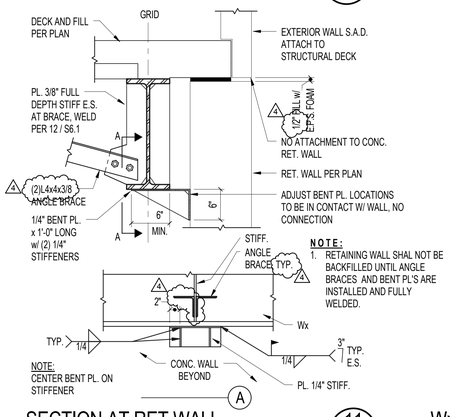
HIGH ROOF BRACED FRAME ELEVATION (SLRS) 12 S6.7
1" = 1'-0"



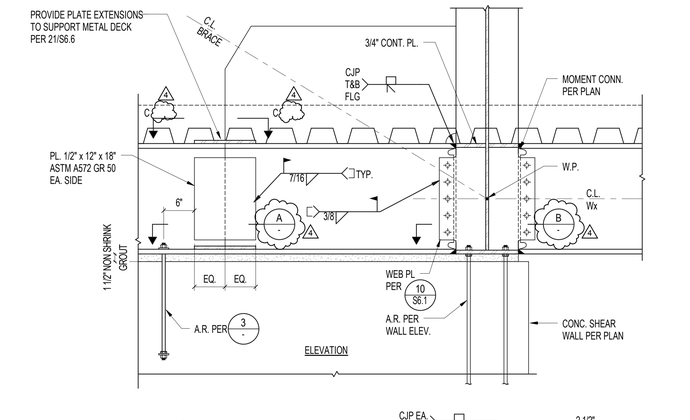
BRACED FRAME TRANSITION AT CONC. WALL (SLRS) 9 S6.7
1" = 1'-0"



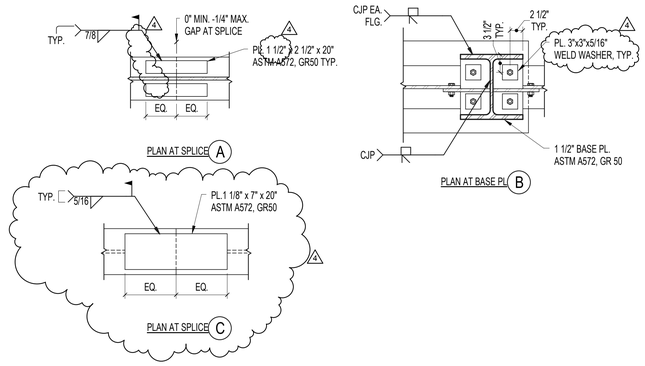
BRACED FRAME TRANSITION AT CONC. WALL (SLRS) 10 S6.7
3/4" = 1'-0"



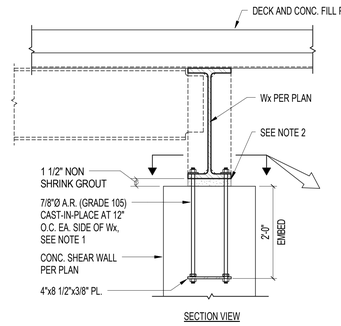
SECTION AT RET WALL 11 S6.7
1" = 1'-0"



BRACED FRAME TRANSITION AT CONC. WALL (SLRS) 2 S6.7
1" = 1'-0"

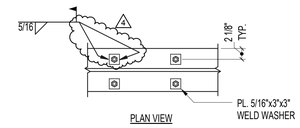


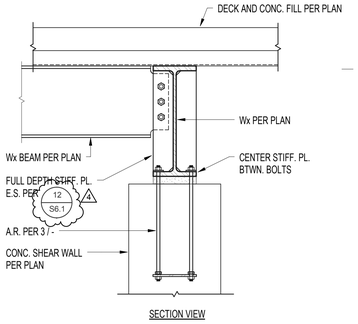
Wx AT TOP OF SHEAR WALL (SLRS) 3 S6.7
1" = 1'-0"



NOTES:

1. CENTER A.R. IN 1 7/8"Ø OVERSIZED HOLE FOR Wx AFTER A.R.'s HAVE BEEN CAST AND FIELD MEASURED.
2. ANCHRS RODS SHALL BE PLACED WITHIN THE STRICTER TOLERANCE BETWEEN AC AND AISC REQUIREMENTS





Wx AT TOP OF SHEAR WALL 4 S6.7
1" = 1'-0"

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PROJECT

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UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Bid #3 – Structure / Utilities / W.P.	07/09/14
4	100% CDs / Permit Submission	08/15/14

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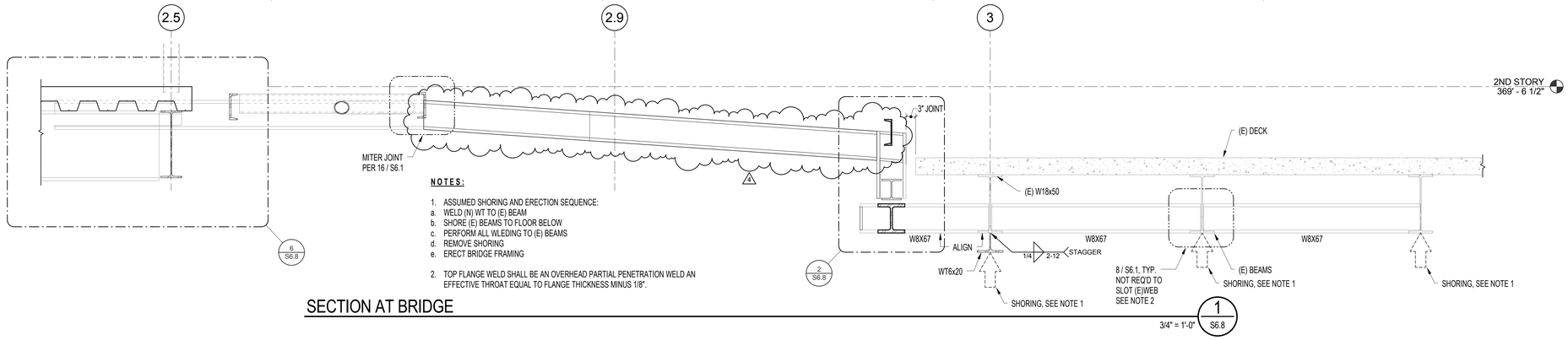
JOB No: 13-059
PHASE: CD
ISSUED FOR: PERMIT
PERMIT No:
SCALE:

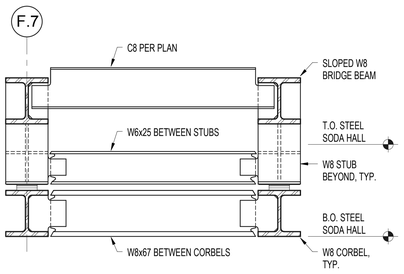
SHEET TITLE
STEEL DETAILS

SHEET No
S6.7



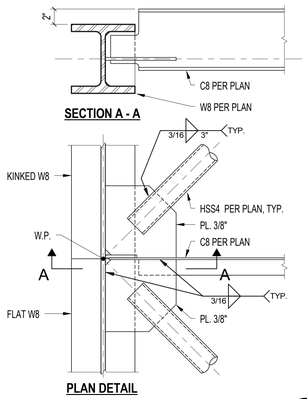
SECTION AT BRIDGE

3/4" = 1'-0" — 1 / S6.8



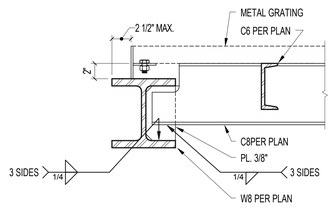
BRIDGE DETAIL AT CORBELS

1" = 1'-0" — 22 / S6.8



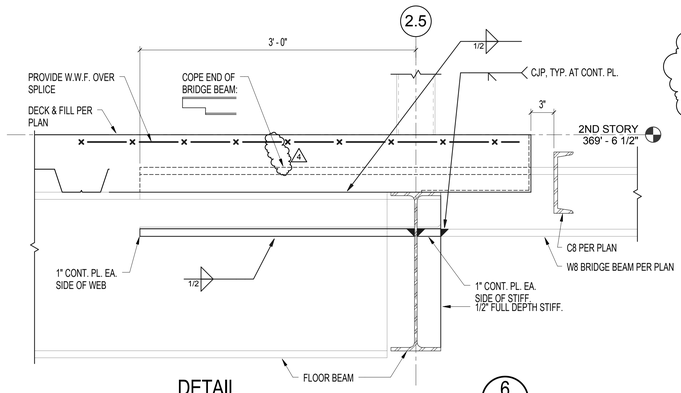
BRIDGE BRACE DETAIL

1 1/2" = 1'-0" — 18 / S6.8



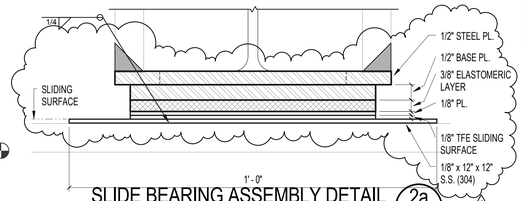
BRIDGE DETAIL

1 1/2" = 1'-0" — 14 / S6.8



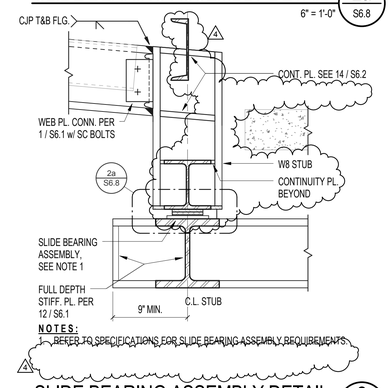
DETAIL

1 1/2" = 1'-0" — 6 / S6.8



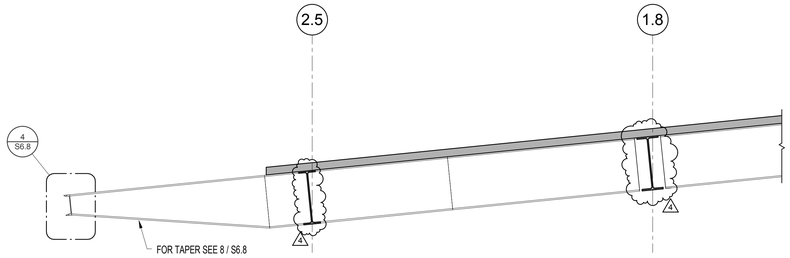
SLIDE BEARING ASSEMBLY DETAIL

6" = 1'-0" — 2a / S6.8



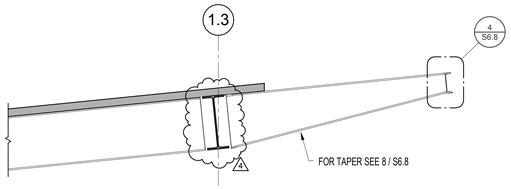
SLIDE BEARING ASSEMBLY DETAIL

1 1/2" = 1'-0" — 2 / S6.8



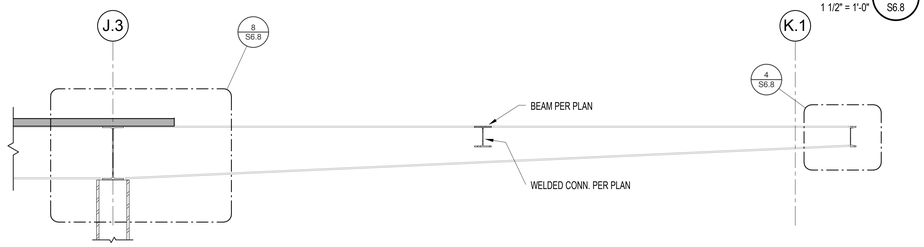
SECTION AT HIGH ROOF TAPERED BEAM

1/2" = 1'-0" — 15 / S6.8



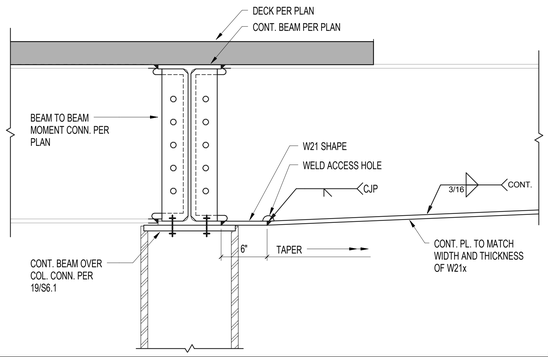
SECTION AT HIGH ROOF TAPERED BEAM

11 / S6.8



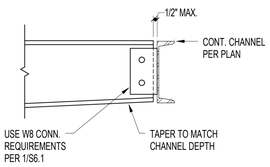
SECTION AT HIGH ROOF TAPERED BEAM

1/2" = 1'-0" — 3 / S6.8



DETAIL

1 1/2" = 1'-0" — 8 / S6.8



DETAIL

1 1/2" = 1'-0" — 4 / S6.8

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% DD	01/24/14
	CM/Contractor RFP	03/31/14
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DATE: 15 August, 2014
JOB No: 13-059
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ISSUED FOR: PERMIT
PERMIT No:
SCALE:

SHEET TITLE
STEEL
DETAILS

SHEET No
S6.8

1. CODES AND STANDARDS
   A. AMERICANS WITH DISABILITIES ACT (ADA)
   B. NFPA 90A: STANDARD FOR THE INSTALLATION OF AIR-CONDITIONING AND VENTILATING SYSTEMS, 2012 EDITION.
   C. NFPA 90B: STANDARD FOR THE INSTALLATION OF WARM AIR HEATING AND AIR-CONDITIONING SYSTEMS, 2012 EDITION.
   D. ASHRAE 2008 HANDBOOK, HVAC SYSTEMS AND APPLICATIONS
   E. ASHRAE 2009 HANDBOOK, FUNDAMENTALS
   F. ASHRAE 2010 HANDBOOK, REFRIGERATION
   G. ASHRAE 2011 HANDBOOK, HVAC APPLICATIONS
   H. ASHRAE 55-2010 THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY
   I. ASHRAE 62.1-2010 VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY
   J. ASHRAE 90.1-2010 ENERGY STANDARD FOR BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS
   K. CALIFORNIA BUILDING CODES ENFORCED BY THE AUTHORITY HAVING JURISDICTION:
      1. 2013 CALIFORNIA BUILDING CODE (CBC), CALIFORNIA CODE REGULATIONS, TITLE-24, PART 2
      2. 2013 CALIFORNIA MECHANICAL CODE (CMC), CALIFORNIA CODE OF REGULATIONS, TITLE-24, PART 4
      3. 2013CALIFORNIA PLUMBING CODE (CPC), CALIFORNIA CODE OF REGULATIONS, TITLE-24, PART 5
      4. 2013 CALIFORNIA FIRE CODE (CFC), CALIFORNIA CODE OF REGULATIONS, TITLE-24, PART 9
      5. 2013 CALIFORNIA ELECTRIC CODE (CEC), BASED ON THE 2008 NATIONAL ELECTRICAL CODE WITH STATE AMENDMENTS
      6. 2010 CALIFORNIA GREEN BUILDING STANDARDS CODE, CALIFORNIA CODE OF REGULATIONS, TITLE-24, PART 11.

2. OUTDOOR DESIGN CONDITIONS
   A. SUMMER: 83°F DB/74°F WB (ASHRAE 0.5% BERKELEY, CALIFORNIA)
   B. WINTER: 33°F (ASHRAE MEDIAN OF EXTREMES, BERKELEY, CALIFORNIA)
   C. ELEVATION: 345 FT.
   D. CALIFORNIA CLIMATE ZONE: 3

3. INDOOR DESIGN CONDITIONS
   A. ALL AREAS:
      1. COOLING: 78°F +/-2°F
      2. HEATING: 70°F +/-2°F

4. DUCTWORK DESIGN CRITERIA (MAXIMUM ALLOWABLE VALUES).
   A. SUPPLY/RETURN DUCTS:
      1. ABOVE CEILING IN OCCUPIED SPACES: 0.08" WG/100FT
   B. PRODUCT CONVEYING DUCTS:
      1. DUST COLLECTION SYSTEM EXHAUST: 3500 FPM
      2. LASER CUTTERS EXHAUST: 4500 FPM
      3. SPRAY PAINT BOOTH EXHAUST: 2000 FPM

5. PIPEWORK DESIGN CRITERIA
   A. CHILLED WATER MAX PRSSURE DROP: .8 FT.WG./100 FT.
   B. HOT WATER MAX PRSSURE DROP: .8 FT.WG. / 100 FT.

6. CENTRAL PLANT SYSTEMS TEMPERATURES SERVING THIS BUILDING:
   A. CHILLED WATER:
      1. SUPPLY WATER TEMPERATURE (EWT): 45°F
      2. RETURN WATER TEMPERATURE (LWT): 57°F
   B. HEATING HOT WATER:
      1. SUPPLY WATER TEMPERATURE (EWT): 180°F
      2. RETURN WATER TEMPERATURE (LWT): 140°F

A/C	AIR CONDITION(ED)	KW	KILOWATT
AD	ACCESS DOOR	LAT	LEAVING AIR TEMPERATURE
AFF	ABOVE FINISH FLOOR	LBS.	POUNDS
BDD	BACKDRAFT DAMPER	LH	LATENT HEAT
BFF	BELOW FINISH FLOOR	MA	MIXED AIR
BFP	BACKFLOW PREVENTER	MAX	MAXIMUM
BHP	BRAKE HORSEPOWER	MBH	THOUSAND BTU'S PER HOUR
CD	CONDENSATE DRAIN	MD	MOTORIZED DAMPER
CONT.	CONTINUATION	MIN	MINIMUM
COP	COEFFICIENT OF PERFORMANCE	N/A	NOT APPLICABLE
CU	CONDENSING UNIT	NIC	NOT IN CONTRACT
CV	CHECK VALVE	NO.	NUMBER
CW	COLD WATER	NTS	NOT TO SCALE
D	DROP	OA	OUTSIDE AIR
db	DECIBEL	OBD	OPPOSED BLADE DAMPER
DB	DRY BULB	OC	ON CENTER
DIA	DIAMETER	OD	OUTSIDE DIAMETER
DL	DOOR LOUVER	PD	PRESSURE DROP
DX	DIRECT EXPANSION	PH	PHASE
EAT	ENTERING AT TEMPERATURE	PRV	PRESSURE REDUCING VALVE
EER	ENERGY EFFICIENCY RATING	PSI	POUNDS PER SQUARE INCH
EF	EXHAUST FAN	QTY	QUANTITY
EFF	EFFICIENT	R	RISE
ELECT	ELECTRICAL	RA	RETURN AIR
EWT	ENTERING WATER TEMPERATURE	RET	RETURN
EXH	EXHAUST	RPM	REVOLUTIONS PER MINUTE
F	FAHRENHEIT	SA	SUPPLY AIR
FD	FIRE DAMPER	SEER	SEASONAL ENERGY EFFICIENCY RATING
FLA	FULL LOAD AMPS	SF	SQUARE FEET
FT	FEET	SH	SENSIBLE HEAT
GAL	GALLONS	SOV	SHUT OFF VALVE
GPH	GALLONS PER HOUR	SP	STATIC PRESSURE
GPM	GALLONS PER MINUTE	T, TEMP.	TEMPERATURE
HD	HEAD	TD	TEMPERATURE DIFFERENCE
HP	HORSEPOWER	TH	TOTAL HEAT
HTG	HEATING	TP	TOTAL PRESSURE
HTR	HEATER	V	VOLT
HWC	HOT WATER COIL	W/	WITH
ID	INSIDE DIAMETER	W	WATT
IE	INVERT ELEVATION	WB	WET BULB
IN	INCHES	WC	WATER COLUMN

SYMBOL	ABBREV.	DESCRIPTION
PIPING FITTINGS, APPURTENANCES AND EQUIPMENT		
		AUTOMATIC AIR VENT
BFP		BACKFLOW PREVENTER
		CAP OR PLUG
		CONTINUATION
F		FLOW SWITCH
	HB	HOSE BIBB
		MANUAL AIR VENT
		PIPE DROP
		PIPE RISE
		PIPE TO DRAIN
		PRESSURE GAUGE WITH COCK
P		PRESSURE SENSOR
		SHOCK ABSORBER
		T&P RELIEF VALVE WITH PIPE TO DRAIN
		TEE DOWN ON PIPE
		TEE UP ON PIPE
T		TEMPERATURE SENSOR
		TEST PORT (PETE'S PLUG OR EQUAL)
		THERMOMETER
		VENT TO ATMOSPHERE
PIPING SYSTEMS		
RL		REFRIGERANT LIQUID
RS		REFRIGERANT SUCTION
PIPING VALVES		
		CHECK VALVE
		GLOBE VALVE
		QUARTER TURN VALVE
		VALVE, GENERAL

SYMBOL	ABBREV.	DESCRIPTION
	CTR.L	CENTER LINE
z		DIRECTION OF NORTH
F.M.		FIELD MEASURE BY FOREMAN OR BY OTHERS (NOT DETAILING)
1		KEY NOTE REFERENCE TAG
T		THERMOSTAT
24"	AP	CEILING ACCESS PANEL (24 = SQ SIZE)
C / SM28		TOP = DETAIL NUMBER OR SECTION NUMBER BOTTTOM = DRAWING NUMBER OR SHEET NUMBER DIRECTION OF VIEW
F - 1 / XXXX		(AH) AIR HANDLER ,(F) FILTER ,(ST) SOUND TRAP,(VAV),(C) COIL EQUIPMENT NUMBER
24X24 T-BAR / 12X12 NK / T_104 / 350		FACE SIZE_CEILING TYPE (T-BAR,GYP,EXP.) NECK SIZE (ROUND,OR RECTANGULAR) FLOOR_ ROOM NUMBER CFM AIR FLOW (4WAY TYP. U.O.N.)
DAMPERS		
	VD	MANUAL VOLUME DAMPER
M	MVD	MOTORIZED VOLUME DAMPER
R	R	REMOTE VOLUME DAMPER (CABLE 5 FT. STD.)
DSD	DSD	DUCT SMOKE DETECTOR
SD	SD	SMOKE DAMPER
BDD	BDD	BACK DRAFT DAMPER
14FD	14FD	VERTICAL FIRE DAMPER W/ 14" SLEEVE (STANDARD) ARROW REPRESENTS DIRRECTION OF AIR FLOW
	FSD	HORIZONTAL FIRE DAMPER & OR FSD @ FLOOR OR ENCLOSURE
	CFD & CFSD	HORIZONTAL CEILING FIRE DAMPER & FSD
PBD	PBD	MULTI BLADE PARALLEL
	OBD	MULTI BLADE OPPOSED
50 / 4 / 24 / 23 / NUMBERING / LENGTH		EXAMPLE: VERTICAL FIRE SMOKE DAMPER W/ MOTOR LOCATION (RH SHOWN) LOOKING TOWARDS MOTOR SIDE OF DAMPER, 24" SLEEVE FLOOR 2 NUMBER 23. ARROW REPRESENTS DIRECTION OF AIR FLOW
DUCTWORK FITTINGS		
		ACOUSTICALLY LINED DUCT (SIZES SHOWN ARE NET INSIDE)
		BELLMOUTH
		CONCENTRIC SQUARE TO ROUND
		CONCENTRIC TRANSITION, RECTANGULAR OR ROUND
		ECCENTRIC TRANSITION, RECTANGULAR OR ROUND
		FLEXIBLE CONNECTION
		MITERED ELBOW WITH TURNING VANES
		NON-SYMMETRICAL WYE
		RADIUS ELBOW
		RECTANGULAR DUCT DROP
		RECTANGULAR DUCT RISER
		RECTANGULAR MAIN WITH RECTANGULAR BRANCH
		RECTANGULAR MAIN WITH ROUND BRANCH
		RECTANGULAR OFFSET LESS THAN 15 DEGREES
		RECTANGULAR OFFSET MORE THAN 15 DEGREES
		ROUND DUCT DROP
		ROUND DUCT RISER
		ROUND DUCT WITH ROUND BRANCH
		ROUND WYE
		SYMMETRICAL WYE

A. MECHANICAL SYSTEM INSTALLATION AND TESTING SHALL BE IN COMPLIANCE TO THE LOCAL ADOPTED BUILDING CODE.

B. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS AND DRAWINGS.

C. IN THE EVENT OF A DISCREPANCY BETWEEN CONTRACT DRAWINGS AND SPECIFICATIONS, THE MOST STRINGENT SHALL GOVERN. ALL WORK TO BE IN ACCORDANCE WITH REQUIREMENTS OF GOVERNING STATE AND LOCAL FIRE AND BUILDING CODES, NFPA, AND OSHA. INSTALL ALL PIPING AND DUCTWORK TO AVOID ARCHITECTURAL FRAMING, STRUCTURAL MEMBERS, AND OTHER OBSTRUCTIONS. COORDINATE PIPING AND DUCTWORK LOCATION WITH ALL APPLICABLE CONTRACT DRAWINGS PRIOR TO PLACING SLEEVES IN FLOORS OR WALLS. INSTALL ALL PIPING DUCTWORK TO BEST SUIT FIELD CONDITIONS AND COORDINATE WITH THE INSTALLATION WORK OF OTHER TRADES. THE DRAWINGS ARE DIAGRAMMATIC AND SHALL NOT BE SCALED TO DETERMINE EXACT LOCATIONS OF PIPING OR DUCTWORK.

D. SEE ARCHITECTURAL REFLECTED CEILING PLANS TO COORDINATE EXACT DIFFUSER LOCATIONS IN FINISHED CEILING OR WALLS. COORDINATE DUCTWORK, PIPING WITH STRUCTURAL DRAWINGS, LIGHTING, AUDIO VISUAL AND SPRINKLER SYSTEM. PROVIDE TRANSITIONS WHERE REQUIRED.

E. COORDINATE LOCATIONS OF ACCESS DOORS WITH FIRE/SMOKE DAMPERS, VOLUME DAMPERS, SMOKE DETECTORS, ETC. THE OPENING TO BE LARGE ENOUGH TO PERMIT MAINTENANCE AND RESETTING OF THE DEVICE.

F. PROVIDE CONDENSATE DRAIN AT ALL COOLING COILS, SIZED PER CODE. DISCHARGE AT 2% SLOPE TO CODE APPROVED LOCATION WITH 1-INCH AIR GAP. PROVIDE SECONDARY DRAIN PAN AND DRAIN AT 2% SLOPE TO OBSERVABLE LOCATION. PROVIDE ESCUTCHEON AT CEILING WHERE PENETRATION OCCURS. SECONDARY DRAIN PAN SYSTEM ONLY REQUIRED FOR CONCEALED EQUIPMENT (I.E. ABOVE CEILING)

G. PROVIDE ALL MISCELLANEOUS STEEL, SPECIAL SUPPORTS AND ANCHORING FOR ALL MECHANICAL EQUIPMENT REQUIRING SUPPORT AND/OR ANCHORING. REFER TO DIVISION 3 FOR CONCRETE PADS. ALL DUCT DIMENSIONS ARE AIRSTREAM DIMENSIONS.

H. PROVIDE SHIM TO LEVEL ALL EQUIPMENT ON THE FLOOR.

I. SEAL ALL FIRE RATED PENETRATIONS WITH FIRE RETARDANT MATERIAL AS SPECIFIED.

J. THERMOSTAT APPEARANCE SHALL BE COORDINATED WITH THE ARCHITECT/OWNER, INSTALL 42" AFF.

K. PROVIDE REMOTE OPERATORS FOR ALL VOLUME DAMPERS LOCATED ABOVE INACCESSIBLE (NON TILE) CEILINGS.

L. PROVIDE OPERATING HANDLES FOR ALL VALVES AND COCKS WITHOUT INTEGRAL OPERATORS.

M. PROVIDE VALVES AND OTHER PIPING SPECIALTIES SAME SIZE AS LINE SIZE SHOWN UNLESS OTHERWISE NOTED.

N. CONNECT HEATING AND COOLING COILS TO PROVIDE COUNTER FLOW BETWEEN WATER AND AIR. PROVIDE ¾" BLOW-OFF VALVE AND ½"IPS TO HOSE THREADADAPTER ON ALL STRAINERS.

O. ALL BRANCH DUCTS TO AIR OUTLET SHALL BE EQUIPPED WITH DUCT VOLUME DAMPER. INTEGRAL OBD'S WITHIN DIFFUSERS OR REGISTER SHALL NOT BE ALLOWED. PROVIDE UNIONS OR FLANGES ON EACH SIDE OF CONTROL VALVES.

P. PIPING ASSEMBLIES SHALL BE MADE TO MAKE EQUIPMENT EASILY REMOVABLE. WELDED OR SOLDER-JOINT VALVES ARE EXPECTED FROM THIS REQUIREMENT.

Q. CEILING DIFFUSER SIZES SHOWN ON FLOOR PLANS ARE NECK SIZES.

R. PROVIDE MINIMUM 1" AIR GAP AT ALL INDIRECT DRAIN CONNECTIONS.

S. DUCTS STORED ON THE CONSTRUCTION SITE SHALL BE PROTECTED AND ISOLATED FROM DUST CONTAMINATION.

T. CONTRACTOR MAY SUBSTITUTE RECTANGULAR DUCTWORK TO ROUND DUCTWORK, WHERE PHYSICAL OBSTRUCTIONS DO NOT INTERFERE. THE SUBSTITUTION WILL REQUIRE THE CONTRACTOR TO COORDINATE WITH ALL OTHER TRADES; DUCT PRESSURE DROPS AND VELOCITIES MAY NOT EXCEED THAT SHOWN ON DOCUMENTS. DUCT ASPECT RATIO SHALL NOT EXCEED 3 TO 1.

U. ALL PIPING AND DUCTWORK TO BE CONNECTED TO COILS AND EQUIPMENT WITH FLEXIBLE CONNECTIONS.

V. PROVIDE MINIMUM 5'-0" ACOUSTICALLY LINED (1-INCH) PLENUM AT DISCHARGE OF EACH VARIABLE AIR VOLUME (VAV) BOX

W. SEE ARCHITECTURAL DOCUMENTS FOR PAINTING OF ALL EXPOSED DUCTWORK , PIPING, AIR OUTLETS, FIXTURE TRIM, AND MECHANICAL EQUIPMENT.

X. INSTALL SHUT-OFF VALVES AT EACH BRANCH PIPE LINE.

Y. ALL CONTROL PANELS SHALL BE MOUNTED NO LESS THAN 48"AFF (DISTANCE FROM FINISHED FLOOR TO BOTTOM OF CONTROL PANEL).

Z. FIRE DAMPERS AND FIRE SMOKE DAMPERS SHALL BE INSTALLED IN RATED PORTIONS OF THE ASSEMBLIES IN WHICH THEY OCCUR. REFER TO ARCHITECTURAL SPECIFICATION FOR APPROVED FIRESTOPPING SYSTEM.

AA. PIPING LOCATED INSIDE WALL CAVITIES OR INACCESSIBLE SPACES SHALL BE LEAK TESTED AND INSULATED WITH VAPOR BARRIER SEAL BEFORE INSTALLATION.

AB. ALL WORK UNDER DIVISION 23 TO BE COORDINATED WITH OTHER TRADES. PROVIDE SHOP FRAWINGS FOR REVIEW.

AC. ALL MATERIAL AND WORKMANSHIP ARE SUBJECT TO REVIEW AND APPROVAL BY THE ARCHITECT. ANY PORTION OF THE WORK FOUND TO BE DEFECTIVE SHALL BE REPLACED BY THE CONTRACTOR AS PART OF THIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.

AD. NOT ALL DUCT AND PIPING TRANSITIONS AND/OR OFFSETS ARE SHOWN. PROVIDE TRANSISITIONS AND/OR OFFSETS AT NO ADDITIONAL COST TO OWNER.

AE. MAXIMUM LENGHT OF FLEXIBLE DUCTWORK IS 5'-0".

AF. ALL AREA AND DUCT SMOKE DETECTORS SHALL BE INSTALLED PER NFPA.

M0.00	MECHANICAL LEAD SHEET (ABBREVIATIONS, SYMBOLS, GENERAL NOTES AND DRAWING LIST)
M0.01	MECHANICAL SCHEDULES
M2.00	MECHANICAL BASEMENT FLOOR PLAN
M2.01	MECHANICAL FLOOR PLAN LEVEL 1
M2.02	MECHANICAL FLOOR PLAN LEVEL 2
M2.03	MECHANICAL FLOOR PLAN LEVEL 3
M2.04	MECHANICAL LOW ROOF PLAN
M3.00	MECHANICAL BASEMENT PIPING PLAN
M3.01	MECHANICAL PIPING PLAN LEVEL 1
M3.02	MECHANICAL PIPING PLAN LEVEL 2
M3.03	MECHANICAL PIPING PLAN LEVEL 3
M5.00	MECHANICAL DIAGRAMS
M5.01	MECHANICAL DETAILS
M5.02	MECHANICAL DETAILS
M6.00	TITLE 24
M6.01	TITLE 24
M6.02	TITLE 24

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

NO.	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE :

SHEET TITLE
MECHANICAL LEAD SHEET

SHEET No
M0.00

100% OUTSIDE AIR UNIT SCHEDULE

SYMBOL	#	AREA SERVED	MANUFACTURER & MODEL	AIR FLOW (CFM)	MAX TURNDOWN (CFM)	MINIMUM OSA		ESP (IN H2O)	TSP (IN H2O)	COOLING COIL									ELECTRICAL			EMERGENCY POWER	PRE-FILTERS MERV 8	FINAL FILTERS MERV 13	MAX WT (LBS)	NOTES
						DEFAULT CFM	DCV CFM			TOTAL CAP (MBH)	SENSIBLE CAP (MBH)	GPM	ROWS/ FPI	EWT (°F)	LWT (°F)	EAT (°F)	LAT (°F)	FACE VELOCITY	WPD (FT WG)	VOLTS	PH	HP					
AHU 1	1	BASEMENT, 1ST, 2ND, 3RD FLOORS	GREENHECK MSX-118-H32	8500	4250	6200	4800	1.75	2.30	207.6	204.6	33	2/12	45	57	83	60.8	400	4.0	460	3	7.5	NO	(16)20"X25"X2"	(16)20"X25"X2"	1950	1-3

NOTES:
1. PROVIDE WITH VFD
2. FAN SHALL BE INTERNALLY ISOLATED WITH 2" MINIMUM STATIC DEFLECTION SPRING ISOLATORS
3. UNIT SHALL BE PROVIDED WITH MOTORIZED DAMPERS

* AHU TO HAVE MIN OSA RESET BASED ON DEMAND CONTROL VENTILATION VIA CO2 SENSORS IN DENSELY OCCUPIED SPACES. THE DCV MIN PROVIDES THE MINIMUM AREA-BASED VENTILATION, AND THE DEFAULT MIN PROVIDES THE VENTILATION REQUIRED WHEN ALL SPACES ARE AT THEIR MAX EXPECTED OCCUPANCY. THE CFM VALUES WERE CALCULATED PER 2008 TITLE-24 SECTION 121 (b)2.

RADIANT PANEL SCHEDULE

SYMBOL	AREA SERVED	MFR	MODEL	OUTPUT BTUH/FT @ AWT 160°F	LENGTH (FT)	WEIGHT (LBS/FT)	WATER SUPPLY (GPM)	NOTES
RP 1-1	OFFICE ROOM 110A	RUNTAL	RF-1	299	2.0	1.9	0.03	1-3
RP 1-2	OFFICE ROOM 110B	RUNTAL	RF-1	299	2.0	1.9	0.03	1-3
RP 1-3	EQUIPMENT ROOM 110C	RUNTAL	RF-1	299	4.0	1.9	0.06	1-3
RP 1-4	EQUIPMENT ROOM 120C	RUNTAL	RF-1	299	4.0	1.9	0.06	1-3
RP 1-5	OFFICE ROOM 120B	RUNTAL	RF-1	299	2.0	1.9	0.03	1-3
RP 1-6	OFFICE ROOM 120A	RUNTAL	RF-1	299	2.0	1.9	0.03	1-3
RP 1-7	LOBBY ROOM 101	RUNTAL	RF-3	613	3.5	5.1	0.11	1-3
RP 1-8	LOBBY ROOM 101	RUNTAL	RF-3	613	4.0	5.1	0.12	1-3
RP 1-9	LOUNGE ROOM 103	RUNTAL	RF-3	613	5.0	5.1	0.15	1-3
RP 1-10	STUDIO ROOM 110	RUNTAL	RF-10	1459	4.0	18.6	0.30	1-3
RP 1-11	STUDIO ROOM 120	RUNTAL	RF-10	1459	4.0	18.6	0.30	1-3
RP 2-1	OFFICE ROOM 210A	RUNTAL	RF-2	299	2.0	1.9	0.05	1-3
RP 2-2	OFFICE ROOM 210B	RUNTAL	RF-2	299	2.0	1.9	0.05	1-3
RP 2-3	EQUIPMENT ROOM 210C	RUNTAL	RF-2	299	4.0	1.9	0.10	1-3
RP 2-4	EQUIPMENT ROOM 220C	RUNTAL	RF-2	299	4.0	1.9	0.10	1-3
RP 2-5	OFFICE ROOM 220B	RUNTAL	RF-2	299	2.0	1.9	0.05	1-3
RP 2-6	OFFICE ROOM 220A	RUNTAL	RF-2	299	2.0	1.9	0.05	1-3
RP 2-7	LOBBY/EXHIBIT ROOM 234	RUNTAL	RF-4	741	3.5	7.1	0.13	1-3
RP 2-8	LOBBY/EXHIBIT ROOM 234	RUNTAL	RF-4	741	4.0	7.1	0.15	1-3
RP 2-9	LOUNGE ROOM 209	RUNTAL	RF-3	613	4.0	5.1	0.12	1-3
RP 2-10	STUDIO ROOM 210	RUNTAL	RF-10	1459	4.0	18.6	0.30	1-3
RP 2-11	STUDIO ROOM 220	RUNTAL	RF-10	1459	4.0	18.6	0.30	1-3
RP 3-1	MEETING ROOM 310A	RUNTAL	RF-3	299	4.0	1.9	0.12	1-3
RP 3-2	MEETING ROOM 310B	RUNTAL	RF-3	299	4.0	1.9	0.12	1-3
RP 3-3	MEETING ROOM 310B	RUNTAL	RF-3	299	4.0	1.9	0.12	1-3
RP 3-4	MEETING ROOM 310C	RUNTAL	RF-3	299	4.0	1.9	0.12	1-3
RP 3-5	LOUNGE ROOM 309	RUNTAL	RF-3	613	4.0	5.1	0.12	1-3
RP 3-6	STUDIO ROOM 310	RUNTAL	RF-3	613	6.0	5.1	0.18	1-3
RP 3-7	STUDIO ROOM 310	RUNTAL	RF-10	1459	4.0	18.6	0.30	1-3
RP 3-8	STUDIO ROOM 310	RUNTAL	RF-3	613	6.0	5.1	0.18	1-3
RP 3-9	EQUIPMENT ROOM 332	RUNTAL	RF-3	613	9.0	5.1	0.28	1-3

NOTES:
1. EACH RADIANT PANEL SHALL BE CONTROLLED BY A THERMOSTATIC VALVE
2. FLOW RATE IS BASED ON 180°F ENTERING WATER TEMPERATURE AND 140°F LEAVING WATER TEMPERATURE
3. BTUH/FT OUTPUT IS BASED ON 160°F AVERAGE WATER TEMPERATURE (AWT)

FAN SCHEDULE

SYMBOL	AREA SERVED	MFR	MODEL	TYPE	DRIVE	AIR FLOW (CFM)	TSP (IN H20)	FAN RPM	SOUNDS SONES	ELECTRICAL			EMERGENCY POWER	MAX WT (LBS)	NOTES
										VOLTS	PH	HP			
EF 1	1ST FLOOR RESTROOMS WOMEN'S RESTROOMS 132 MEN'S RESTROOMS 134	GREENHECK	SQ-95VG	INLINE	DIRECT	560	0.35	1471	7.4	115	1	1/6	N	60	2,7
EF 2	1ST FLOOR LOUNGE 103 2ND & 3RD FLOOR RESTROOMS WOMEN'S 203, JANITOR'S CLOSET 205, MEN'S 207 WOMEN'S 303, JANITOR'S CLOSET 305, MEN'S 307	GREENHECK	G-143-VG	CENTRIFUGAL	DIRECT	1880	1.0	1442	12.9	115	1	1.0	N	70	1,7
EF 3	BASEMENT ELECTRICAL ROOM 010E	GREENHECK	SQ-99-VG	INLINE	DIRECT	700	0.50	1572	12.6	115	1	1/4	N	60	3,4,7
EF 4	EQUIPMENT 010B, EQUIPMENT 110C, EQUIPMENT 120C, EQUIPMENT 210C, EQUIPMENT 220C	GREENHECK	SQ-120-VG	INLINE	DIRECT	1200	1.0	1593	10.3	115	1	1/2	N	70	2,7
EF 5	EQUIPMENT 332	GREENHECK	G-103-VG	CENTRIFUGAL	DIRECT	800	0.5	1308	6.7	115	1	1/4	N	50	1,7
EF 6	FUTURE LASER CUTTER LOCATED IN EQUIPMENT 110C & 120C	THE NEW YORK BLOWER COMPANY	2308A	CENTRIFUGAL	BELT	1250	15	2169	91.9 dB	208	3	7.5	N	250	6,7
EF 7	PAINT SPRAY BOOTH LOCATED IN EQUIPMENT 110C	GREENHECK	SWB-210-5	CENTRIFUGAL	BELT	1000	1.25	1842	10.3	115	1	1/2	N	150	5,7
EF 8	PAINT SPRAY BOOTH LOCATED IN EQUIPMENT 332	GREENHECK	SWB-212-4	CENTRIFUGAL	BELT	1000	0.75	1380	8.6	115	1	1/4	N	150	5,7
EF 9	FUTURE LASER CUTTERS LOCATED IN EQUIPMENT 332	THE NEW YORK BLOWER COMPANY	2112A	CENTRIFUGAL	DIRECT	2250	10	2039	94.7 dB	208	3	10	N	--	6,7

NOTES:
1. PROVIDE WITH ROOF CURB AND BACKDRAFT DAMPER
2. PROVIDE WITH INSULATED HOUSING AND BACKDRAFT DAMPER
3. PROVIDE WITH BACKDRAFT DAMPER, INSULATED HOUSING, AND INLET GUARD
4. EXHAUST FAN SHALL BE INTERLOCKED WITH AHU-1
5. PROVIDE WITH WEATHER PROOF MOTOR COVER, SPARK RESISTANT CONSTRUCTION, EXPLOSION PROOF MOTOR
6. PROVIDE WITH SPARK RESISTANCE CONSTRUCTION AND WEATHER COVER/BELT GUARD
7. FUSE DISCONNECT PROVIDED BY ELECTRICAL CONTRACTOR

COMPUTER ROOM SPLIT SYSTEM OUTDOOR CONDENSING UNIT SCHEDULE

SYMBOL	#	AREA SERVED	BASIS OF DESIGN		RELATED FAN COIL	NOM TONS	COOLING CAP (MBH)	ELECTRICAL			EMERGENCY POWER	MAX WT (LBS)	NOTES
			MFR	MODEL				VOLTS	PH	FUSE/BREAKER SIZE			
CU 1	1	TELECOM 010D	MITSUBISHI	PUY-A18NHA4	FC 1	1.5	18.0	208	1	15	N	89.0	

NOTES:

COMPUTER ROOM SPLIT SYSTEM INDOOR UNIT SCHEDULE

SYMBOL	NOM. TONS	AREA SERVED	BASIS OF DESIGN		CONDENSING UNIT	AIR FLOW (CFM)	SEER	EER	COOLING (MBH)	ELECTRICAL		EMERGENCY POWER	MAX. WT. (LBS)	NOTES
			MFR	MODEL						MCA (A)	FLA (A)			
FC 1	1.5	TELECOM 010D	MITSUBISHI	PKA-A18NHA4	CU 1	425	15.3	8.0	18.0	1	1	N	29	

NOTES:
1. PROVIDE WITH CONDENSATE PUMP
2. PROVIDE WITH WIRED WALL MOUNTED CONTROLLER

DIFFUSER AND GRILLE SCHEDULE

TAG	MFR	MODEL	DESCRIPTION	FACE TYPE	FACE SIZE (IN.)	COLOR	MATERIAL	OBD	NOTES
A	TITUS	350RL	RETURN/EXHAUST/TRANSFER	3/4" BLADE SPACING	SEE PLANS	WHITE	STEEL	NO	1-3
B	TITUS	R-OMNI	ROUND SUPPLY	ROUND PLAQUE	SEE PLANS	WHITE	STEEL	NO	1,2,4
C	TITUS	R300F	ROUND SIDEWALL SUPPLY	3/4" BLADE SPACING	SEE PLANS	WHITE	STEEL	YES	1-3
D	TITUS	50F	SIDEWALL TRANSFER	EGGCRATE GRILLE	SEE PLANS	WHITE	STEEL	NO	1-2

NOTES
1. MAXIMUM TOTAL PRESSURE DROP SHALL BE 0.1" WG.
2. NECK SIZE AND CFM SHOWN ON PLANS (E.G. 12x12-A-400 REFERS TO TAG "A" WITH 12x12 NECK AND 400 CFM).
3. SEE 2 / M5.01 FOR TYPICAL CEILING DIFFUSER INSTALLATION DETAIL.
4. SEE 1 / M5.01 FOR TYPICAL CEILING DIFFUSER INSTALLATION DETAIL.

VARIABLE AIR VOLUME TERMINAL UNIT SCHEDULE

TAG	MFR & MODEL	INLET SIZE (IN)	AIRFLOW CFM			AIR P.D. (IN.WG.)	HW REHEAT COIL					NOTES
			MAXIMUM (CFM)	MINIMUM (CFM)	DCV (CFM)		CAP (MBH)	LAT (°F)	FLOW (GPM)	WPD (FT.WG.)	ROWS	
B-1	TITUS	14	1600	1300	1100	0.087	30.0	79.7	2	0.45	1	1-7
1-1	TITUS	14	1100	800	600	0.087	30.0	86.4	2	0.45	1	1-7
1-2	TITUS	14	1100	800	600	0.087	30.0	86.4	2	0.45	1	1-7
2-1	TITUS	14	1100	800	600	0.087	30.0	86.4	2	0.45	1	1-7
2-2	TITUS	14	1400	900	700	0.087	30.0	86.4	2	0.45	1	1-7
3-1	TITUS	14	1100	800	600	0.087	30.0	86.4	2	0.45	1	1-7, PROVIDE 3-WAY @ REHEAT COIL
3-2	TITUS	14	1100	800	600	0.087	30.0	86.4	2	0.45	1	1-7, PROVIDE 3-WAY @ REHEAT COIL

NOTES
1. PROVIDE PRESSURE INDEPENDENT TERMINAL UNIT
2. HEATING CAPACITY BASED ON 40°F EAT, 180°F EWT, 140°F LWT
3. SEE 4/M5.01 FOR INSTALLATION DETAIL.
4. SEE 10/M5.01 FOR 2-WAY & 3-WAY COIL PIPING DETAIL.
5. PROVIDE NEMA 1 CONTROLS ENCLOSURE
6. PROVIDE UL CLASS II 24VAC TRANSFORMER AND DISCONNECT
7. PROVIDE CO2 CONTROL.

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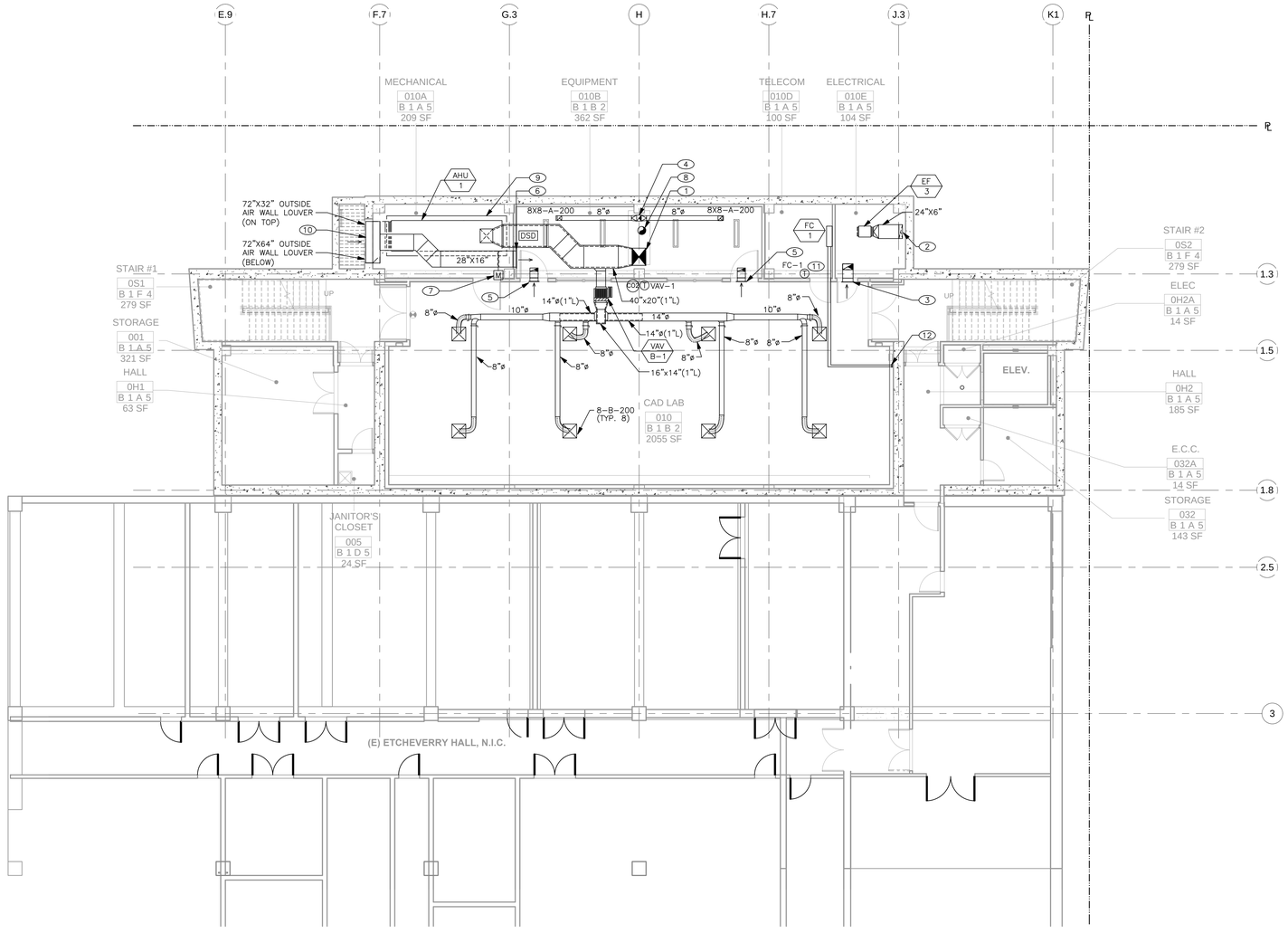
SHEET TITLE
MECHANICAL EQUIPMENT SCHEDULES

SHEET No
M0.01



1 MECHANICAL BASEMENT FLOOR PLAN

SCALE: 1/8"=1'-0"

SHEET NOTES

1. 30"X24"(1"L) SUPPLY AIR DUCT UP TO LEVEL 1. PROVIDE AND INSTALL COMBINATION FIRE SMOKE DAMPER AT FLOOR PENETRATION.
2. 24"x6" EXHAUST AIR DUCT UP TO LEVEL 1.
3. 18X12-A- SIDEWALL REGISTER CONNECTED TO TRANSFER DUCT WITH SOUND BOOT. SEE DETAIL 3/M5.01
4. 10"X8" EXHAUST AIR DUCT UP TO LEVEL 1. SUPPLY AND INSTALL COMBINATION FIRE SMOKE DAMPER AT FLOOR PENETRATION
5. 14X6-A- SIDEWALL REGISTER CONNECTED TO TRANSFER DUCT WITH SOUND BOOT. SEE DETAIL 3/M5.01
6. 28"X28" SIDEWALL REGISTER TYPE D
7. MOTORIZED DAMPER SHALL BE INTERLOCKED WITH FUTURE DUST COLLECTOR
8. 14"ø EXHAUST AIR DUCT UP THRU THE ROOF AND DOWN TO CONNECT TO FUTURE DUST COLLECTOR DISCHARGE. DUCT SHALL BE SPIRAL 20 GAUGE DUCT WITH A MINIMUM OF G60 THICK PROTECTIVE COATING OF GALVANIZED STEEL. DUCT SHALL BE CLASS 2 CLASSIFICATION PER 2013 CMC SECTION 502.1
9. 6" CONCRETE LEVEL PAD
10. OUTSIDE AIR INTAKE LOUVERS SHALL BE RUSKIN MODEL ELF635DMP
11. THERMOSTAT SHALL BE SET @80°F COOLING SETPOINT
12. REFRIGERANT LINES IN THE WALL UP TO LEVEL 3. REFRIGERANT LINES SHALL BE SIZED PER MANUFACTURER RECOMMENDATION.

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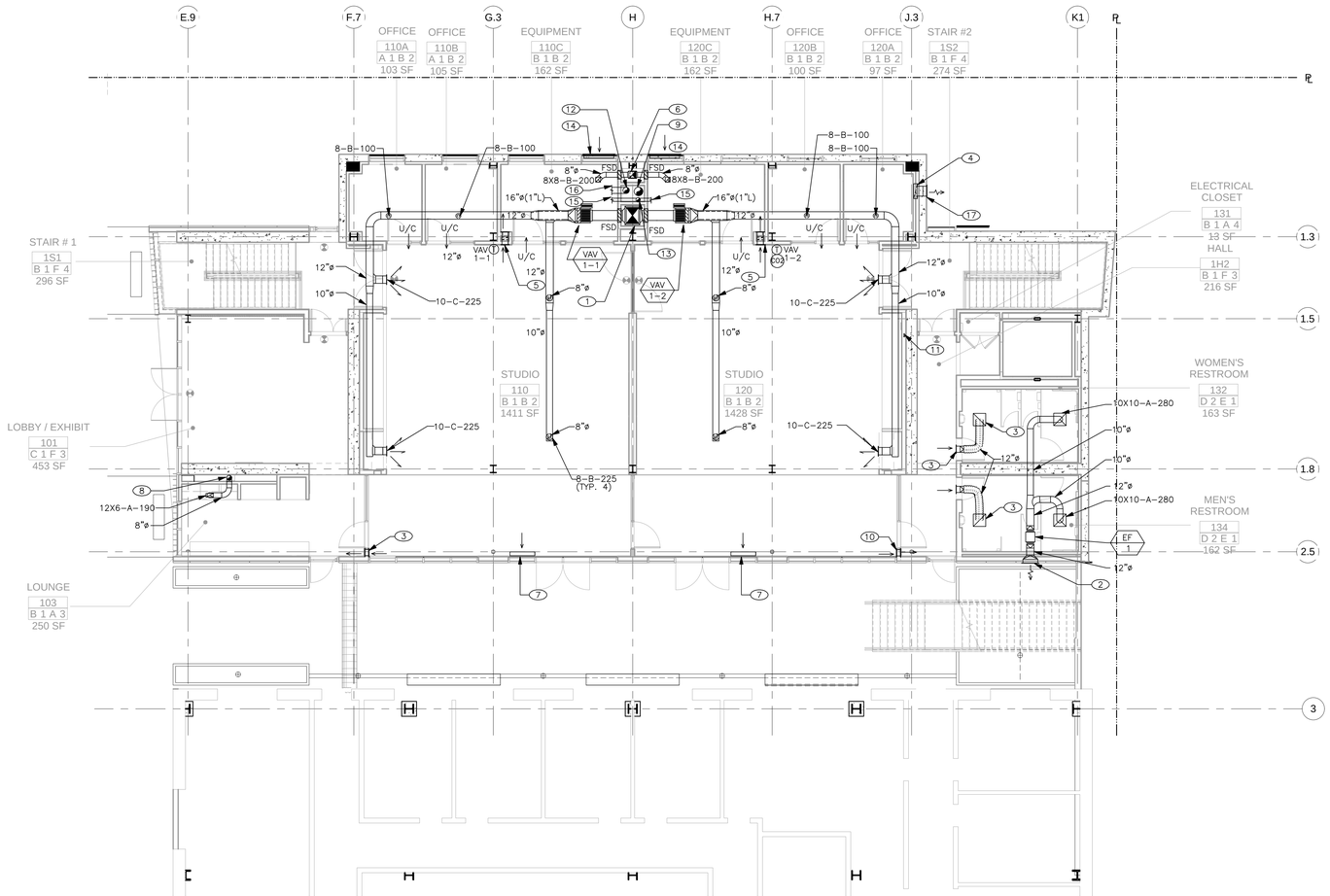
SHEET TITLE
MECHANICAL BASEMENT FLOOR PLAN

SHEET No.
M2.00



1 **MECHANICAL FLOOR PLAN LEVEL 1**
SCALE: 1/8"=1'-0"

SHEET NOTES

1. 30"X24"(1"L) SUPPLY AIR DUCT DOWN TO THE BASEMENT & 26"X20"(1"L) UP TO LEVEL 2
2. 24"x14" EXHAUST AIR WALL LOUVER. EXHAUST AIR LOUVER SHALL BE RUSKIN MODEL ELF15J
3. 10X10-A- TRANSFER GRILLES
4. 24"x6" EXHAUST AIR DUCT DOWN TO THE BASEMENT
5. 10x10-A- SIDEWALL REGISTER CONNECTED TO 4"x10(1"L) TRANSFER DUCT INSIDE THE WALL. REFER TO ARCHITECTURAL PLANS FOR DETAIL AND EXACT REGISTER LOCATION
6. 12"X12" EXHAUST AIR DUCT UP TO LEVEL 2 AND 10"X8" DOWN TO THE BASEMENT
7. RELIEF AIR WALL LOUVER. SEE ARCH DWGS FOR EXACT LOCATION AND SIZE. RELIEF AIR LOUVER SHALL BE "SAFE AIR DOWCO" MODEL BRL. RELIEF LOUVER SHALL BE PROVIDED WITH BACKDRAFT DAMPER. SEE ARCHITECTURAL DETAILS FOR INSTALLATION
8. 8"ø EXHAUST AIR DUCT UP TO LEVEL 2. PROVIDE & INSTALL FIRE SMOKE DAMPER AT FLOOR PENETRATION
9. 14"ø EXHAUST AIR DUCT DOWN TO THE BASEMENT TO CONNECT TO FUTURE DUST COLLECTOR AND UP THRU THE ROOF
10. 18X10-A- TRANSFER GRILLES
11. REFRIGERANT LINES IN THE WALL UP TO LEVEL 3 AND DOWN TO THE BASEMENT
12. 10"ø EXHAUST AIR DUCT UP TO LEVEL 3
13. 7"ø EXHAUST AIR DUCT UP TO LEVEL 3
14. OUTSIDE AIR INTAKE WALL LOUVER WITH BACKDRAFT DAMPER. SEE ARCH DWGS FOR EXACT LOCATION AND SIZE. OUTISDE AIR INTAKE LOUVER SHALL BE "SAFE AIR DOWCO"
15. 5"ø EXHAUST AIR DUCT TO CONNECT TO LASER CUTTER
16. 10"ø EXHAUST AIR DUCT TO CONNECT TO PAINT SPRAY BOOTH
17. 16"X24" EXHAUST WALL LOUVER. EXHAUST AIR LOUVER SHALL BE RUSKIN MODEL ELF15J

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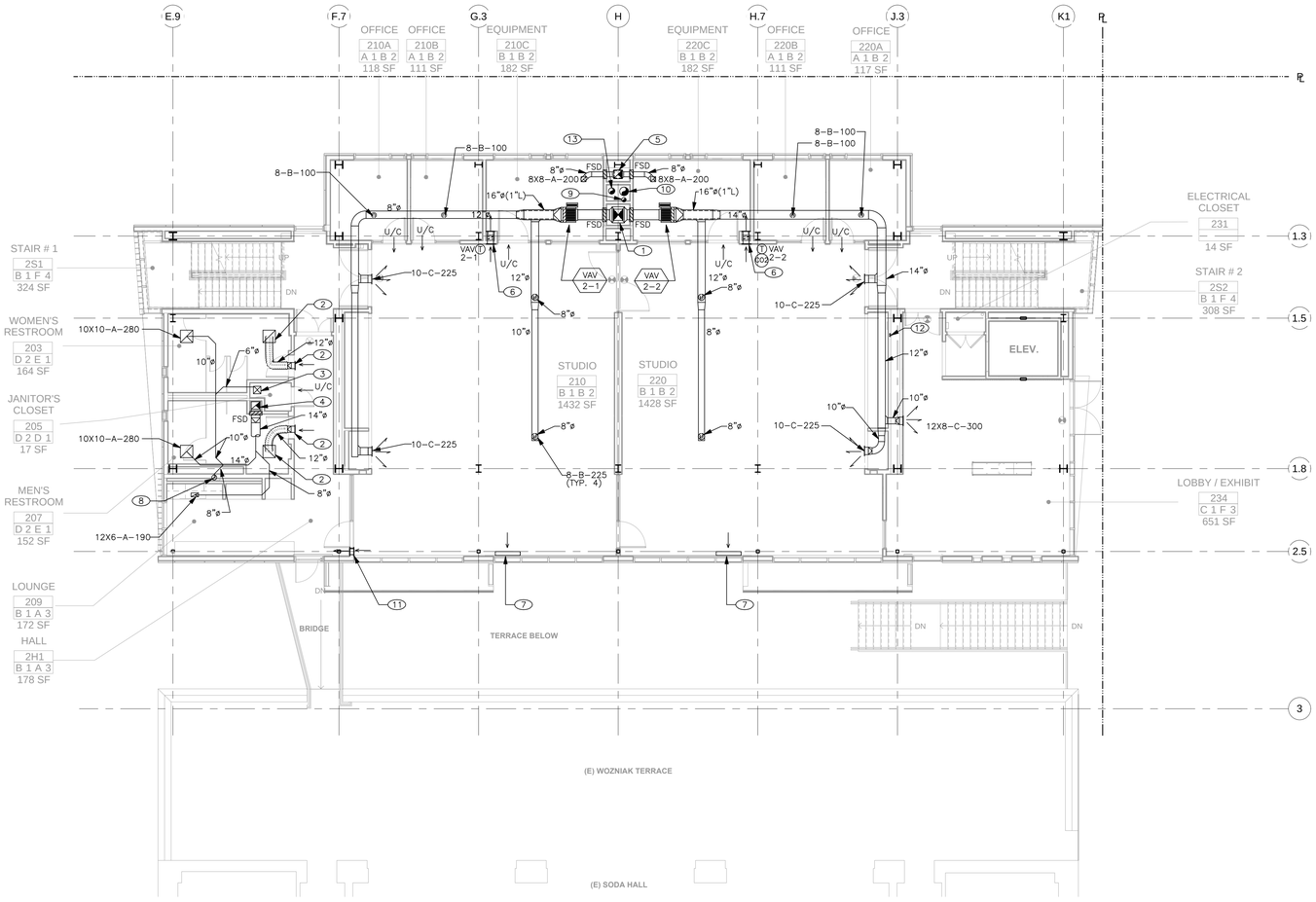
SHEET TITLE
MECHANICAL FLOOR PLAN LEVEL 1

SHEET No
M2.01



SHEET NOTES

1. 20"x26"(1"L) SUPPLY AIR DUCT DOWN TO LEVEL 1 & 18"X16"(1"L) UP TO LEVEL 3
2. 10X10-A- TRANSFER GRILLE
3. 6X6-A-50
4. 14"X12" EXHAUST AIR DUCT UP TO LEVEL 3
5. 12"X12" EXHAUST AIR DUCT DOWN TO LEVEL 1 & 14"X14" EXHAUST AIR DUCT UP TO CONNECT TO EXHAUST FAN EF-4 IN THE SHAFT AND DISCHARGE THRU THE ROOF
6. 10X10-A- SIDEWALL REGISTER CONNECTED TO 4"x10(1"L) TRANSFER DUCT INSIDE THE WALL. REFER TO ARCHITECTURAL PLANS FOR DETAIL AND EXACT REGISTER LOCATION
7. RELIEF AIR WALL LOUVER. SEE ARCH DWGS FOR EXACT LOCATION AND SIZE. RELIEF AIR LOUVER SHALL BE "SAFE AIR DOWCO" MODEL BRL. RELIEF LOUVER SHALL BE PROVIDED WITH BACKDRAFT DAMPER. SEE ARCHITECTURAL DETAILS FOR INSTALLATION
8. 8"ø EXHAUST AIR DUCT DOWN TO LEVEL 1.
9. 7"ø EXHAUST AIR DUCT UP TO LEVEL 3
10. 14"ø EXHAUST AIR DUCT DOWN TO THE BASEMENT TO CONNECT TO FUTURE DUST COLLECTOR AND UP THRU THE ROOF. DUST COLLECTOR & PAINT SPRAY BOOTH DUCT SHALL SWITCH LOCATION WITHIN THE SHAFT AS THEY GO UP THE THIRD FLOOR
11. 22X10-A- TRANSFER GRILLES
12. REFRIGERANT LINES UP TO LEVEL 3 AND DOWN TO THE BASEMENT
13. 10"ø EXHAUST AIR DUCT UP TO LEVEL 3

1 MECHANICAL FLOOR PLAN LEVEL 2

SCALE: 1/8"=1'-0"

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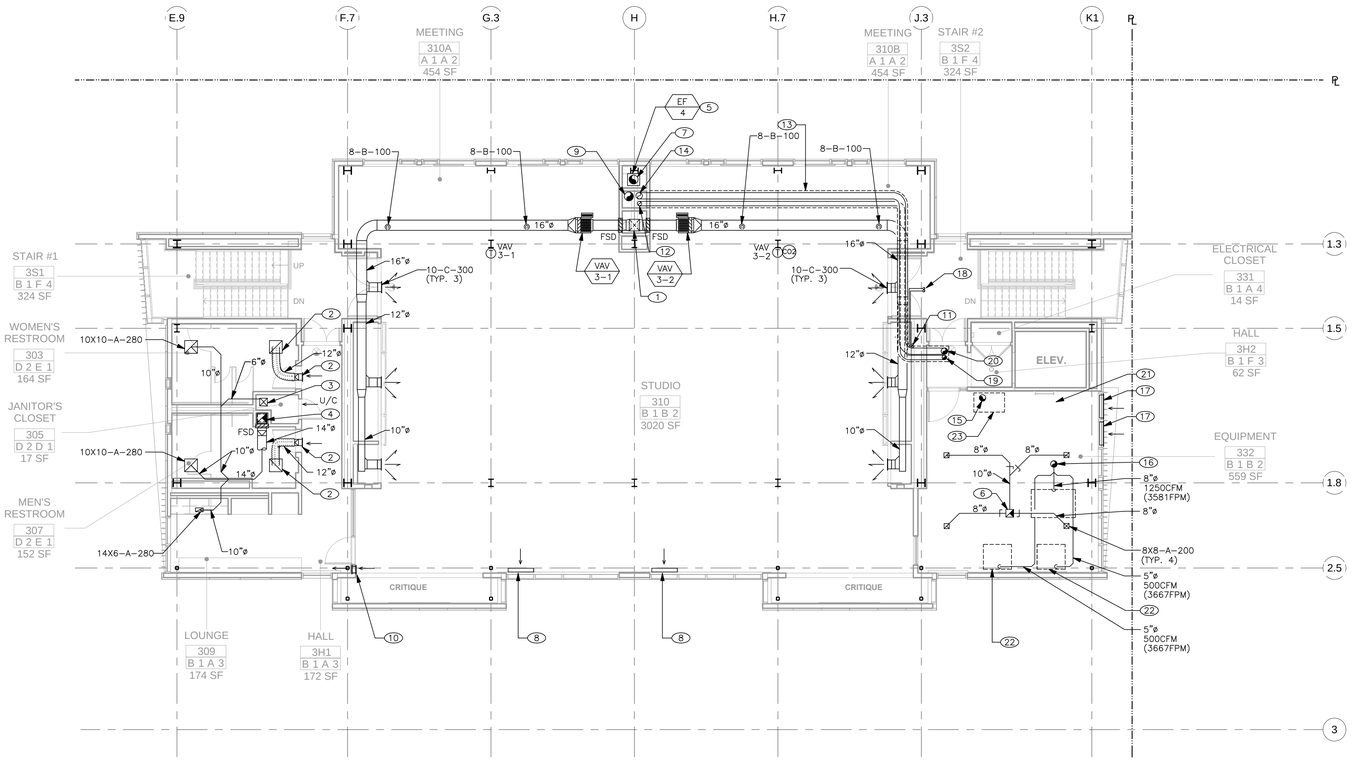
SHEET TITLE

MECHANICAL FLOOR PLAN LEVEL 2

SHEET No

M2.02



(E) SODA HALL BELOW

1 MECHANICAL FLOOR PLAN LEVEL 3

SCALE: 1/8"=1'-0"

SHEET NOTES

1. 18"x16"(1"L) SUPPLY AIR DUCT DOWN TO LEVEL 2
2. 10X10-A- TRANSFER GRILLE
3. 6X6-A-50
4. 14"X12" EXHAUST AIR DUCT DOWN TO LEVEL 2 & 16"X16" EXHAUST AIR DUCT UP THRU THE ROOF TO EXHAUST FAN EF-2
5. INLINE EXHAUST FAN IN THE DUCT RISER WITHIN THE SHAFT. SEE ARCHITECTURAL PLAN FOR ACCESS DOOR LOCATION
6. 12"X12" EXHAUST AIR DUCT UP THRU THE ROOF TO EXHAUST FAN EF-5
7. 14"ø EXHAUST AIR DUCT UP THRU THE ROOF
8. RELIEF AIR WALL LOUVER. SEE ARCH DWGS FOR EXACT LOCATION AND SIZE. RELIEF AIR LOUVER SHALL BE "SAFE AIR DOWCO" MODEL BRL. RELIEF LOUVER SHALL BE PROVIDED WITH BACKDRAFT DAMPER. SEE ARCHITECTURAL DETAILS FOR INSTALLATION
9. 14"ø EXHAUST AIR DUCT DOWN TO THE BASEMENT TO CONNECT TO FUTURE DUST COLLECTOR AND UP THRU THE ROOF.
10. 22X10-A- TRANSFER GRILLES
11. REFRIGERANT LINES DOWN TO THE BASEMENT
12. 7"ø EXHAUST AIR DUCT DOWN TO LEVEL 1 TO CONNECT TO LASER CUTTERS IN EQUIPMENT ROOM 110C & 120C
13. EXHAUST AIR DUCT ENCLOSED IN A CONTINUOUS 1-HR RATED ENCLOSURE
14. 10"ø EXHAUST AIR DUCT DOWN TO LEVEL 1 TO CONNECT TO PAINT SPRAY BOOTH
15. 10"ø EXHAUST AIR DUCT UP THRU THE ROOF TO EXHAUST FAN EF-8
16. 10"ø EXHAUST AIR DUCT UP THRU THE ROOF TO EXHAUST FAN EF-9, 2250 CFM (4125 FPM)
17. OUTSIDE AIR INTAKE WALL LOUVER WITH BACKDRAFT DAMPER. SEE ARCH DWGS FOR EXACT LOCATION AND SIZE. OUTSIDE AIR INTAKE LOUVER SHALL BE "SAFE AIR DOWCO"
18. REFRIGERANT LINES UP THRU THE ROOF TO CONDENSING UNIT CU-1
19. 7"ø EXHAUST AIR DUCT UP THRU THE ROOF TO CONNECT TO EXHAUST FAN EF-6
20. 10"ø EXHAUST AIR DUCT UP THRU THE ROOF TO CONNECT TO EXHAUST FAN EF-7
21. ROOF ACCESS
22. LASER CUTTER
23. SPRAY BOOTH

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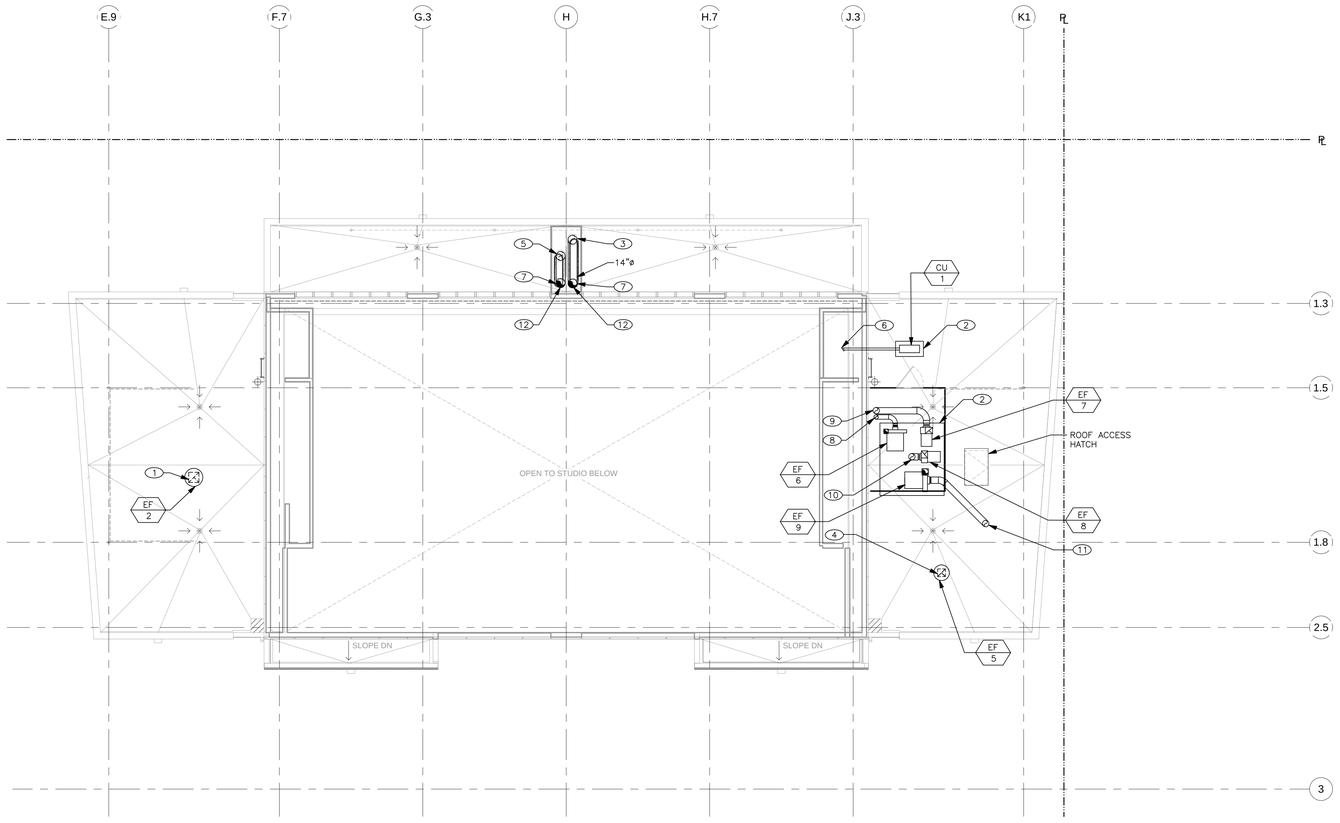
SHEET TITLE
MECHANICAL FLOOR PLAN LEVEL 3

SHEET No
M2.03



1 MECHANICAL LOW ROOF PLAN

SCALE: 1/8"=1'-0"

SHEET NOTES

1. 16"X16" EXHAUST AIR DUCT DOWN THRU THE ROOF
2. MIN. 6" ROOF LEVEL PAD
3. 14"ø EXHAUST AIR DUCT DOWN THRU THE ROOF
4. 12"X12" EXHAUST AIR DUCT DOWN THRU THE ROOF
5. 14"ø EXHAUST AIR DUCT DOWN TO THE BASEMENT TO CONNECT TO FUTURE DUST COLLECTOR
6. REFRIGERANT LINES DOWN THRU THE ROOF. SEE M2.03 FOR CONTINUATION
7. 14"ø EXHAUST AIR DUCT UP TO ABOVE HIGHER ROOF. TERMINATE WITH CODE APPROVED ROOF CAP
8. 7"ø EXHAUST AIR DUCT DOWN THRU THE ROOF
9. 10"ø EXHAUST AIR DUCT DOWN THRU THE ROOF
10. 10"ø EXHAUST AIR DUCT DOWN THRU THE ROOF TO CONNECT TO PAINT SPRAY BOOTH
11. 10"ø EXHAUST AIR DUCT DOWN THRU THE ROOF TO CONNECT TO LASER CUTTERS
12. EXHAUST AIR DUCT SHALL TERMINATE WITH UP-BLAST STACK CAP

GENERAL NOTES

A. EXHAUST AIR DUCT TERMINATION FOR EXHAUST FANS EF-6, EF-7, EF-8, EF-9 SHALL TERMINATE 30 FEET FROM THE PROPERTY LINE, 10 FEET FROM OPENINGS INTO THE BUILDING, 6 FEET FROM EXTERIOR WALLS OR ROOF, 30 FEET FROM COMBUSTIBLE WALLS OR OPENINGS INTO THE BUILDING THAT ARE IN THE DIRECTION OF THE EXHAUST DISCHARGE

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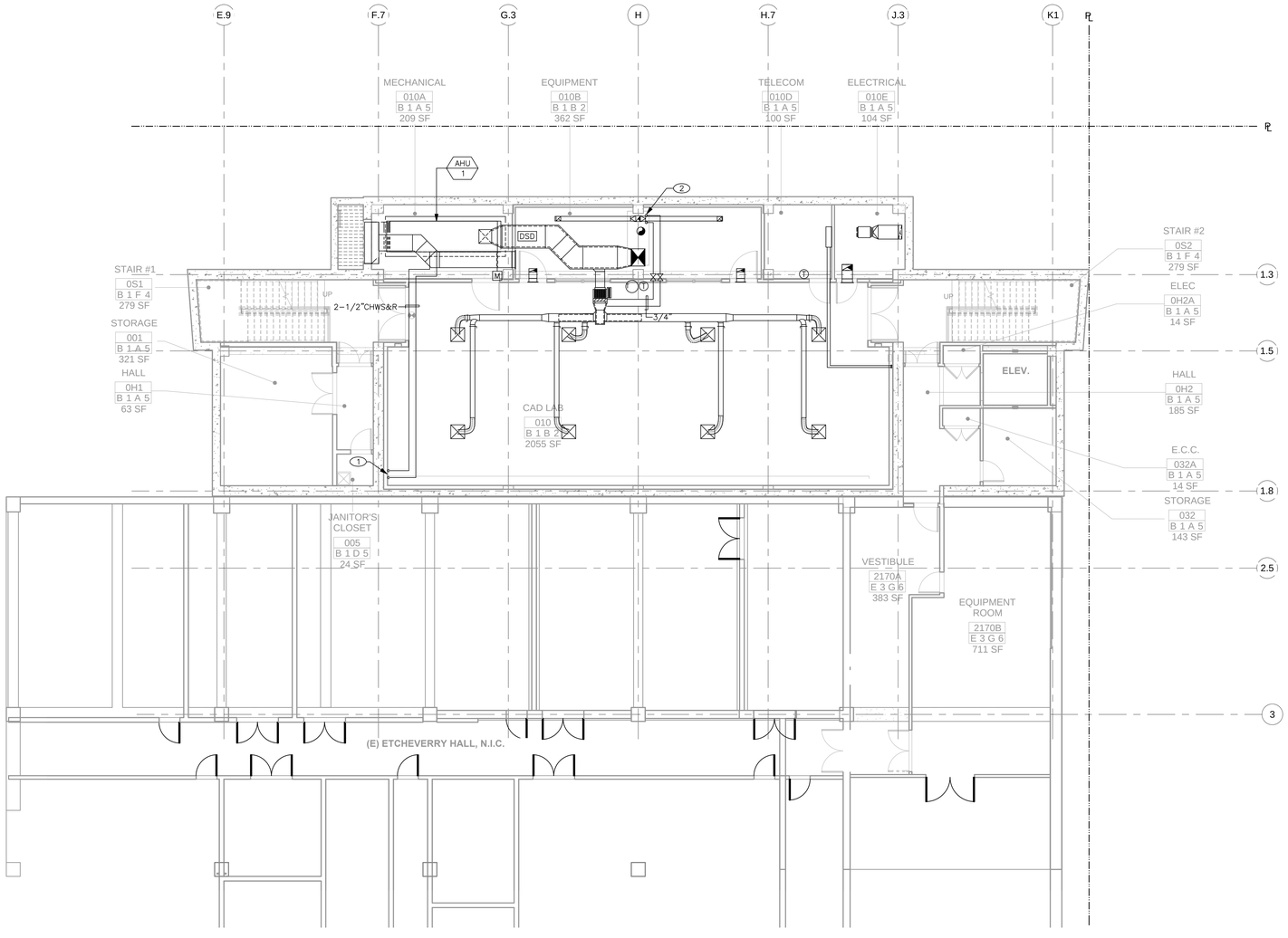
SHEET TITLE
MECHANICAL LOW ROOF PLAN

SHEET No
M2.04



SHEET NOTES

1. 2-1/2" CHWS&R UP TO LEVEL 1
2. 3/4" HWS&R UP TO LEVEL 1

1 MECHANICAL PIPING PLAN BASEMENT LEVEL

SCALE: 1/8"=1'-0"

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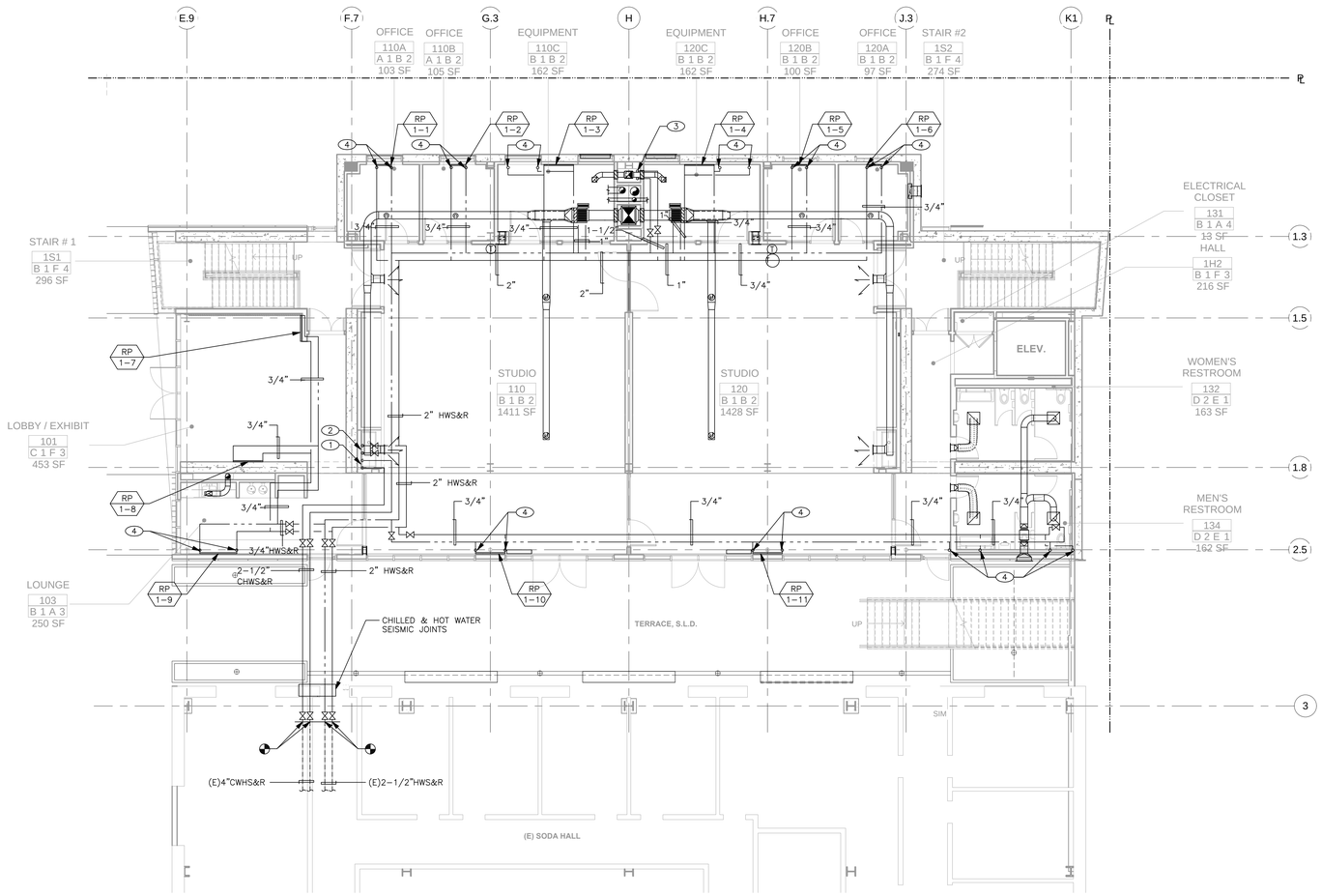
MECHANICAL PIPING PLAN BASEMENT LEVEL

SHEET No

M3.00



1 MECHANICAL PIPING PLAN LEVEL 1

SCALE: 1/8"=1'-0"

SHEET NOTES

1. 2-1/2" CHWS&R DOWN TO BASEMENT
2. 1" HWS&R UP TO LEVEL 2
3. 1" HWS&R DOWN TO BASEMENT & 1-1/2" HWS&R UP TO LEVEL 2
4. 3/4" HWS & R UP TO LEVEL 2 TO CONNECT TO RADIANT PANELS

GENERAL NOTES

A. HOT WATER PIPING DISTRIBUTION AT LEVEL 1 CEILING FEEDS LEVEL 1 AND LEVEL 2 FLOOR RADIANT PANELS

B. HOT WATER PIPING DISTRIBUTION AT LEVEL 2 FEEDS LEVEL 3 RADIANT PANELS

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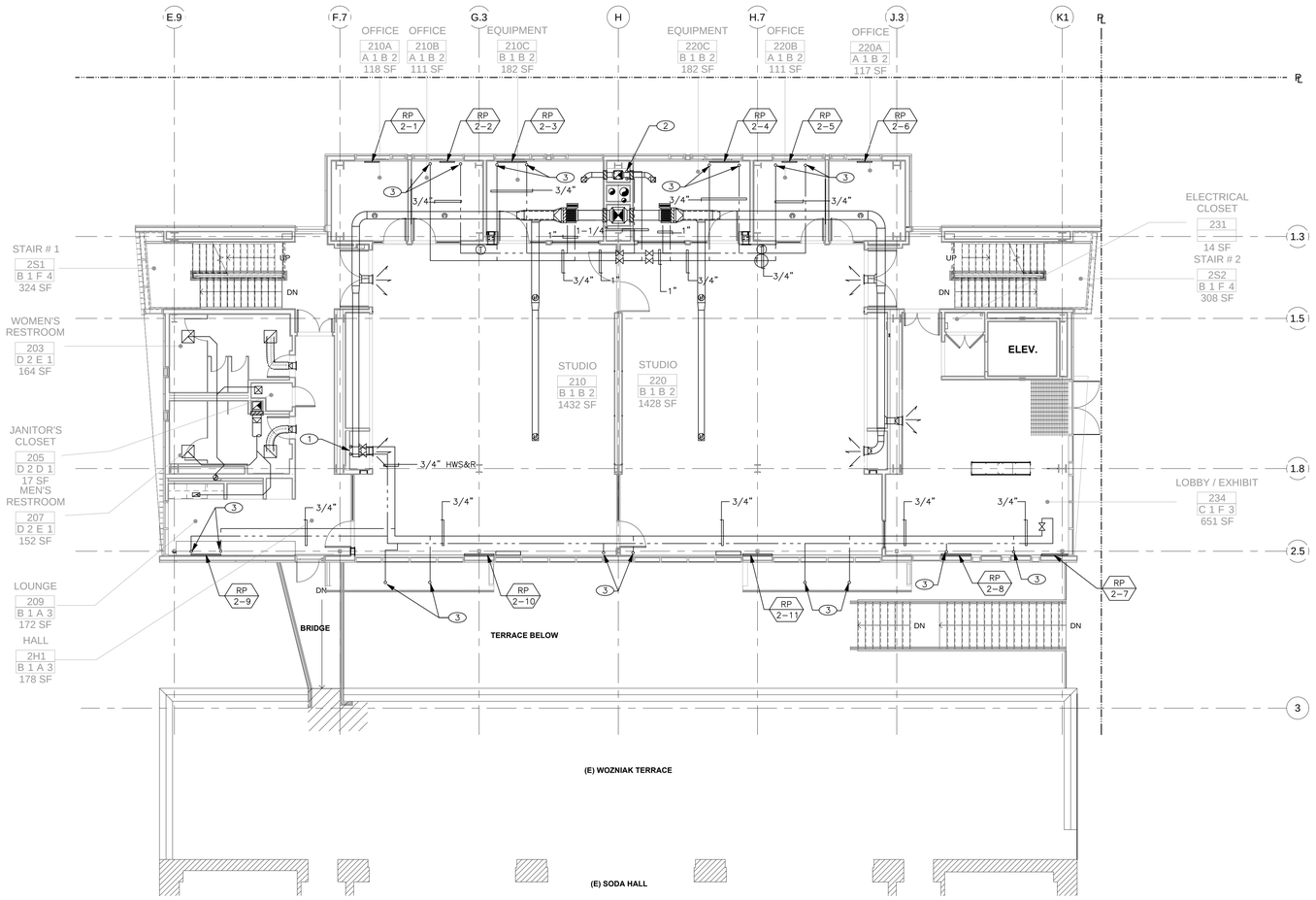
MECHANICAL PIPING PLAN LEVEL 1

SHEET No
M3.01



1 MECHANICAL PIPING PLAN LEVEL 2

SCALE: 1/8"=1'-0"

SHEET NOTES

1. 3/4" HWS&R DOWN TO LEVEL 1
2. 1-1/4" HWS&R UP TO LEVEL 3 & 1-1/2" DOWN TO LEVEL 1
3. 3/4" HWS&R UP TO LEVEL 3 TO CONNECT TO RADIANT PANEL

GENERAL NOTES

A. HOT WATER PIPING DISTRIBUTION AT LEVEL 1 CEILING FEEDS LEVEL 1 AND LEVEL 2 FLOOR RADIANT PANELS

B. HOT WATER PIPING DISTRIBUTION AT LEVEL 2 FEEDS LEVEL 3 RADIANT PANELS

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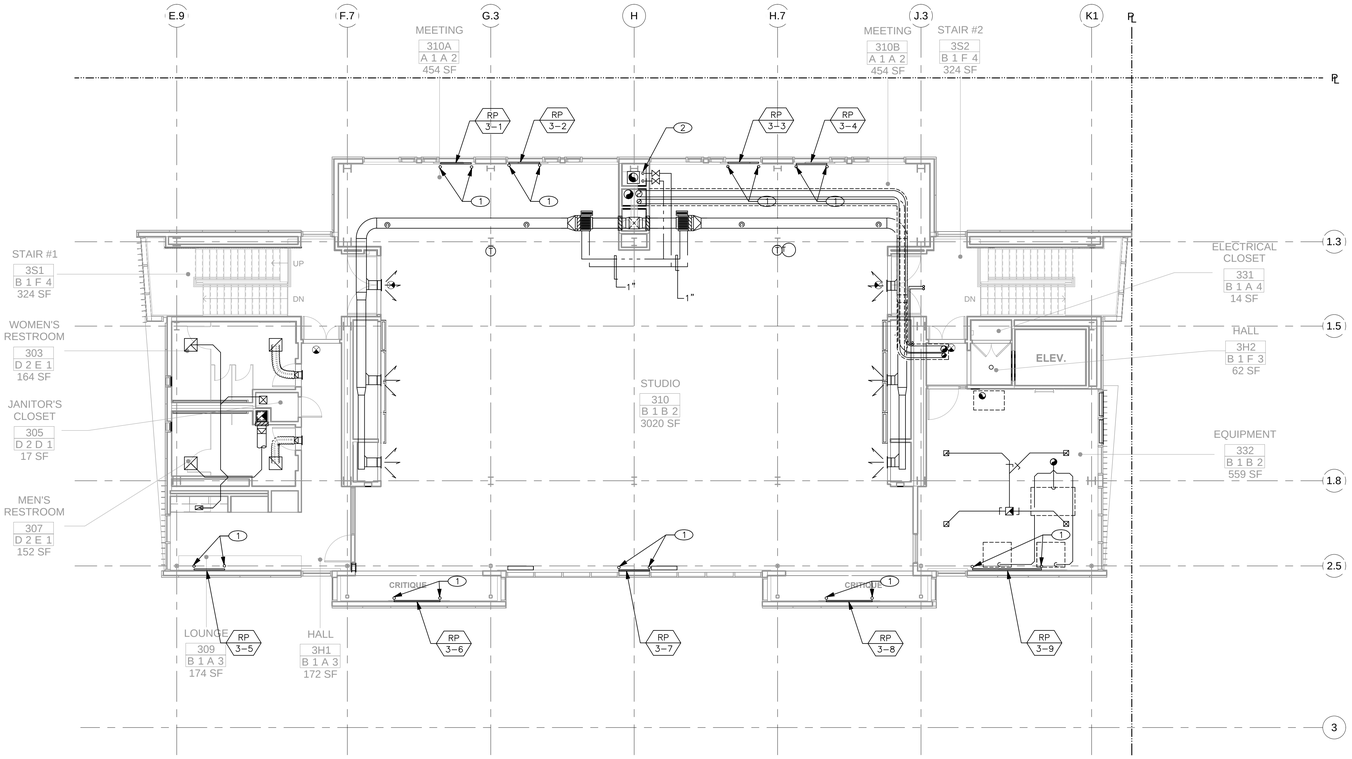
MECHANICAL PIPING PLAN LEVEL 2

SHEET No.

M3.02



(E) SODA HALL BELOW

1 MECHANICAL PIPING PLAN LEVEL 3

SCALE: 1/8"=1'-0"

SHEET NOTES

1. 3/4" HWS&R DOWN TO LEVEL 2 TO CONNECT TO HEATING SUPPLY AND RETURN HOT WATER PIPING
2. 1-1/4" HWS&R DOWN TO LEVEL 2

GENERAL NOTES

A. HOT WATER PIPING DISTRIBUTION AT LEVEL 1 CEILING FEEDS LEVEL 1 AND LEVEL 2 FLOOR RADIANT PANELS

B. HOT WATER PIPING DISTRIBUTION AT LEVEL 2 FEEDS LEVEL 3 RADIANT PANELS

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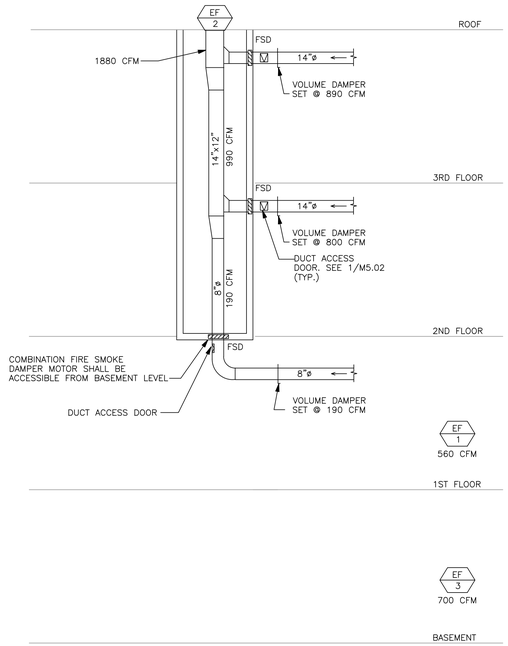
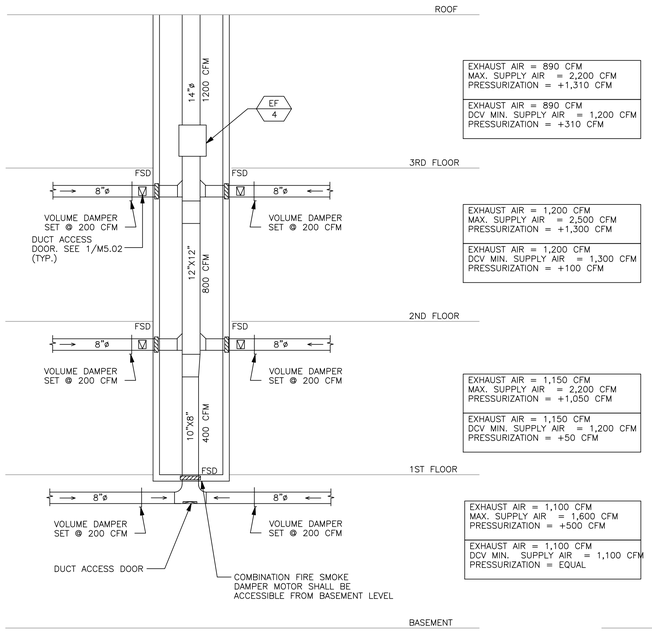
MECHANICAL PIPING PLAN LEVEL 3

SHEET No

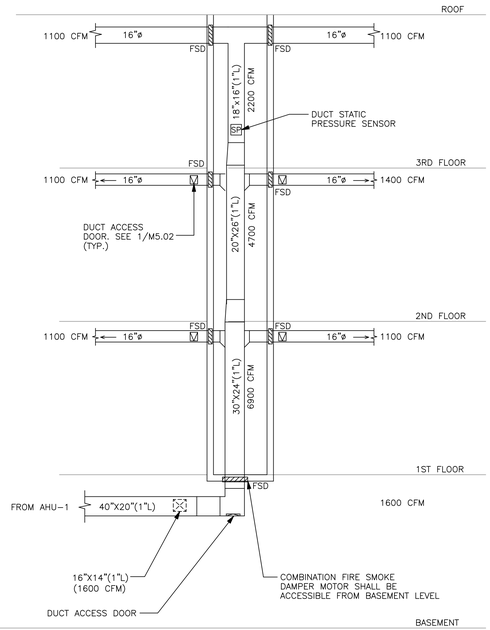
M3.03





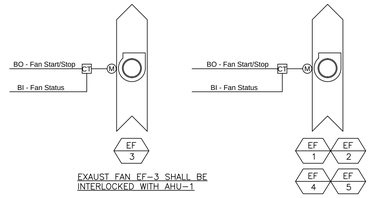
2 EXHAUST DUCT RISER DIAGRAM

SCALE: NONE



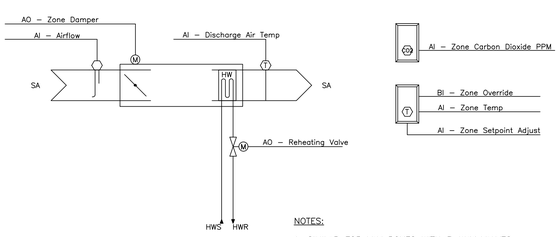
1 SUPPLY DUCT RISER DIAGRAM

SCALE: NONE



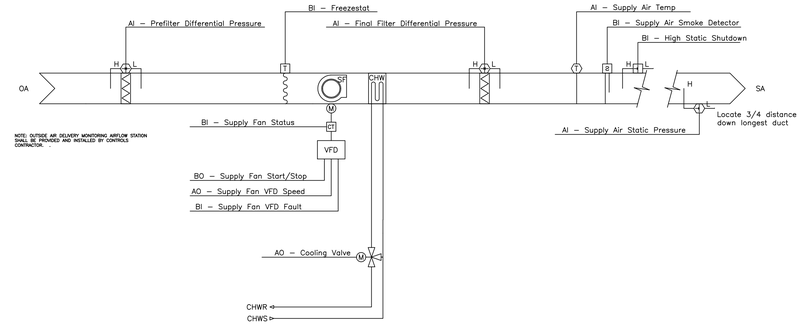
4 EXHAUST FAN CONTROL DIAGRAM

SCALE: NONE



3 VAV BOX CONTROL DIAGRAM

SCALE: NONE



5 100% OUTSIDE AIR UNIT CONTROL DIAGRAM

SCALE: NONE

100% Outside Air Variable Air Volume - AHU-1

Run Conditions - Requested:
The unit shall run whenever:
- Any zone is occupied.
- OR a definable number of unoccupied zones need heating or cooling.

Freeze Protection:
The unit shall shut down and generate an alarm upon receiving a freezestat status.

High Static Shutdown:
The unit shall shut down and generate an alarm upon receiving an high static shutdown signal.

Supply Air Smoke Detection:
The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

Supply Fan:
The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.

Alarms shall be provided as follows:
- Supply Fan Failure: Commanded on, but the status is off.
- Supply Fan in Hand: Commanded off, but the status is on.
- Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

Supply Air Duct Static Pressure Control:
The controller shall measure duct static pressure and shall modulate the supply fan VFD speed to maintain a duct static pressure setpoint of 1.5in H2O (adj.). The supply fan VFD speed shall not drop below 30% (adj.).

Alarms shall be provided as follows:
- High Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) greater than setpoint.
- Low Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) less than setpoint.
- Supply Fan VFD Fault.

Supply Air Temperature Setpoint - Outside Air Reset:
The controller shall monitor the supply air temperature and shall maintain supply air temperature setpoint. The supply air temperature setpoint shall reset for cooling as follows:

As outside air temperature rises from 45°F (adj.) to 75°F (adj.)
the supply air temperature setpoint shall reset downwards from 70°F (adj.) to 55°F (adj.).

Cooling Coil Valve:
The controller shall measure the supply air temperature and modulate the cooling coil valve to maintain its cooling setpoint.

The cooling shall be enabled whenever:
- Outside air temperature is greater than 70°F (adj.).
- AND the economizer is disabled or fully open.
- AND the supply fan status is on.
- AND the heating (if present) is not active.

The cooling coil valve shall open to 50% (adj.) whenever the freezestat is on.

Alarms shall be provided as follows:
- High Supply Air Temp: If the supply air temperature is 5°F (adj.) greater than setpoint.

Low Supply Air Temperature Alarm:
The controller shall alarm if the supply air temperature is less than 45°F (adj.).

Minimum Outside Air Ventilation - Carbon Dioxide (CO2) Control:

When in the occupied mode, the controller shall monitor zone CO2 levels served by this air handling unit. The controller shall take the highest zone CO2 level and modulate the outside air dampers open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of 750 ppm (adj.).

Alarms shall be provided as follows:

High Zone Carbon Dioxide Concentration: If the highest zone CO2 concentration is greater than 1000 ppm (adj.).

Prefilter Differential Pressure Monitor:
The controller shall monitor the differential pressure across the prefilter.

Alarms shall be provided as follows:
- Prefilter Change Required: Prefilter differential pressure exceeds a user definable limit (adj.).

Final Filter Differential Pressure Monitor:
The controller shall monitor the differential pressure across the final filter.

Alarms shall be provided as follows:
- Final Filter Change Required: Final filter differential pressure exceeds a user definable limit (adj.).

Supply Air Temperature:
The controller shall monitor the supply air temperature.

Alarms shall be provided as follows:
- High Supply Air Temp: If the supply air temperature is greater than 120°F (adj.).
- Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

Variable Air Volume - Terminal Unit

Run Conditions - Scheduled:
The unit shall run according to a user definable time schedule in the following modes:
- Occupied Mode: The unit shall maintain
- A 78°F (adj.) cooling setpoint
- A 70°F (adj.) heating setpoint.
- Unoccupied Mode (night setback): The unit shall maintain
- A 85°F (adj.) cooling setpoint.
- A 55°F (adj.) heating setpoint.

Alarms shall be provided as follows:
- High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
- Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Minimum Ventilation on Carbon Dioxide (CO2) Concentration:
When in the occupied mode, the controller shall measure the zone CO2 levels and modulate the zone damper open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of not more than 750 ppm (adj.).

Alarms shall be provided as follows:
- High Zone Carbon Dioxide Concentration: If the zone CO2 concentration is greater than 1000 ppm (adj.).

Zone Setpoint Adjust:
The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Optimal Start:
The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

Zone Unoccupied Override:
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Variable Volume Terminal Unit - Flow Control:
The unit shall maintain zone setpoints by controlling the airflow through one of the following:

Occupied:
- When zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
- When the zone temperature is less than the cooling setpoint, the zone damper shall maintain the minimum required zone ventilation (adj.).

Unoccupied:
- When the zone is unoccupied the zone damper shall control to its minimum unoccupied airflow (adj.).
- When the zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.

Reheating Coil Valve:
The controller shall measure the zone temperature and modulate the reheating coil valve open on dropping temperature to maintain its heating setpoint.

Reheating - High Discharge Air Temperature Limit:
The controller shall measure the discharge air temperature and limit reheating if the discharge air temperature is more than 15°F (adj.) above the zone temperature.

Discharge Air Temperature:
The controller shall monitor the discharge air temperature.

Alarms shall be provided as follows:
- High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
- Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

Exhaust Fan: EF-1, EF-2, EF-3, EF-4, EF-5
Run Conditions - Scheduled:
The fan shall run according to an user definable schedule.
Fan:
The fan shall have a user definable (adj.) minimum runtime.
Fan Status:
The controller shall monitor the fan status.
Alarms shall be provided as follows:
- Fan Failure: Commanded on, but the status is off.

Fan in Hand: Commanded off, but the status is on.

6 CONTROL SEQUENCE OF OPERATION

SCALE: NONE

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PROJECT

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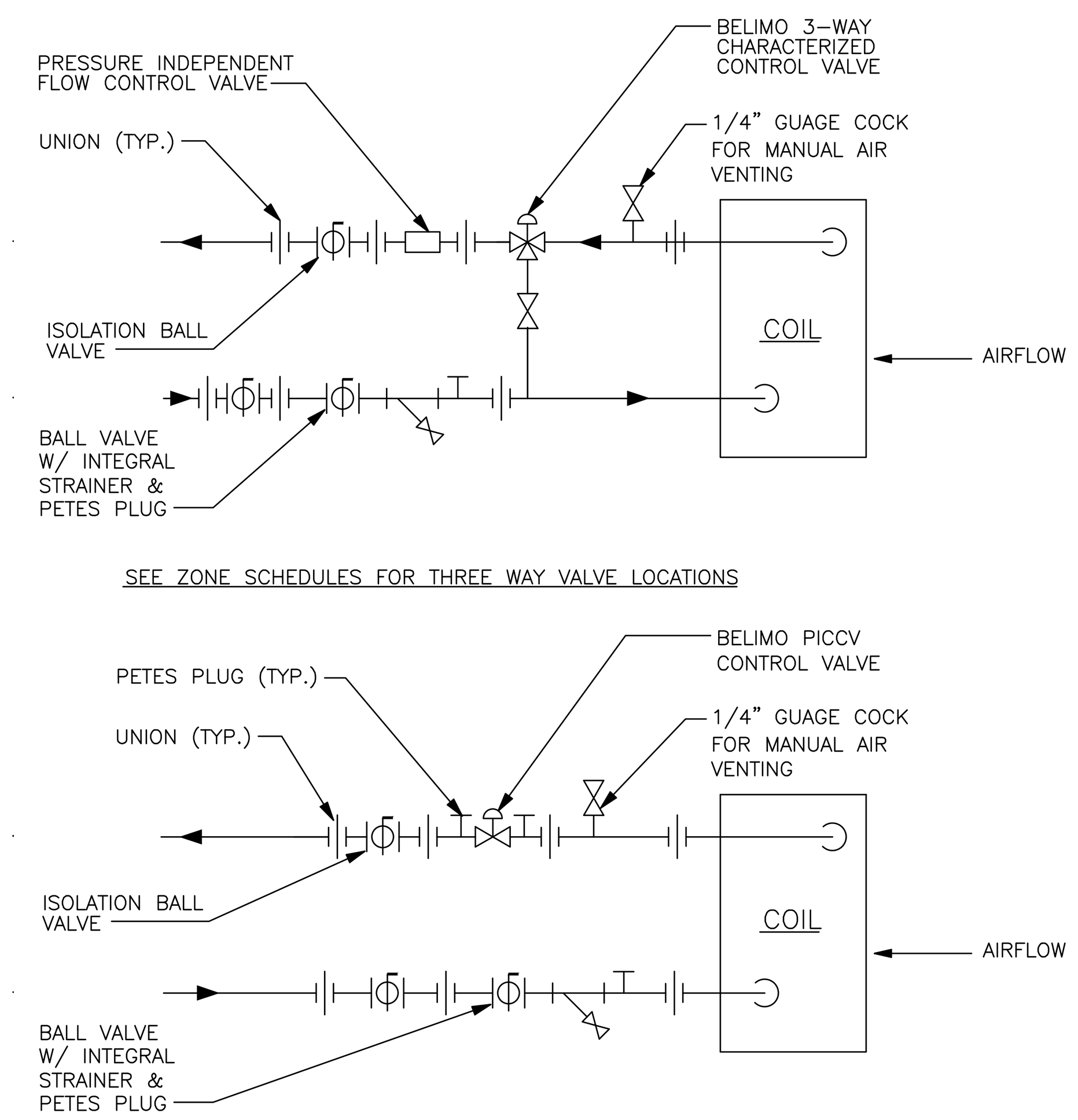
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

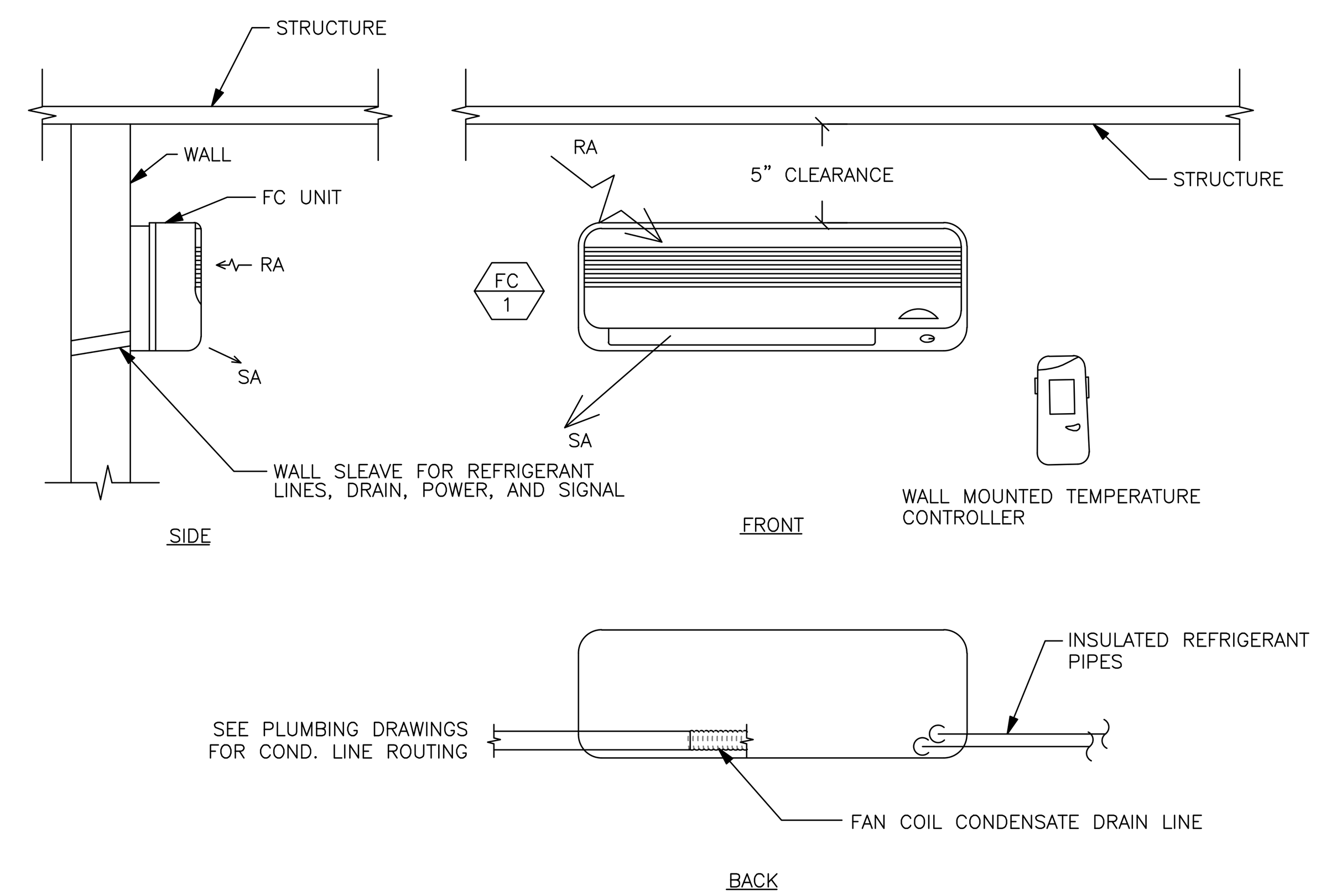
DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE :

SHEET TITLE
MECHANICAL DIAGRAMS

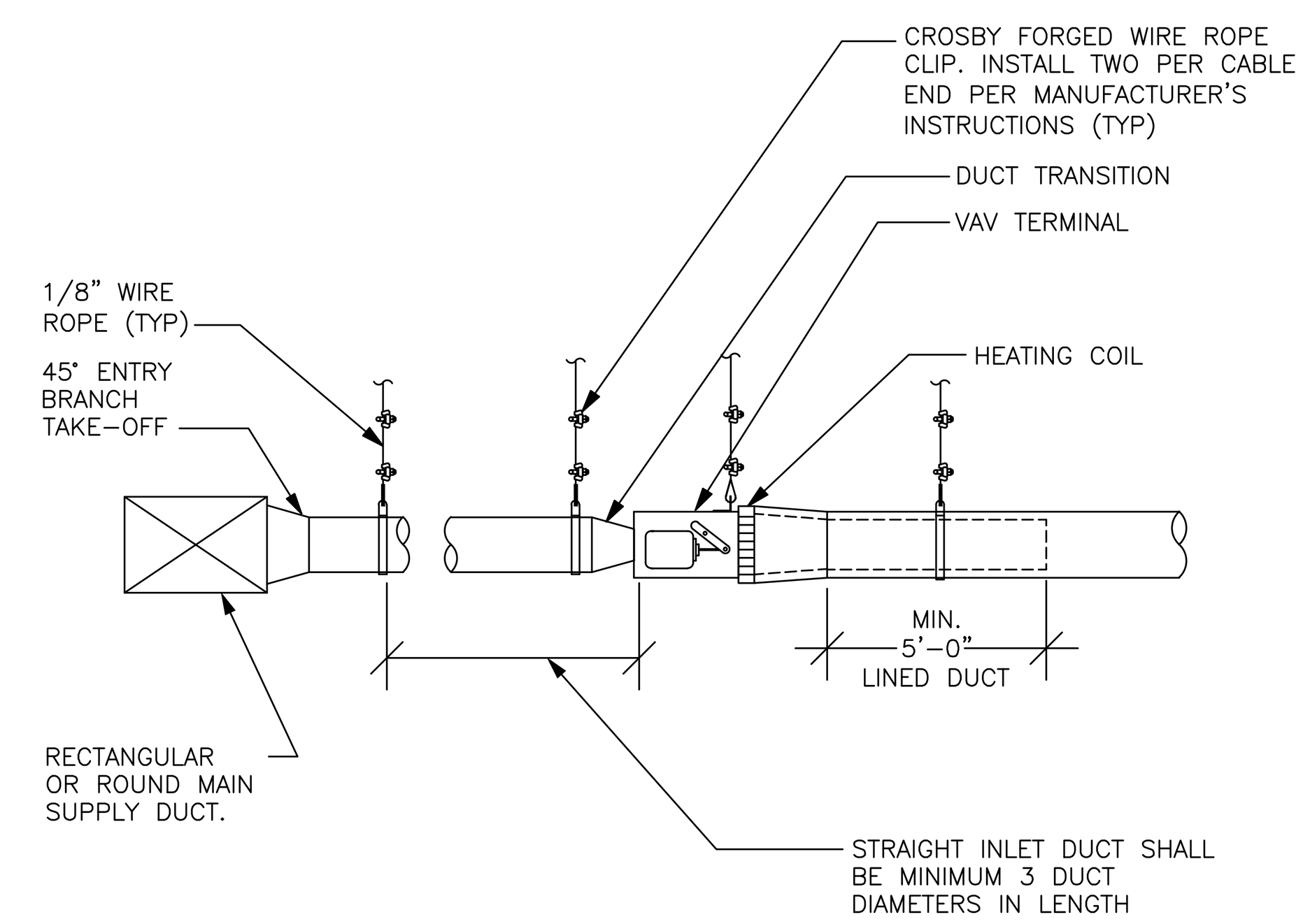
SHEET No:
M5.00



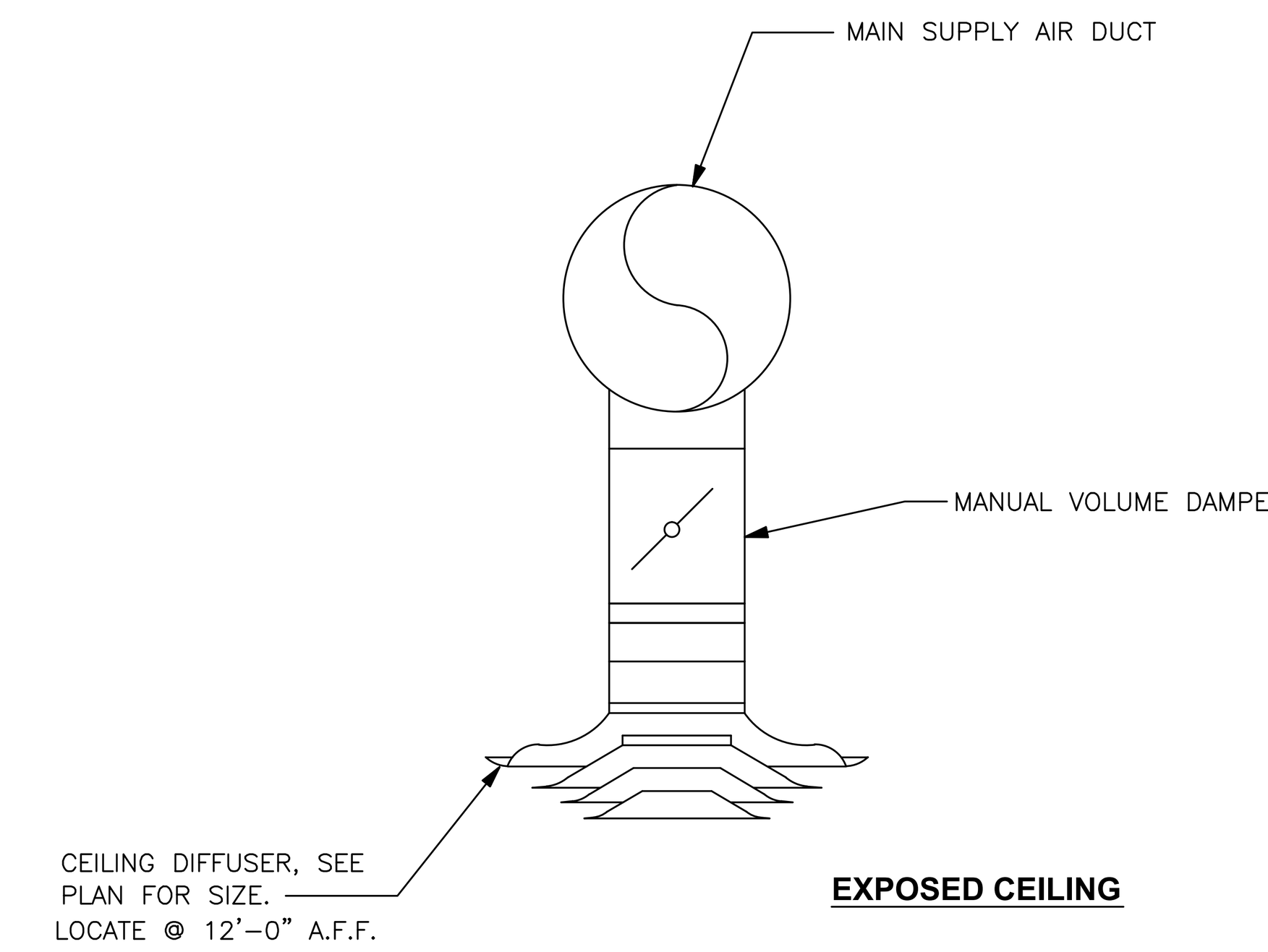
10 VAV REHEAT COIL DETAIL
SCALE: NONE



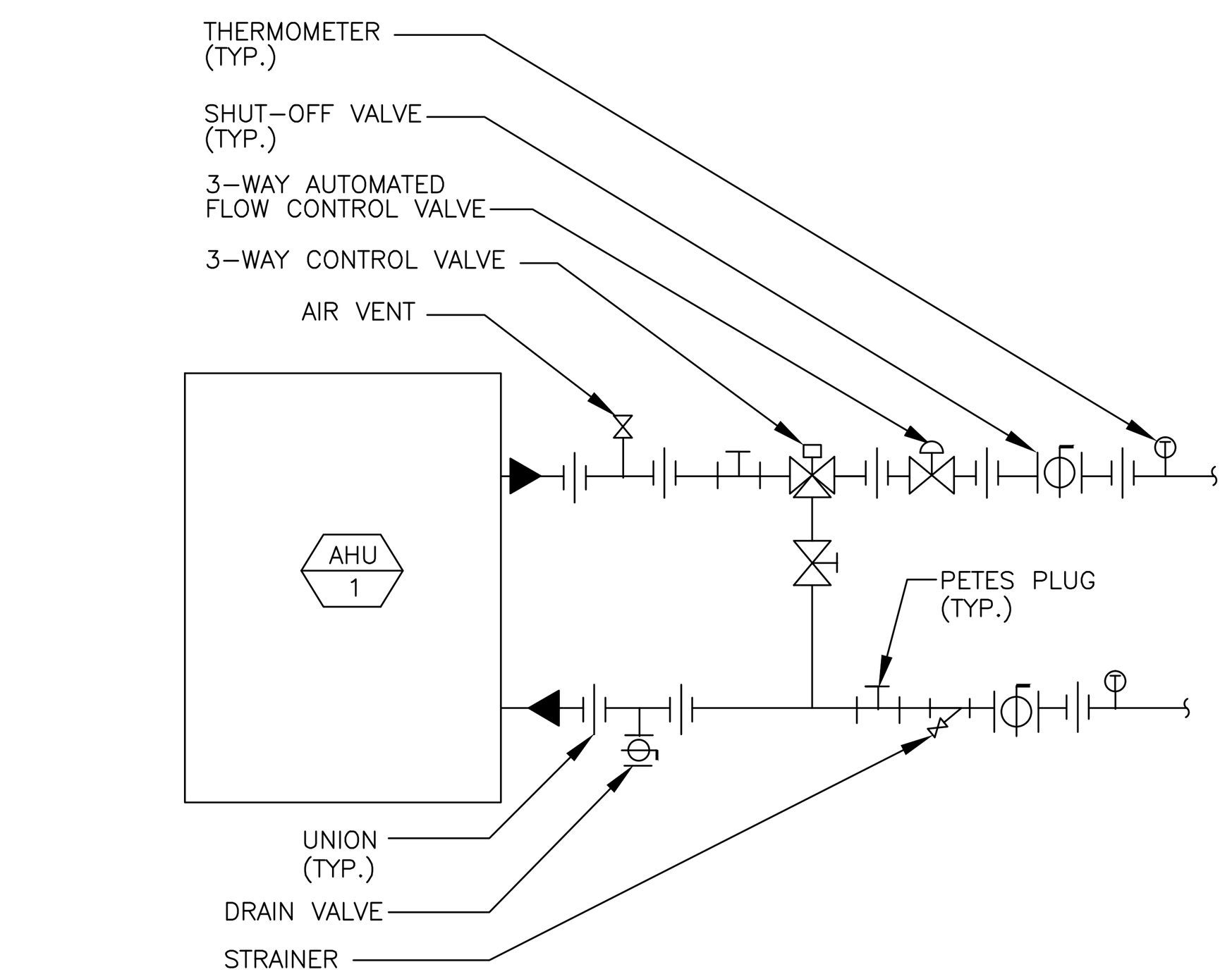
7 WALL MOUNTED FAN COIL UNIT DETAIL
SCALE: NONE



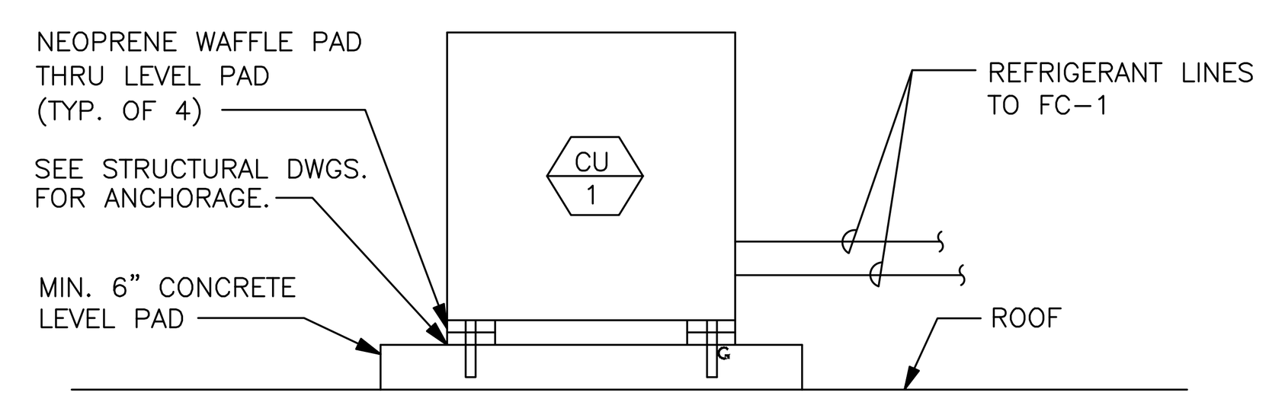
4 VAV TERMINAL DETAIL
SCALE: NONE



1 ROUND CEILING DIFFUSER DETAIL
SCALE: NONE



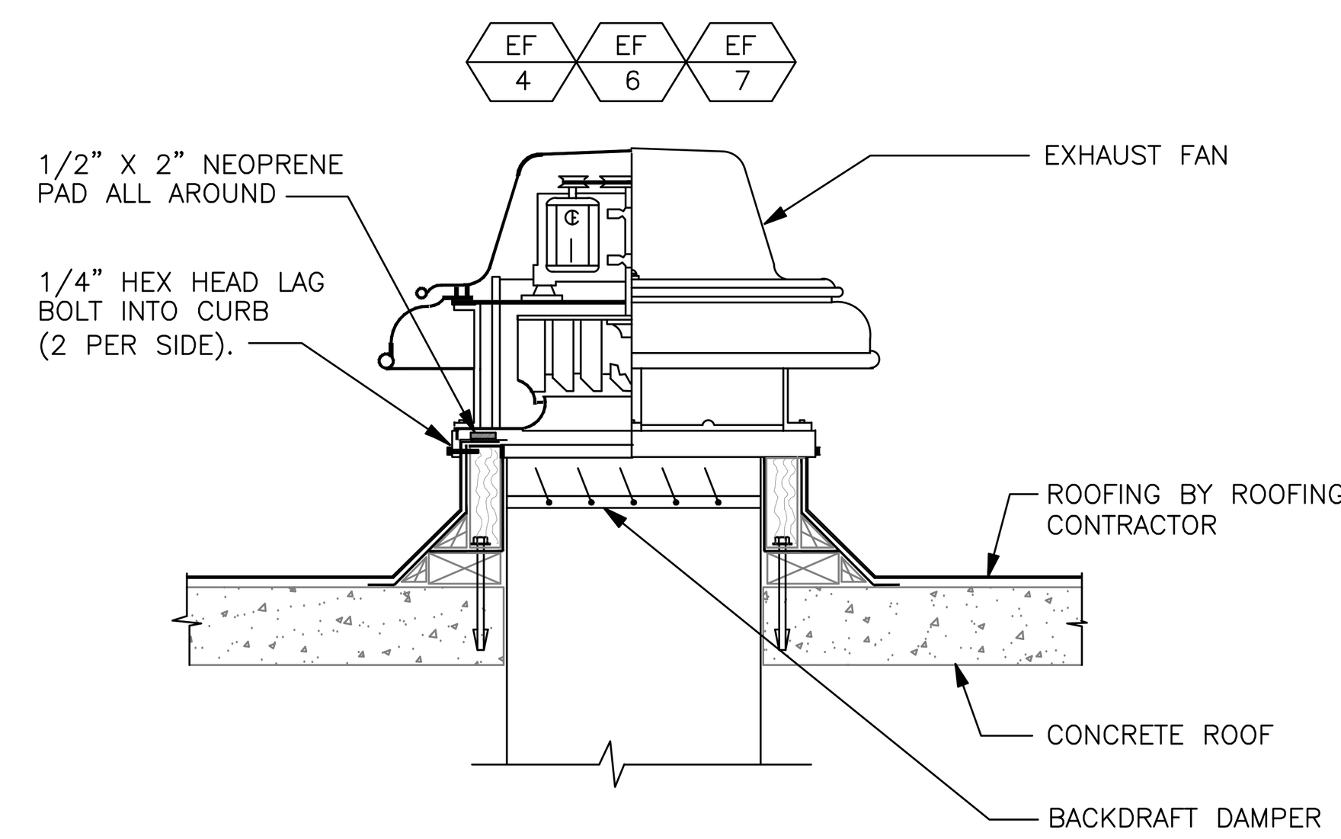
11 AIR HANDLER PIPING CONNECTION (1-COIL) WITH 3-WAY VALVE
SCALE: NONE



NOTE:

1. REFRIGERANT PIPING INSULATION LOCATED OUTDOORS SHALL BE WRAPPED W/ ALUMINUM JACKETING AND VAPOUR SEALED.

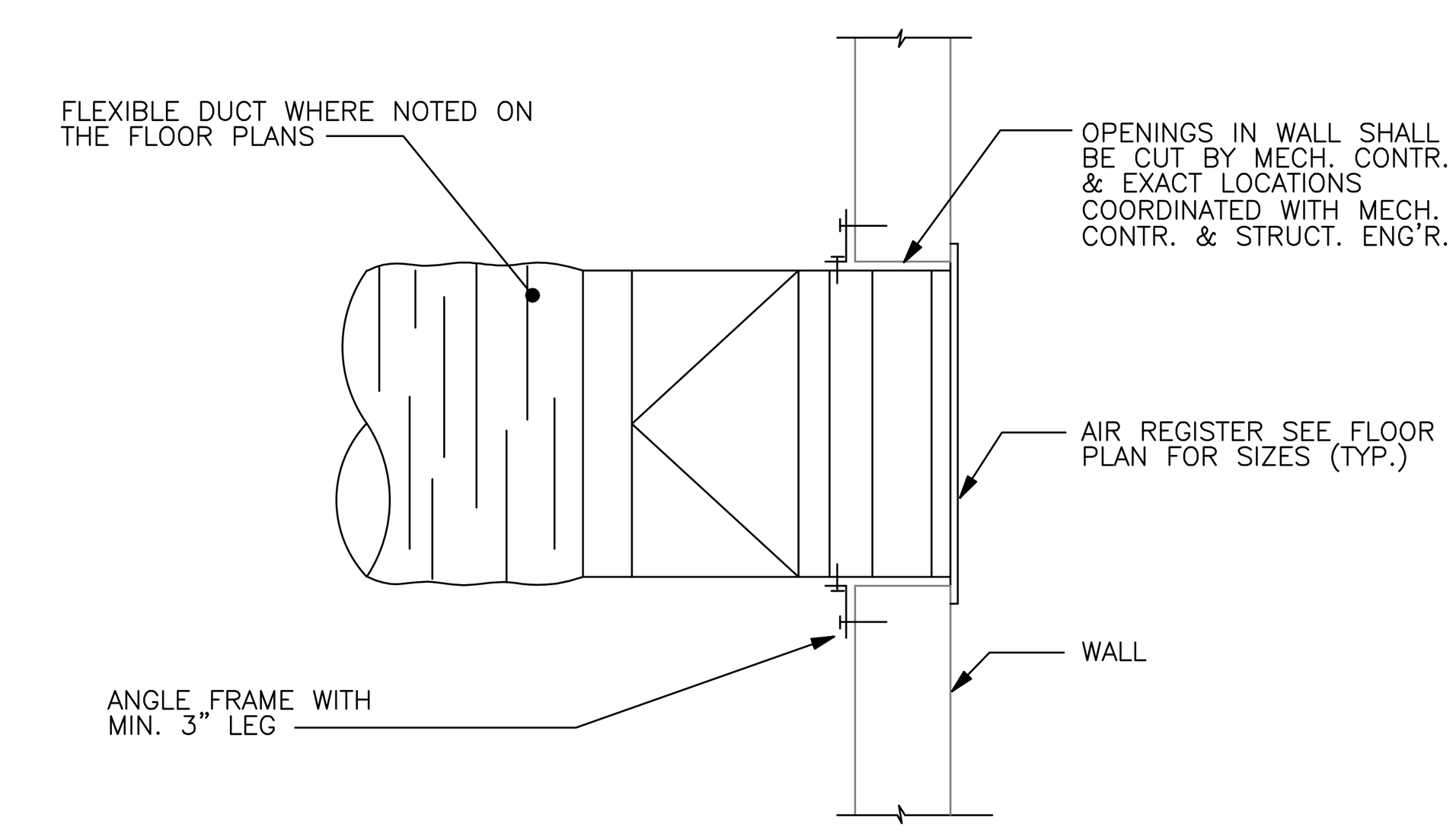
8 CONDENSING UNIT DETAIL
SCALE: NONE



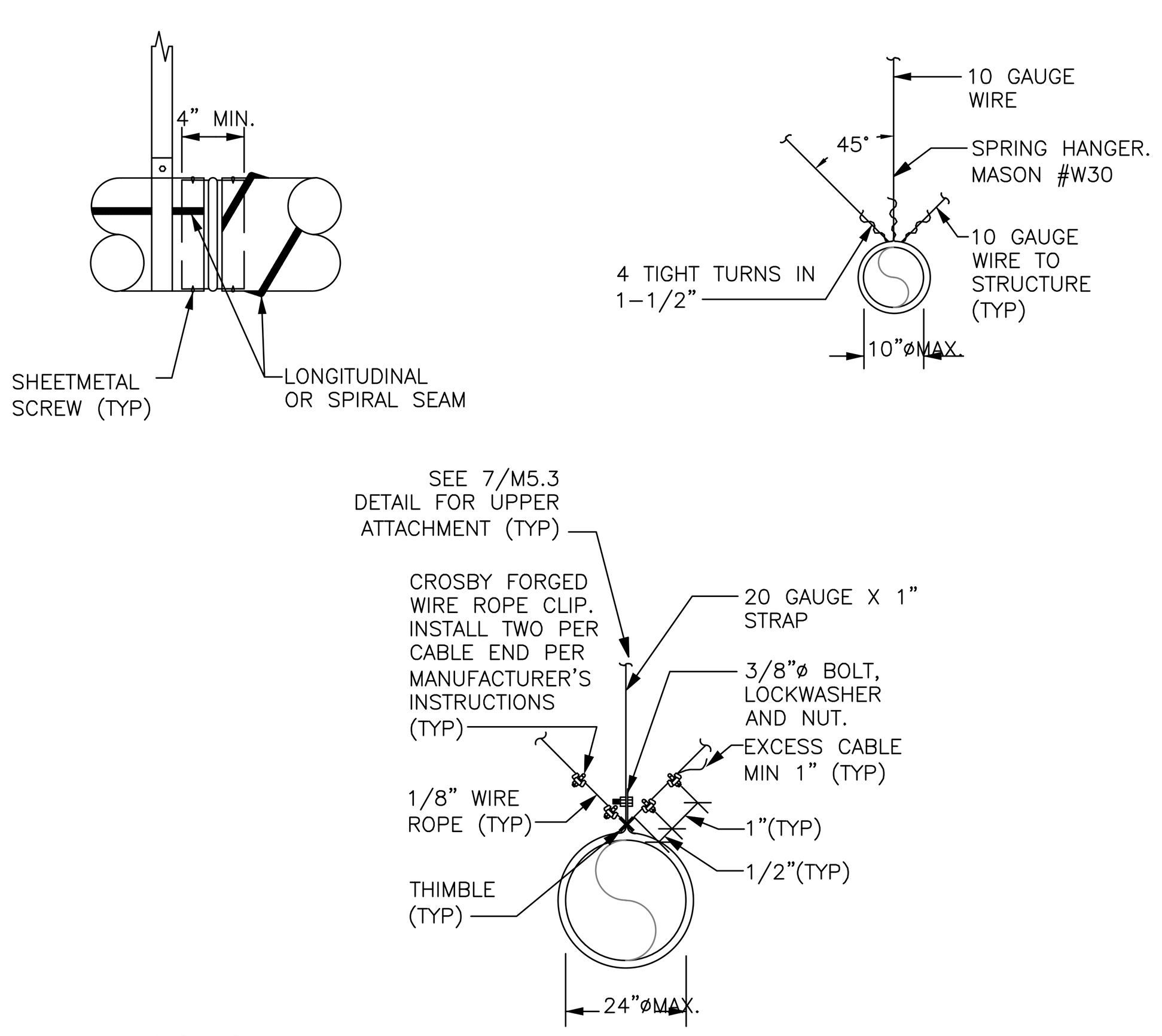
NOTES:

1. REFER TO ARCHITECTURAL PLANS FOR ADDITIONAL INFORMATION

5 ROOF EXHAUST FAN
SCALE: NONE



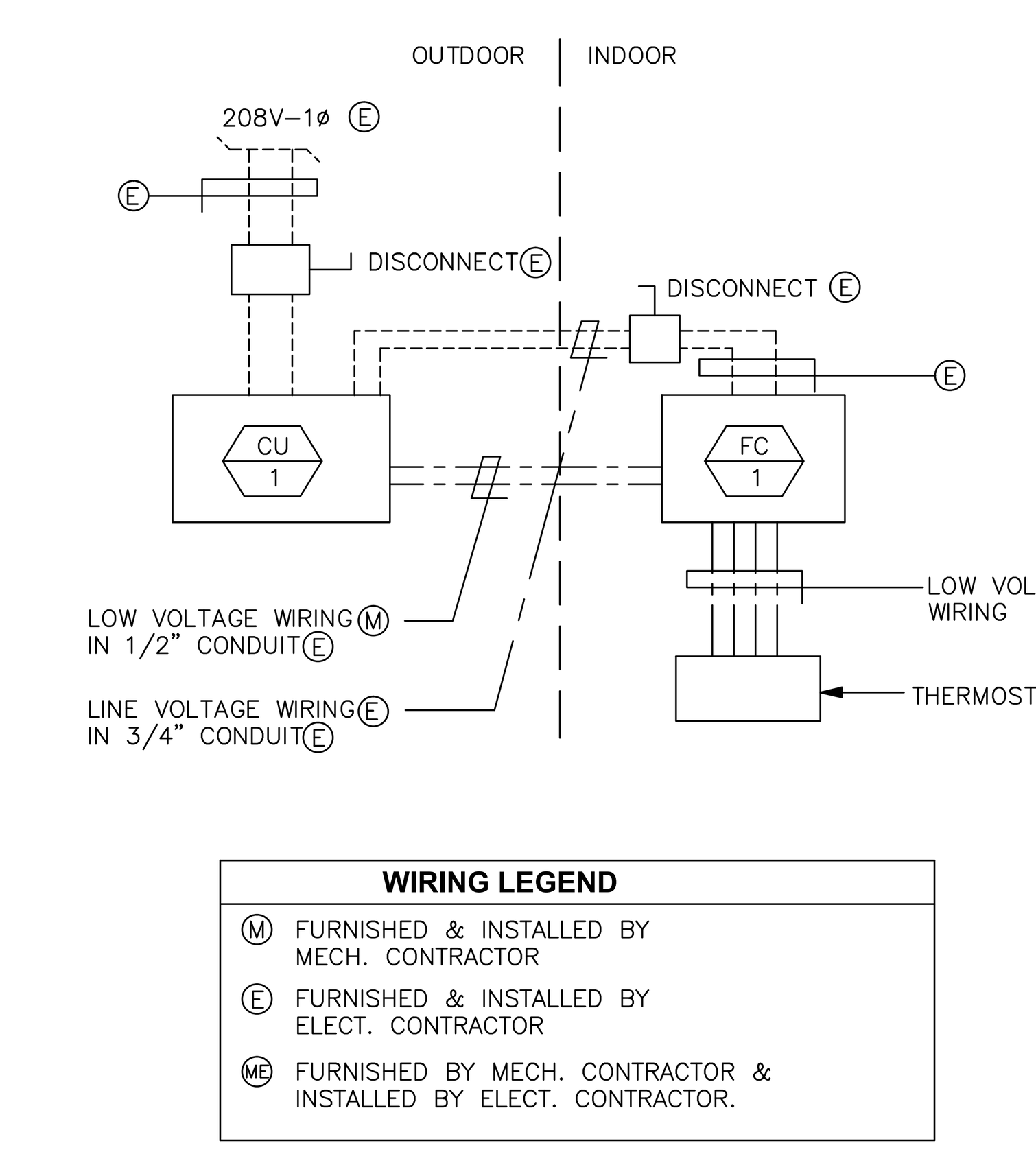
2 SIDEWALL MOUNTED REGISTERS
SCALE: NONE



NOTES

STRAP AND WIRE TO BE SIZED PER SMACNA DUCT CONSTRUCTION STANDARDS TABLE 4-2. MAXIMUN SPACING BETWEEN SUPPORTS – 12 FEET MAX AND AT EACH ELBOW. SECURE STRAPS TIGHT TO DUCT.

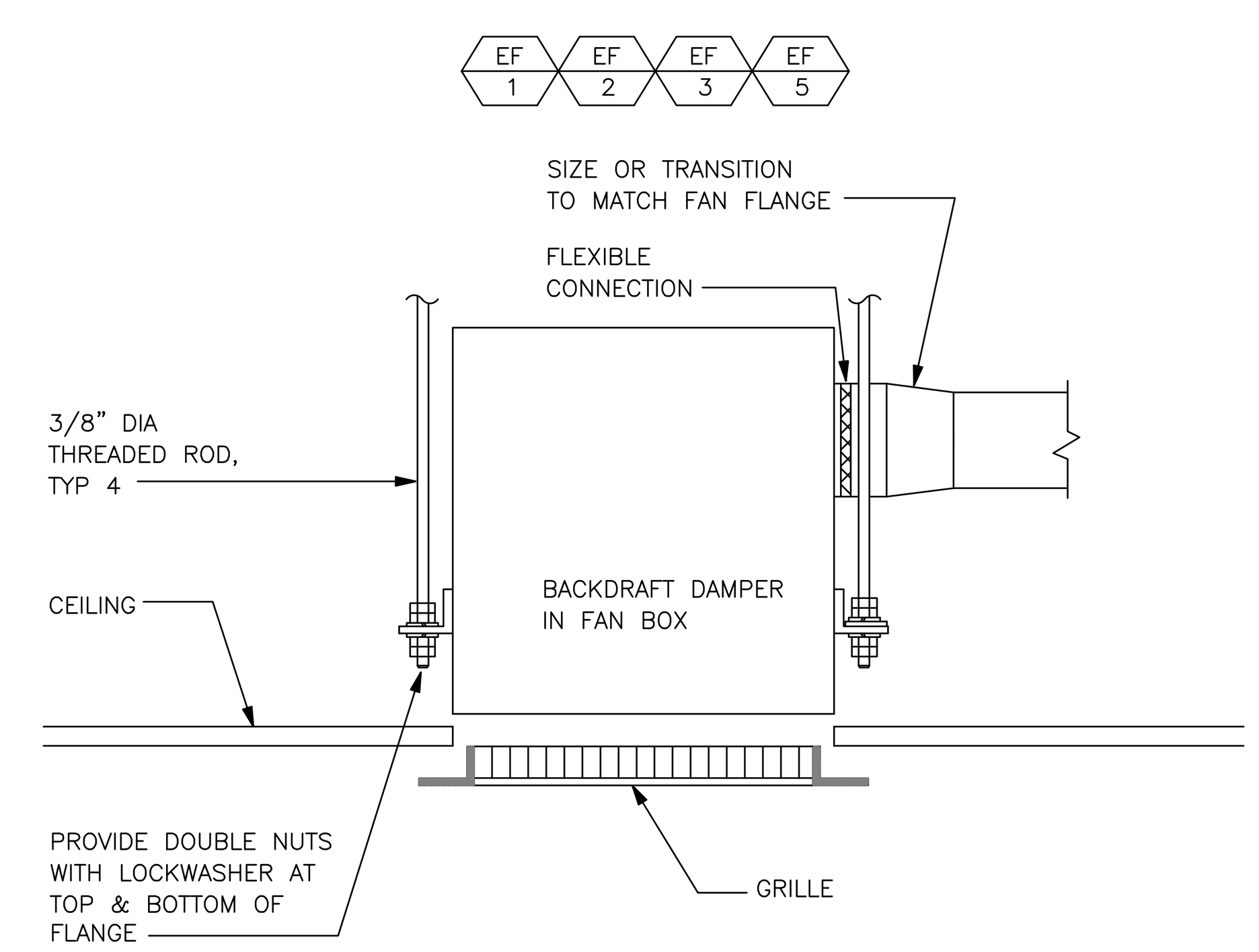
12 ROUND DUCT SUPPORT DETAIL
SCALE: NONE



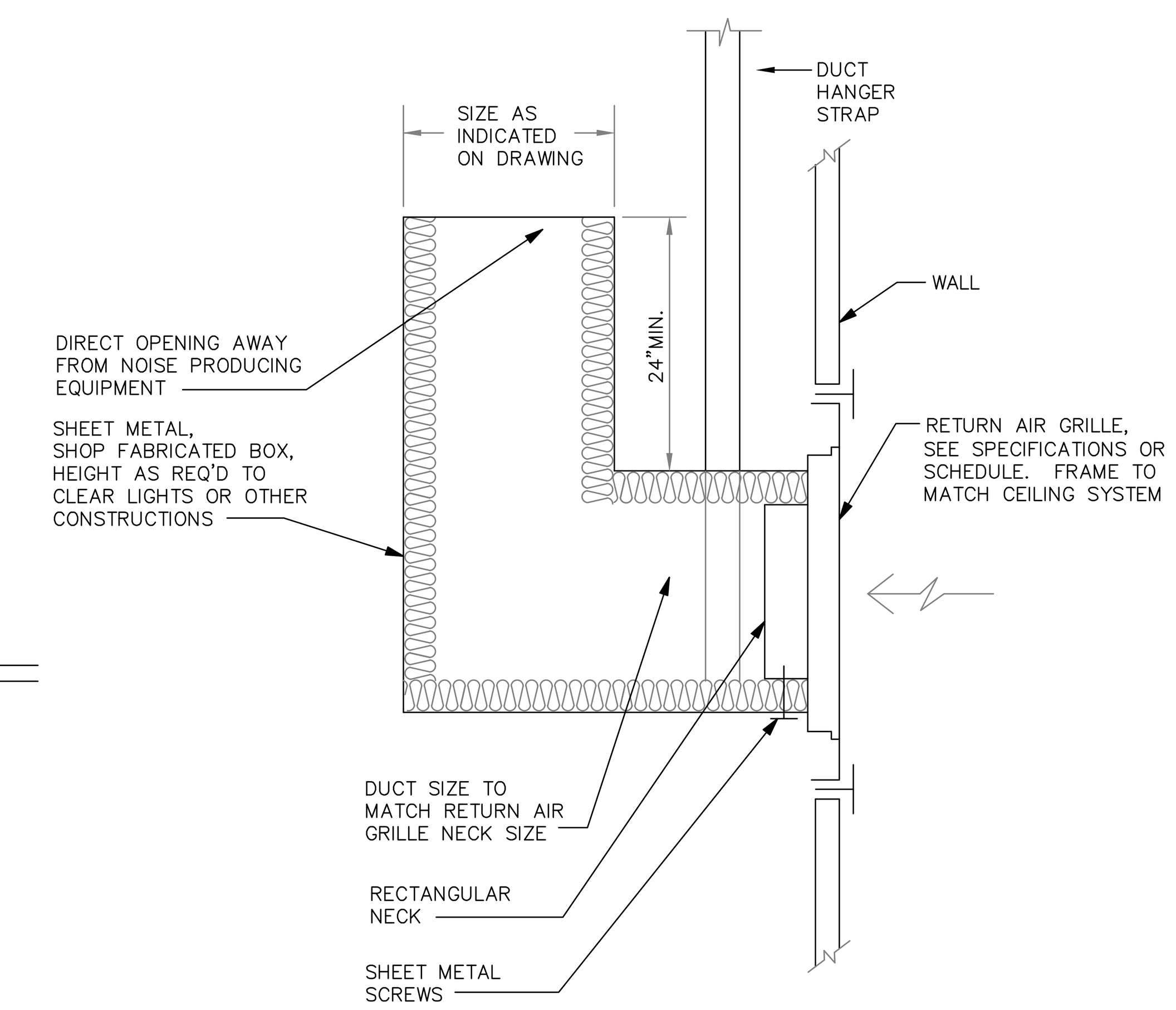
NOTES:

1. CONDUIT FOR LOW VOLTAGE WIRING SHALL BE BY ELECTRICAL CONTRACTOR

9 SPLIT SYSTEM UNITS WIRING DIAGRAM
SCALE: NONE



6 CEILING EXHAUST FAN
SCALE: NONE



3 TRANSFER AIR BOOT DETAIL
SCALE: NONE

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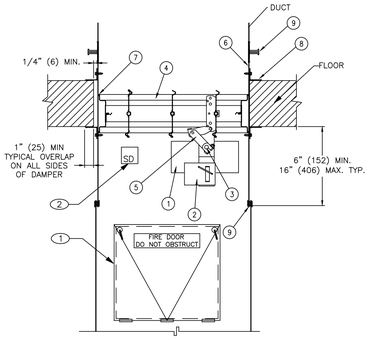
SCALE :

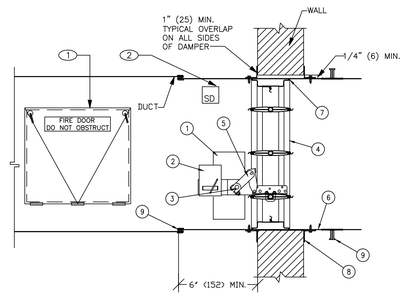
SHEET TITLE
MECHANICAL DETAILS

SHEET No
M5.01



VERTICAL INSTALLATION

ACTUATOR BELOW FLOOR



HORIZONTAL INSTALLATION

FIRE/SMOKE DAMPER INSTALLATION SHALL BE COORDINATED WITH MANUFACTURER'S INSTALLATION WRITTEN INSTRUCTIONS

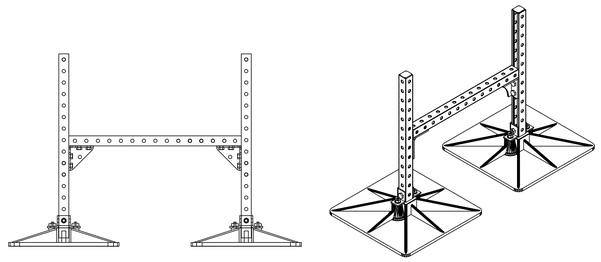
NOTE:

1. ACCESS TO FIRE DAMPER BLADES AND ACTUATOR MOTOR SHALL BE THROUGH DUCT ACCESS PANEL. PANEL SHALL BE HINGED WITH A TIGHT FITTING SEAL. ACCESS SIZE SHALL BE A MINIMUM OF 18" LONG IN DIRECTION OF AIRFLOW BY HEIGHT OR WIDTH OF DUCT (PERPENDICULAR TO AIRFLOW) WITH A 12" MINIMUM. WHERE 12" CONNOT BE ACHIEVED, CONTRACTOR SHALL INSTALL EASILY REMOVABLE AND REPLACABLE TIGHTLY GASKETED DUCT SECTION(S). ACCESS PANEL SHALL BE LABELED WITH THE WORDS, "FIRE DOOR – DO NOT OBSTRUCT" IN LETTERS NO LESS THAN 1" IN HEIGHT. EXTERNAL INSULATION SHALL NOT CONCEAL ACCESS UNLESS A LABEL IS ATTACHED TO THE INSULATION WHICH INDICATES THE EXACT LOCATION OF THE OPENING.
2. DUCT SMOKE DETECTOR SHALL BE COMPATIBLE WITH FIRE ALARM SYSTEM. IT SHALL BE PROVIDED BY ELECTRICAL, INSTALL BY MECHANICAL & CONNECTED TO FIRE ALARM CONTROL PANEL BY ELECTRICAL

ITEM.	DESCRIPTION
1.	ACTUATOR (LOCATION MAY VARY). SEE ACTUATOR INSTALLATION INSTRUCTIONS FOR FIELD MOUNTING OF DAMPER ACTUATORS
2.	FIRESTAT
3.	AUXILLARY OPERATING JACK SHAFT
4.	DAMPER
5.	OVER CENTER LOCK
6.	SLEEVE
7.	CAULKING MATERIAL (MAY BE ON EITHER SIDE OF DAMPER FRAME
8.	PFMA OR CONVENTIONAL MOUNTING ANGLES
9.	S-JOINT/DUCT MATE, SLEEVE TO DUCT

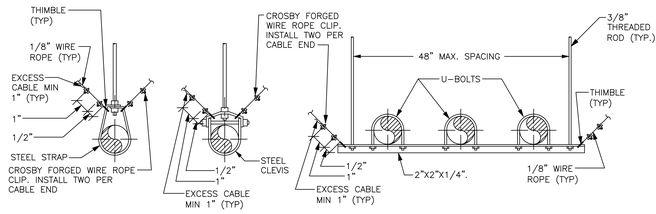
1 COMBINATION FIRE/SMOKE DAMPER DETAILS - VERTICAL & HORIZONTAL

SCALE: NONE



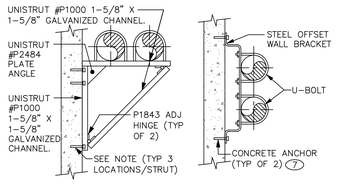
5 ROOF DUCT SUPPORT DETAIL

SCALE: NONE



DETAIL A (1)(2)(5)(6) DETAIL B (3)(4)(5)

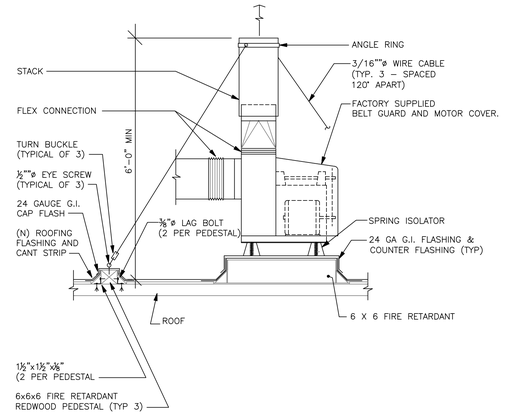
OVERHEAD BRACKET



WALL BRACKET

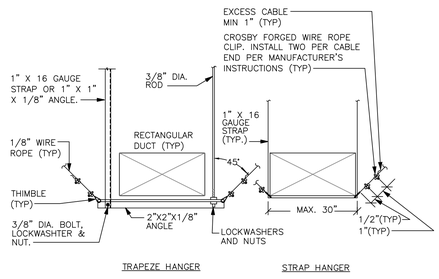
NOTES:

1. PROVIDE SEISMIC CABLE TRANSVERSE BRACING AT 40 FT. AND EACH CHANGE OF DIRECTION.
2. SEISMIC CABLE LONGITUDINAL BRACING AT 80 FT. AND EACH CHANGE OF DIRECTION.
3. MAXIMUM ROD SPAN BETWEEN SUPPORTS IS 10', CLOSER SPAN AS REQUIRED BY SPECIFICATIONS AND SMACNA.
4. PROVIDE TRANSVERSE AND LONGITUDINAL BRACES AT 40 FT MAXIMUM FOR PIPES SMALLER THAN 4 IN. AND AT 20 FT MAXIMUM FOR PIPES 4 TO 8 IN.
5. SEISMIC CABLE RESTRAINTS ARE NOT REQUIRED AT EVERY HANGER LOCATION. VERTICAL HANGERS, DIAGONAL AND HORIZONTAL BRACES TO BE SIZED IN ACCORDANCE WITH SMACNA SEISMIC RESTRAINT MANUAL.
6. SEISMIC BRACING REQUIRED FOR PIPE SIZE 2-1/2" AND LARGER.
7. MOUNTING TO CONCRETE: FOR DIRECT BOLTING USE 1/2"ø HILTI KB-III CONCRETE WEDGE ANCHOR, MINIMUM 4" EMBEDMENT; FOR ANCHORING THREADED ROD USE HILTI HDI 5/8" FLUSH MOUNT INTERNAL THREAD ANCHOR MINIMUM 2" EMBEDMENT FOR USE WITH 5/8"ø THREADED ROD.



4 EXHAUST FAN MOUNTING DETAIL

SCALE: NONE



TRAPEZE HANGER STRAP HANGER

NOTES

HANGERS AND TRAPEZE ANGLES TO BE SIZED IN ACCORDANCE WITH SMACNA DUCT CONTRUCTION STANDARDS, TABLES 4-1 & 4-3. MAXIMUM SPACING BETWEEN HANGERS – 10 FEET.

3 RECTANGULAR DUCT SUPPORT DETAIL

SCALE: NONE

2 PIPE SUPPORT DETAIL

SCALE: NONE

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PROJECT

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DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE :

SHEET TITLE
MECHANICAL DETAILS

SHEET No
M5.02

PERFORMANCE CERTIFICATE OF COMPLIANCE (Part 3 of 3) PERF-1C

Project Name: Jacobs Hall | Date: 8/15/2014

ZONE INFORMATION

System Name	Zone Name	Occupancy Type	Floor Area (sqft.)	Inst. LPD (W/sf)[1]	Ctrl. Credits (W/sf)[2]	Allowed LPD Area (W/sf)[3]	Allowed LPD Tailored (W/sf)[4]	Proc. Loads (W/sf)
AHU-1	VAV 3-1 & VAV3-2	Corridor/Restroom/Support	5,613	*0.780				
	VAV 2-1 & VAV2-2	Corridor/Restroom/Support	6,197	*0.780				
	VAV 1-1 & VAV1-2	Corridor/Restroom/Support	6,248	*0.780				
	VAV B-1 & B-2	Corridor/Restroom/Support	3,743	*0.780				

Notes: 1. See LTG-1C (items marked with asterisk, see LTG-1-C by others) 2. See LTG-2C 3. See LTG-3C (by others) 4. See LTG-4C — Items above require special documentation

EXCEPTIONAL CONDITIONS COMPLIANCE CHECKLIST

The local enforcement agency should pay special attention to the items specified in this checklist. These items require special written justification and documentation, and special verification to be used with the performance approach. The local enforcement agency determines the adequacy of the justifications, and may reject a building or design that otherwise complies based on the adequacy of the special justification and documentation submitted.

The Hot Water Pump includes a Variable Speed Drive.

The HVAC System AHU-1 includes Demand Control Ventilation per Standards Section 121.

The HVAC System Greenheck MSX-118-H32 includes a Variable Speed Drive on the Fan.

The exceptional features listed in this performance approach application have specifically been reviewed. Adequate written justification and documentation for their use have been provided by the applicant.

Authorized Signature or Stamp ____________________

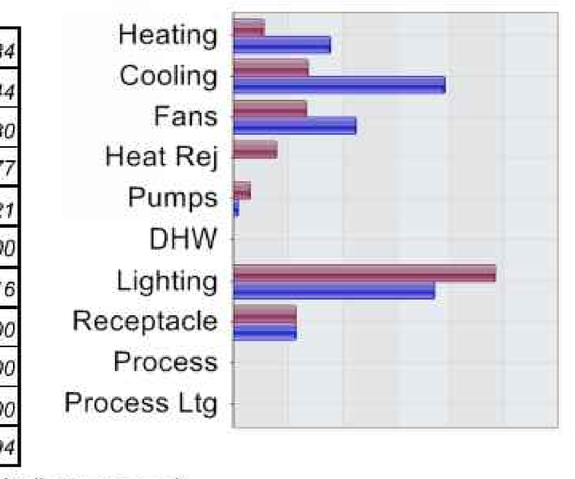
PERFORMANCE CERTIFICATE OF COMPLIANCE (Part 2 of 3) PERF-1C

Project Name: Jacobs Hall | Date: 8/15/2014

ANNUAL TDV ENERGY USE SUMMARY (kBtu/sqft-yr)

Energy Component	Standard Design	Proposed Design	Compliance Margin
Space Heating	17.75	5.40	12.34
Space Cooling	39.05	13.62	25.44
Indoor Fans	22.62	13.32	9.30
Heat Rejection	0.00	7.77	-7.77
Pumps & Misc.	0.91	3.12	-2.21
Domestic Hot Water	0.00	0.00	0.00
Lighting	37.20	48.37	-11.16
Receptacle	11.36	11.36	0.00
Process	0.00	0.00	0.00
Process Lighting	0.00	0.00	0.00
TOTALS	128.88	102.95	25.94

Percent better than Standard: 20.1 % (20.1 % excluding process)



BUILDING COMPLIES

GENERAL INFORMATION

Building Orientation	(N) 0 deg	Conditioned Floor Area	21,801	sqft.
Number of Stories	3	Unconditioned Floor Area	0	sqft.
Number of Systems	1	Conditioned Footprint Area	3,723	sqft.
Number of Zones	4	Natural Gas Available On Site	Yes	

	Orientation	Gross Area	Glazing Area	Glazing Ratio
Front Elevation	(N)	4,359 sqft.	2,151 sqft.	49.3 %
Left Elevation	(E)	1,482 sqft.	1,059 sqft.	71.5 %
Rear Elevation	(S)	5,825 sqft.	2,318 sqft.	39.8 %
Right Elevation	(W)	1,817 sqft.	1,188 sqft.	65.4 %
Total		13,483 sqft.	6,716 sqft.	49.8 %
Roof		5,613 sqft.	0 sqft.	0.0 %

	Standard	Proposed
Prescriptive Lighting Power Density	0.600 W/sqft.	0.780 W/sqft.
Prescriptive Envelope TDV Energy	567,847	416,351

Prescriptive Values for Comparison only. See LTG-1C for allowed LPD.

Remarks:

PERFORMANCE CERTIFICATE OF COMPLIANCE (Part 1 of 3) PERF-1C

Project Name	Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area	Date
Jacobs Hall	Berkeley	CA Climate Zone 03	21,801	n/a	8/15/2014

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ Relocatable - indicate ☐ High-Rise Residential ☐ specific climate zone ☐ Hotel/Motel Guest Room ☐ all climates

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

STATEMENT OF COMPLIANCE

This certificate of compliance lists the building features and specifications needed to comply with Title 24, Parts 1 and 6 of the California Code of Regulations. This certificate applies only to a Building using the performance compliance approach.

The documentation author hereby certifies that the documentation is accurate and complete.

Documentation Author

Name: Ryan Boughey | Signature:
Company: Pan-Pacific Mechanical | Date: 8/15/2014
Address: 17911 Mitchell South | Phone: 949-474-9170
City/State/Zip: Irvine, CA 92614

The Principal Designer hereby certifies that the proposed building design represented in this set of construction documents is consistent with the other compliance forms and worksheets, with the specifications, and with any other calculations submitted with this permit application. The proposed building has been designed to meet the energy efficiency requirements contained in sections 110, 116 through 118, and 140 through 149 of Title 24, Part 6. Please check one:

ENV. LTG. MECH.

☐ ☐ ☐ I hereby affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code to sign this document as the person responsible for its preparation; and that I am licensed in the State of California as a civil engineer, mechanical engineer, electrical engineer, or I am a licensed architect.

☐ ☐ ☐ I affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code by section 5537.2 or 6737.3 to sign this document as the person responsible for its preparation; and that I am a licensed contractor performing this work.

☐ ☐ ☐ I affirm that I am eligible under Division 3 of the Business and Professions Code to sign this document because it pertains to a structure or type of work described as exempt pursuant to Business and Professions Code Sections 5537, 5538 and 6737.1.

Principal Envelope Designer

Name: Charlie Stott | Signature:
Company: LMS Architects | Date:
Address: 677 Harrison Street | License #:
City/State/Zip: San Francisco, CA 94107 | Phone: 415-495-1700

Principal Mechanical Designer

Name: Ryan Boughey | Signature:
Company: Pan-Pacific Mechanical | Date:
Address: 17911 Mitchell South | License #:
City/State/Zip: Irvine, CA 92614 | Phone: 949-474-9170

Principal Lighting Designer

Name: | Signature:
Company: | Date:
Address: | License #:
City/State/Zip: , | Phone:

INSTRUCTIONS TO APPLICANT COMPLIANCE & WORKSHEETS (check box if worksheets are included)

☑	ENV-1C	Certificate of Compliance. Required on plans.	☑	MECH-1C	Certificate of Compliance. Required on plans.
☑	LTG-1C	Certificate of Compliance. Required on plans.	☑	MECH-2C	Air/Water Side/Service Hot Water & Pool Requirements.
☐	LTG-2C	Lighting Controls Credit Worksheet.	☑	MECH-3C	Mechanical Ventilation and Reheat.
☐	LTG-3C	Indoor Lighting Power Allowance.	☑	MECH-5C	Mechanical Equipment Details.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST (Part 3 of 3) ENV-1C

Project Name: Jacobs Hall | Date: 8/15/2014

Required Acceptance Tests

Designer:

This form is to be used by the designer and attached to the plans. Listed below is the acceptance test for Envelope Fenestrations system. The designer is required to check the acceptance tests and list all the fenestration products that require an acceptance test. If all the site-built fenestration of a certain type requires a test, list the different fenestration products and the number of systems. The NA7 Section in the Appendix of the Nonresidential Reference Appendices Manual describes the test. Since this form will be part of the plans, completion of this section will allow the responsible party to budget for the scope of work appropriately.

Enforcement Agency:

Systems Acceptance. Before Occupancy Permit is granted for a newly constructed building or space or whenever new fenestration is installed in the building or space shall be certified as meeting the Acceptance Requirements. The ENV-2A form is not considered a complete form and is not to be accepted by the enforcement agency unless the boxes are checked and/or filled and signed. In addition, a Certificate of Acceptance forms shall be submitted to the enforcement agency that certifies plans, specifications, installation certificates, and operating and maintenance information meet the requirements of §10-103(b) of Title 24 Part 6. The field inspector must receive the properly filled out and signed forms before the building can receive final occupancy. A copy of the ENV-2A for each different fenestration product line must be provided to the owner of the building for their records.

Test Description: Fenestration Products Name or ID Requiring Testing or Verification	Area of like Products	ENV-2A Building Envelope Acceptance Test	Test Performed By:
2x Pane SB70XL Clear Argon	6,716	☑	

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST (Part 2 of 3) ENV-1C

Project Name: Jacobs Hall | Date: 8/15/2014

ROOFING PRODUCT (COOL ROOFS)

(Note if the roofing product is not CRRC certified, this compliance approach cannot be used). Go to Overall Envelope Approach or Performance Approach.

CHECK APPLICABLE BOX BELOW IF EXEMPT FROM THE ROOFING PRODUCT "COOL ROOF" REQUIREMENTS:	Pass	Fail[1]	N/A
☐ Roofing compliance not required in Climate Zones 1 and16 with a Low-Sloped. 2:12 pitch or less.	☐	☐	☐
☐ Roofing compliance not required in Climate Zone 1 with a Steep-Sloped with less than 5 lb/ft². Greater than 2:12 pitch.	☐	☐	☐
☐ Low-sloped Wood framed roofs in Climate Zones 3 and 5 are exempted, solar reflectance and thermal emittance or SRI that have a U-factor of 0.039 or lower. See Opaque Surface Details roof assembly, Column H of ENV-2C.	☐	☐	☐
☐ Low-sloped Metal building roofs in Climate Zone 3 and 5 are exempted, solar relectance and thermal emittance or SRI that have a U-factor of 0.048 or lower. See Opaque Surface Details roof assembly below, Column H of ENV-2C.	☐	☐	☐
☐ The roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are exempted. Solar reflectance and thermal emittance or SRI, see spreadsheet calculator at www.energy.ca.gov/title24/	☐	☐	☐
☐ Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft² are exempt from the Cool Roof criteria below.	☐	☐	☐
☐ High-rise residential buildings and hotels and motels with low-sloped roofs in Climate Zones 1 through 9, 12 and 16 are exempted from the low-sloped roofing criteria.	☐	☐	☐

1. If Fail then describe on this page of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CRRC Product ID Number[1]	Roof Slope ≤ 2:12	Roof Slope > 2:12	Product Weight < 5lb/ft²	Product Weight ≥ 5lb/ft²	Product Type[2]	Aged Solar Reflectance[3]		Thermal Emmitance	SRI[5]	Pass	Fail[6]
	☐	☐	☐	☐		☐ 4				☐	☐
	☐	☐	☐	☐		☐ 4				☐	☐
	☐	☐	☐	☐		☐ 4				☐	☐
	☐	☐	☐	☐		☐ 4				☐	☐
	☐	☐	☐	☐		☐ 4				☐	☐
	☐	☐	☐	☐		☐ 4				☐	☐

1. The CRRC Product ID Number can be obtained from the Cool Roof Rating Council's Rated Product Directory at www.coolroofs.org/products/search.php
2. Indicate the type of product is being used for the roof top, i.e. single-ply roof, asphalt roof, metal roof, etc.
3. If the Aged Reflectance is not available in the Cool Roof Rating Council's Rated Product Directory then use the Initial Reflectance value from the same directory and use the equation $(0.2+0.7(\rho_{initial} - 0.2)$ to obtain a calculated aged value. Where **ρ** is the Initial Solar Reflectance from the Cool Roof Rating Council's Rated Product Directory.
4. Check box if the Aged Reflectance is a calculated value using the equation above.
5. The SRI value needs to be calculated from a spreadsheet calculator at http://www.energy.ca.gov/title24/
6. If Fail then describe on this page of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

To apply **Liquid Field Applied Coatings**, the coating must be applied across the entire roof surface and meet the dry mil thickness or coverage recommended by the coatings manufacturer and meet minimum performance requirements listed in §118(i)4. Select the applicable coating:

☐ Aluminum-Pigmented Asphalt Roof Coating ☐ Cement-Based Roof Coating ☐ Other ____________

Discrepancies:

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST (Part 1 of 3) ENV-1C

Project Name	Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area	Date
Jacobs Hall	Berkeley	3	21,801	n/a	8/15/2014

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ High-Rise Residential ☐ Hotel/Motel Guest Room

☐ Schools (Public School) ☐ Relocatable Public School Bldg. ☑ Conditioned Spaces ☐ Unconditioned Spaces

☐ Skylight Area for Large Enclosed Space ≥ 8000 ft² (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: 0 deg

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS / INSULATION

Tag/ID	Assembly Type	Area (ft²)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
1	Wall	0	(E)	0.079	R-21	7.0	None			4.3.3-A6	New	☐	☐
2	Roof	546	(N)	0.031	R-38					4.2.4-A9	New	☐	☐
3	Wall	172	(S)	0.079	R-21	7.0	None			4.3.3-A6	New	☐	☐
4	Wall	0	(W)	0.079	R-21	7.0	None			4.3.3-A6	New	☐	☐
5	Wall	280	(N)	0.079	R-21	7.0	None			4.3.3-A6	New	☐	☐
6	Roof	312	(N)	0.027	R-44					4.2.4-A10	New	☐	☐
7	Wall	5	(S)	0.079	R-21	7.0	None			4.3.3-A6	New	☐	☐
8	Wall	230	(S)	0.079	R-21	7.0	None			4.3.3-A6	New	☐	☐
9	Wall	42	(W)	0.079	R-21	7.0	None			4.3.3-A6	New	☐	☐
10	Roof	172	(N)	0.027	R-44					4.2.4-A10	New	☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft²)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
1	Window	1,059	(E)	0.280	NFRC	0.270	NFRC	☐	New	☐	☐
2	Window	1,952	(S)	0.280	NFRC	0.270	NFRC	☐	New	☐	☐
3	Window	1,188	(W)	0.280	NFRC	0.270	NFRC	☐	New	☐	☐
4	Window	2,151	(N)	0.280	NFRC	0.270	NFRC	☐	New	☐	☐
5	Window	366	(S)	0.280	NFRC	0.270	NFRC	☑	New	☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

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REGISTERED PROFESSIONAL ENGINEER
RYAN A. BOUGHEY
M36492
EXP. 09/30/15
MECHANICAL
STATE OF CALIFORNIA

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE :

SHEET TITLE
TITLE 24

SHEET No
M6.00

CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST (Part 4 of 4) MECH-1C

Project Name	Date
Jacobs Hall	*8/15/2014*

TEST DESCRIPTION Equipment Requiring Testing	Qty.	MECH-12A Fault Detection & Diagnostics for DX Units	MECH-13A Automatic Fault Detection & Diagnostics for Air & Zone	MECH-14A Distributed Energy Storage DX AC Systems	MECH-15A Thermal Energy Storage (TES) Systems	Test Performed By:
Greenheck MSX-118-H32	*1*	☐	☐	☐	☐	
		☐	☐	☐	☐	
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CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST (Part 3 of 4) MECH-1C

Project Name	Date
Jacobs Hall	*8/15/2014*

Required Acceptance Tests

Designer:

This form is to be used by the designer and attached to the plans. Listed below are all the acceptance tests for mechanical systems. The designer is required to check the applicable boxes by all acceptance tests that apply and listed all equipment that requires an acceptance test. If all equipment of a certain type requires a test, list the equipment description and the number of systems. The NA number designates the Section in the Appendix of the Nonresidential Reference Appendices Manual that describes the test. Since this form will be part of the plans, completion of this section will allow the responsible party to budget for the scope of work appropriately.

Building Departments:

Systems Acceptance: Before occupancy permit is granted for a newly constructed building or space, or a new space-conditioning system serving a building or space is operated for normal use, all control devices serving the building or space shall be certified as meeting the Acceptance Requirements for Code Compliance.
Systems Acceptance: Before occupancy permit is granted. All newly installed HVAC equipment must be tested using the Acceptance Requirements.

The MECH-1C form is not considered a completed form and is not to be accepted by the building department unless the correct boxes are checked. The equipment requiring testing, person performing the test (Example: HVAC installer, TAB contractor, controls contractor, PE in charge of project) and what Acceptance test must be conducted. The following checked-off forms are required for **ALL** newly installed equipment. In addition a Certificate of Acceptance forms shall be submitted to the building department that certifies plans, specifications, installation, certificates, and operating and maintenance information meet the requirements of §10-103(b) and Title-24 Part 6. The building inspector must receive the properly filled out and signed forms before the building can receive final occupancy.

TEST DESCRIPTION Equipment Requiring Testing or Verification	Qty.	MECH-2A Outdoor Ventilation For VAV & CAV	MECH-3A Constant Volume & Single-Zone Unitary	MECH-4A Air Distribution Ducts	MECH-5A Economizer Controls	MECH-6A Demand Control Ventilation DCV	MECH-7A Supply Fan VAV	MECH-8A Valve Leakage Test	MECH-9A Supply Water Temp. Reset	MECH-10A Hydronic System Variable Flow Control	MECH-11A Automatic Demand Shed Control
Greenheck MSX-118-H32	*1*	☐	☐	☐	☑	☑	☑	☐	☐	☐	☑
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CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST (Part 1 of 4) MECH-1C

Project Name			Date
Jacobs Hall			*8/15/2014*
Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area
Berkeley	*3*	*21,801*	*n/a*

GENERAL INFORMATION

Building Type:	☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/Motel Guest Room
☐ Schools (Public School)	☐ Relocatable Public School Bldg.	☑ Conditioned Spaces	☐ Unconditioned Spaces (affidavit)
Phase of Construction:	☑ New Construction	☐ Addition	☐ Alteration
Approach of Compliance:	☐ Component	☐ Overall Envelope TDV Energy	☐ Unconditioned (file affidavit)
Front Orientation: N, E, S, W or in Degrees:	*0 deg*		

HVAC SYSTEM DETAILS

Equipment[2]	Inspection Criteria	FIELD INSPECTION ENERGY CHECKLIST Meets Criteria or Requirements Pass	Fail – Describe Reason[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*DHW Heater*	☐	☐
Equipment Type[3]:	*Electric Res DHW Boiler*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*15,359 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*1.00 EF*	☐	☐
Max Allowed Cooling Capacity[1]	*n/a*	☐	☐
Cooling Efficiency[1]	*n/a*	☐	☐
Duct Location/ R-Value	*n/a*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*n/a*	☐	☐
Economizer	*n/a*	☐	☐
Thermostat	*n/a*	☐	☐
Fan Control	*n/a*	☐	☐

Equipment[2]	Inspection Criteria	FIELD INSPECTION ENERGY CHECKLIST Pass	Fail – Describe Reason[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*AHU-1*	☐	☐
Equipment Type[3]:	*Built-Up VAV*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*0 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*n/a*	☐	☐
Max Allowed Cooling Capacity[1]	*198,400 Btu/hr*	☐	☐
Cooling Efficiency[1]	*n/a*	☐	☐
Duct Location/ R-Value	*Conditioned / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*Diff. Temp (Integrated)*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Variable Speed*	☐	☐

1. If the Actual installed equipment performance efficiency and capacity is less than the Proposed (from the energy compliance submittal or from the building plans) the responsible party shall resubmit energy compliance to include the new changes.
2. For additional detailed discrepancy use Page 2 of the Inspection Checklist Form. Compliance fails if a Fail box is checked.
3. Indicate Equipment Type: Gas (Pkg or, Split), VAV, HP (Pkg or split), Hydronic, PTAC, or other.

ARCHITECTS

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE :

SHEET TITLE
TITLE 24

SHEET No
M6.01

MECHANICAL EQUIPMENT DETAILS (Part 2 of 2) MECH-5C

Project Name: *Jacobs Hall* — Date: *8/15/2014*

ZONE SYSTEM SUMMARY

		SYSTEM				VAV		Fan				
Zone Name	System Name	Type	Qty.	Heating	Cooling	Min CFM Ratio	Reheat Coil	CFM	BHP	Fan Cycles	ECM Motor	Outside Air
VAV 3-1 & VAV3-2	VAV Box/Reheat	VAV Box	2	0		10 %	Hot Water			☐	☐	
VAV 2-1 & VAV2-2	VAV Box/Reheat	VAV Box	2	0		10 %	Hot Water			☐	☐	
VAV 1-1 & VAV1-2	VAV Box/Reheat	VAV Box	2	0		10 %	Hot Water			☐	☐	
										☐	☐	
										☐	☐	
										☐	☐	
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EXHAUST FAN SUMMARY

EXHAUST FAN				EXHAUST FAN				EXHAUST FAN			
Room Name	Qty.	CFM	BHP	Room Name	Qty.	CFM	BHP	Room Name	Qty.	CFM	BHP

MECHANICAL EQUIPMENT DETAILS (Part 1 of 2) MECH-5C

Project Name: *Jacobs Hall* — Date: *8/15/2014*

CHILLER AND TOWER SUMMARY

					PUMPS			
Equipment Name	Type	Qty.	Efficiency	Tons	Qty.	GPM	BHP	Pump Control

DHW / BOILER SUMMARY

System Name	Type	Distribution	Qty.	Rated Input	Vol. (Gals).	Energy Factor or RE	Standby Loss or Pilot	Tank Ext. R-Value	Status
Tankless Electric	Instant Elec	Kitchen Pipe Ins	1	15,359	0	1.00	n/a	n/a	New

MULTI-FAMILY CENTRAL WATER HEATING DETAILS

	Hot Water Pump			Hot Water Piping Length (ft)			
Control	Qty.	HP	Type	In Plenum	Outside	Buried	Add ½" Insulation
							☐
							☐
							☐

CENTRAL SYSTEM RATINGS

			HEATING			COOLING		
System Name	Type	Qty.	Output	Aux. kW	Efficiency	Output	Efficiency	Status
Greenheck MSX-118-H32	Built-Up VAV	1		0.0	n/a	198,400	n/a	New

CENTRAL SYSTEM FAN SUMMARY

			SUPPLY FAN		RETURN FAN	
System Name	Fan Type	Economizer Type	CFM	BHP	CFM	BHP
Greenheck MSX-118-H32	Variable Speed	Diff. Temp (Integrated)	8,500	7.50	none	

MECHANICAL VENTILATION AND REHEAT MECH-3C

Project Name: *Jacobs Hall* — Date: *8/15/2014*

MECHANICAL VENTILATION (§121(b)2)									REHEAT LIMITATION (§144(d))				
	AREA BASIS			OCCUPANCY BASIS					VAV MINIMUM				
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone/System	Condition Area (ft²)	CFM per ft²	Min CFM By Area B X C	Number Of People	CFM per Person	Min CFM by Occupant E X F	REQ'D V.A. Max of D or G	Design Ventilation Air CFM	50% of Design Zone Supply CFM	B X 0.4 CFM / ft²	Max. of Columns H, J, K, 300 CFM	Design Minimum Air Setpoint	Transfer Air
VAV 3-1 & VAV3-2	5,613	0.15	842	138.7	15.0	2,081	2,081	2,081					
VAV 2-1 & VAV2-2	6,197	0.15	930	183.6	8.8	1,616	1,616	1,616					
VAV 1-1 & VAV1-2	6,248	0.15	937	185.8	8.7	1,618	1,618	1,618					
VAV B-1 & B-2	3,743	0.15	561	125.0	8.0	1,001	1,001	1,001					
AHU-1						Total	6,316	6,316					
			Totals						Column I Total Design Ventilation Air				

C	Minimum ventilation rate per Section §121, Table 121-A.
E	Based on fixed seat or the greater of the expected number of occupants and 50% of the CBC occupant load for egress purposes for spaces without fixed seating.
H	Required Ventilation Air (REQ'D V.A.) is the larger of the ventilation rates calculated on an AREA BASIS or OCCUPANCY BASIS (Column D or G).
I	Must be greater than or equal to H, or use Transfer Air (column N) to make up the difference.
J	Design fan supply CFM (Fan CFM) x 50%; or the design zone outdoor airflow rate per §121.
K	Condition area (ft²) x 0.4 CFM / ft²; or
L	Maximum of Columns H, J, K, or 300 CFM
M	This must be less than or equal to Column L and greater than or equal to the sum of Columns H plus N.
N	Transfer Air must be provided where the Required Ventilation Air (Column H) is greater than the Design Minimum Air (Column M). Where required, transfer air must be greater than or equal to the difference between the Required Ventilation Air (Column H) and the Design Minimum Air (Column M), Column H minus M.

MECHANICAL MANDATORY MEASURES: NONRESIDENTIAL MECH-MM

Project Name: *Jacobs Hall* — Date: *8/15/2014*

Equipment and System Efficiencies

§111:	Any appliance for which there is a California standard established in the Appliance Efficiency Regulations will comply with the applicable standard.
§115(a):	Fan type central furnaces shall not have a pilot light.
§123:	Piping, except that conveying fluids at temperatures between 60 and 105 degrees Fahrenheit, or within HVAC equipment, shall be insulated in accordance with Standards Section 123.
§124:	Air handling duct systems shall be installed and insulated in compliance with Sections 601, 602, 603, 604, and 605 of the CMC Standards.

Controls

§122(e):	Each space conditioning system shall be installed with one of the following:
1A.	Each space conditioning system serving building types such as offices and manufacturing facilities (and all others not explicitly exempt from the requirements of Section 112 (d)) shall be installed with an automatic time switch with an accessible manual override that allows operation of the system during off-hours for up to 4 hours. The time switch shall be capable of programming different schedules for weekdays and weekends and have program backup capabilities that prevent the loss of the device's program and time setting for at least 10 hours if power is interrupted; or
1B.	An occupancy sensor to control the operating period of the system; or
1C.	A 4-hour timer that can be manually operated to control the operating period of the system.
2.	Each space conditioning system shall be installed with controls that temporarily restart and temporarily operate the system as required to maintain a setback heating and/or a setup cooling thermostat setpoint.
§122(g):	Each space conditioning system serving multiple zones with a combined conditioned floor area more than 25,000 square feet shall be provided with isolation zones. Each zone: shall not exceed 25,000 square feet; shall be provided with isolation devices, such as valves or dampers that allow the supply of heating or cooling to be setback or shut off independently of other isolation areas; and shall be controlled by a time control device as described above.
§122(c):	Thermostats shall have numeric setpoints in degrees Fahrenheit (F) and adjustable setpoint stops accessible only to authorized personnel.
§122(b):	Heat pumps shall be installed with controls to prevent electric resistance supplementary heater operation when the heating load can be met by the heat pump alone
§122(a&b):	Each space conditioning system shall be controlled by an individual thermostat that responds to temperature within the zone. Where used to control heating, the control shall be adjustable down to 55 degrees F or lower. For cooling, the control shall be adjustable up to 85 degrees F or higher. Where used for both heating and cooling, the control shall be capable of providing a deadband of at least 5 degrees F within which the supply of heating and cooling is shut off or reduced to a minimum.

Ventilation

§121(e):	Controls shall be provided to allow outside air dampers or devices to be operated at the ventilation rates as specified on these plans.
§122(f):	All gravity ventilating systems shall be provided with automatic or readily accessible manually operated dampers in all openings to the outside, except for combustion air openings.
§121(f):	Ventilation System Acceptance. Before an occupancy permit is granted for a newly constructed building or space, or a new ventilating system serving a building or space is operated for normal use, all ventilation systems serving the building or space shall be certified as meeting the Acceptance Requirements for Code Compliance

Service Water Heating Systems

§113(c)	Installation
3.	Temperature controls for public lavatories. The controls shall limit the outlet Temperature to 110°F.
2.	Circulating service water-heating systems shall have a control capable of automatically turning off the circulating pump when hot water is not required.

ENVELOPE MANDATORY MEASURES: NONRESIDENTIAL ENV-MM

Project Name: *Jacobs Hall* — Date: *8/15/2014*

DESCRIPTION

Building Envelope Measures:

§118(a):	Installed insulating material shall have been certified by the manufacturer to comply with the California Quality Standards for insulating material, Title 20 Chapter 4, Article 3.
§118(c):	All Insulating Materials shall be installed in compliance with the flame spread rating and smoke density requirements of Sections 2602 and 707 of Title 24, Part 2.
§118(f):	The opaque portions of framed demising walls in nonresidential buildings shall have insulation with an installed R-value of no less than R-13 between framing members.
§117(a):	All Exterior Joints and openings in the building that are observable sources of air leakage shall be caulked, gasketed, weatherstripped or otherwise sealed.
§116(a) 1:	Manufactured fenestration products and exterior doors shall have air infiltration rates not exceeding 0.3 cfm/ft.² of window area, 0.3 cfm/ft.² of door area for residential doors, 0.3 cfm/ft.² of door area for nonresidential single doors (swinging and sliding), and 1.0 cfm/ft.² for nonresidential double doors (swinging).
§116(a) 2:	Fenestration U-factor shall be rated in accordance with NFRC 100, or the applicable default U-factor.
§116(a) 3:	Fenestration SHGC shall be rated in accordance with NFRC 200, or NFRC 100 for site-built fenestration, or the applicable default SHGC.
§116(b):	Site Constructed Doors, Windows and Skylights shall be caulked between the unit and the building, and shall be weatherstripped (except for unframed glass doors and fire doors).

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE :

SHEET TITLE
TITLE 24

SHEET No
M6.02

GENERAL NOTES

1. PROVIDE PLUMBING SYSTEM FOR AFFECTED BUILDING AREAS.
2. ROUGH-INS, EXTEND ALL PIPING (WASTE, VENT, COLD WATER, HOT WATER, ETC.) TO ALL FIXTURES INDICATED ON THE ARCHITECTURAL DRAWINGS.
3. ALL FIXTURE ROUGH-INS, HEIGHTS, ELEVATIONS AND LOCATIONS PER ARCHITECTURAL DRAWINGS.
4. MOUNT ALL PLUMBING FIXTURES FOR DISABLED PERSONS AT REQUIRED HEIGHTS AND WITH ALL RELATED ACCESSORIES AS REQUIRED BY THE CALIFORNIA OFFICE OF THE STATE ARCHITECT AND AMERICANS WITH DISABILITIES ACT (ADA), ALL FIXTURE TRAPS, PIPING AND VALVES UNDER THE FIXTURE SHALL BE INSULATED WITH A FACTORY PERFORMED INSTALLATION.
5. CHROME PLATED ANGLE STOPS ON ALL PLUMBING FIXTURES AND ISOLATION VALVES ON ALL EQUIPMENT.
6. SECURE ALL ESCUTCHEONS TIGHT TO WALL, OR STUD.
7. ALL SHUT-OFF VALVES, WATER HAMMER ARRESTORS AND TRAP PRIMERS SHALL BE ACCESSIBLE.
8. WATER HAMMER ARRESTORS WITH ACCESS PANELS WILL BE PROVIDED AT ALL QUICK CLOSING VALVES.
9. ALL FAUCETS, AND SUPPLIES TO HAVE FIELD SERVICEABLE AND REPAIRABLE COMPRESSION CARTRIDGE.
10. ALL URINALS, SINKS AND LAVATORIES TO HAVE WALL CLEANOUTS.
11. ALL CLEANOUTS SHALL BE ACCESSIBLE.
12. A MINIMUM 1/2" CLEARANCE SHALL BE PROVIDED AROUND PIPES AT ALL PENETRATIONS THROUGH WALLS AND ROOF. THE GAP SHALL BE PACKED TIGHTLY WITH LOOSE, LIGHTWEIGHT INSULATION THROUGH NON-RATED WALLS, AND APPROVED U.L. LISTED FIRE RATED MATERIAL RATED WALLS TO MATCH WALL RATING.
13. INSULATE ALL HOT WATER, HOT WATER RETURN PIPING, FITTINGS, VALVES, STRAINERS, ETC., BY EITHER PREFABRICATION OR BY FABRICATING FITTINGS FROM METERED SEGMENTS OF PIPE INSULATION TO AN EQUAL THICKNESS OF ADJOINING PIPE INSULATION.
14. ALL WATER FAUCETS SHOWER HEADS SHALL BE PROVIDED WITH CODE APPROVED LOW-FLOW RESTRICTORS. LAVATORY FAUCETS AT 0.35 GPM AND SINK FAUCETS AT 1.0 GPM (NOT INCLUDING SERVICE SINK FAUCETS) SHALL MEET THE FLOW REQUIREMENTS OUTLINED WITH THE LATEST CAL-GREEN REQUIREMENTS.
15. POTABLE WATER SYSTEMS SHALL BE DISINFECTED PRIOR TO USE IN ACCORDANCE WITH THE METHOD SET FORTH IN THE LATEST EDITION OF THE CALIFORNIA PLUMBING CODE OR AS REQUIRED BY UC BERKELEY EH&S DEPARTMENT, WHICHEVER IS MORE RESTRICTIVE.
16. ALL SOIL AND WASTE PIPING TO BE SLOPED 2% UNLESS OTHERWISE NOTED.
17. ROUGH-INS, CONNECTIONS AND TERMINATION OF PLUMBING WORK SHALL BE SEQUENCED IN COORDINATION WITH THE PROJECT SCHEDULE AND THE OWNERS OTHER CONTRACTORS AND VENDORS.
18. DURING CONSTRUCTION, PROVIDE MECHANICAL PLUGS IN OPEN DRAINS TO PREVENT DAMAGE.
19. ALL DOMESTIC WATER PIPING THAT COME IN CONTACT WITH HUMANS SHALL BE LEAD-FREE.
20. TEMPERATURE MIXING VALVE AT POINT OF SERVICE SHALL BE PROVIDED PER ASSE 1070.
21. PLUMBING FIXTURES SHALL MEET THE MAXIMUM FLOW RATE VALUES SHOWN IN TABLE 5.303.2.3 OF CALIFORNIA CODE OF REGULATIONS TITLE 24, PART 11, THE CALIFORNIA GREEN BUILDING STANDARDS.
22. THE EFFECTIVE FLUSH VOLUME OF ALL WATER CLOSETS SHALL NOT EXCEED 1.28 GALLONS PER FLUSH. WATER CLOSETS SHALL BE CERTIFIED TO THE PERFORMANCE CRITERIA OF THE U.S. EPA WATER SENSE SPECIFICATION TO MEET THE MAXIMUM PERFORMANCE TEST SCORE OF 1,000.
23. THE EFFECTIVE FLUSH VOLUME OF URINALS SHALL NOT EXCEED 0.125 GALLONS PER FLUSH.
24. EACH BUILDING SHALL REDUCE BY 20 PERCENT WASTEWATER BY ONE OF THE FOLLOWING METHODS:
    A. THE INSTALLATION OF WATER-CONSERVING FIXTURES (WATER CLOSETS, URINALS) MEETING THE CRITERIA ESTABLISHED IN SECTION 5.303.2 OR 5.303.3 OF CALIFORNIA CODE OF REGULATIONS TITLE 24, PART 11. THE CALIFORNIA GREEN BUILDING STANDARDS.

    B. UTILIZING NON-POTABLE WATER SYSTEMS [CAPTURED RAINWATER, GRAYWATER, AND MUNICIPALLY TREATED WASTEWATER (RECYCLED WATER) COMPLYING WITH THE CURRENT EDITION OF THE CALIFORNIA PLUMBING CODE OR OTHER METHODS DESCRIBED IN SECTION A5.304.8 OF CALIFORNIA CODE OF REGULATIONS TITLE 24, PART 11, THE CALIFORNIA GREEN BUILDING STANDARDS.

    C. PLUMBING FIXTURES AND FITTINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE CALIFORNIA PLUMBING CODE, AND SHALL MEET THE APPLICABLE STANDARDS REFERENCED IN TABLE 1401.1 OF THE CALIFORNIA PLUMBING CODE IN CHAPTER 6 OF THIS CODE.

ABBREVIATIONS

ABV	ABOVE
AD	ACCESS DOOR
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AP	ACCESS PANEL
ARCH	ARCHITECT
ASR	AUTO FIRE SPRINKLER RISER
BFV	BUTTERFLY VALVE
BHP	BRAKE HORSEPOWER
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
BWV	BACKWATER VALVE
CA	COMPRESSED AIR
CD	CONDENSATE DRAIN
CFF	CAP FOR FUTURE
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CI	CAST IRON
CLG	CEILING
CO	CLEANOUT
CONC	CONCRETE
CV	CHECK VALVE
CW	COLD WATER
CWFU	COLD WATER FIXTURE UNIT
DN	DOWN
DCVA	DOUBLE CHECK VALVE ASSEMBLY
DDCVA	DOUBLE DETECTOR CHECK VALVE ASSEMBLY
DFU	DRAINAGE FIXTURE UNIT
HWR	HOT WATER RECIRC
DIA	DIAMETER
DSN	DOWNSPOUT NOZZLE
D	DRAIN
DWG	DRAWING
DWV	DRAINAGE WASTE AND VENT
E	EXISTING
ELEC	ELECTRICAL
FA	FLOW ALARM
FC	FLEXIBLE CONNECTION
FCO	FLOOR CLEANOUT
FDV	FIRE DEPARTMENT VALVE
FDVC	FIRE DEPARTMENT VALVE CABINET
FFE	FINISHED FLOOR ELEVATION
FH	FIRE HYDRANT
FHV	FIRE HOSE VALVE
FIN	FINISHED
FO	FUEL OIL
FPS	FEET PER SECOND
FRM	FROM
FT	FEET
FT	FLUSH TANK
FU	FIXTURE UNIT
FV	FLUSH VALVE
G	GAS
GAL	GALLONS
GC	GAS COCK
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GV	GATE VALVE
HD	HUB DRAIN
HP	HORSEPOWER
HW	HOT WATER
HWFU	HOT WATER FIXTURE UNIT
IAPMO	INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS
ICBO	INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS
IE	INVERT ELEVATION
IRR	IRRIGATION
LAV	LAVATORY
LBS	POUNDS (UNIT OF FORCE)
LP	LUBRICATED PLUG VALVE
MAX	MAXIMUM
MBH	THOUSANDS BTU/HR
MECH	MECHANICAL
MFR	MANUFACTURER
MIN	MINIMUM
MH	MANHOLE
NC	NORMALLY CLOSED
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NO	NORMALLY OPEN OR NUMBER
NIC	NOT IN CONTRACT
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OW	OIL WASTE
POC	POINT OF CONNECTION
POD	POINT OF DISCONNECTION
PRV	PRESSURE REDUCING VALVE
PS	PRESSURE SWITCH
PSI	POUNDS PER SQUARE INCH
RI&C	ROUGH IN AND CONNECT
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER
RPM	REVOLUTIONS PER MINUTE
RV	RELIEF VALVE
SD	STORM DRAIN
SF	SQUARE FEET
(#)	SHEET NOTE
SOV	SHUT-OFF VALVE
SPR	SPRINKLER
SS	STAINLESS STEEL
TP	TRAP PRIMER
TS	TAMPER SWITCH
TT	TEST TEE
TYP	TYPICAL
U	URINAL
UN	UNION
VB	VACUUM BREAKER
V	VENT
VTR	VENT THROUGH ROOF
W	WASTE
WC	WATER CLOSET
WHA	WATER HAMMER ARRESTOR
WCO	WALL CLEANOUT
W/	WITH
YB	YARD BOX

PLUMBING LEGEND

DOMESTIC PIPING

SYMBOL	DESCRIPTION
	TRAP PRIMER
	BALL VALVE
	BUTTERFLY VALVE
	GATE VALVE
	BALANCING VALVE
	SHUT OFF VALVE IN CONCRETE YARD BOX
	ANGLE GATE VALVE
	SOLENOID VALVE
	CHECK VALVE
	PRESSURE REDUCING VALVE
	RELIEF VALVE
	VACUUM RELIEF VALVE
	PRESSURE & TEMPERATURE RELIEF VALVE
	AUTOMATIC AIR VENT
	CIRCUIT SETTER
	BACKWATER VALVE
RPBFP	REDUCED PRESSURE BACKFLOW PREVENTER
	UNION
	STRAINER
	STRAINER WITH BLOW OFF HOSE BIBB
	PIPE ANCHOR
	PIPE ALIGNMENT GUIDE
	EXPANSION JOINT
	FLEXIBLE CONNECTOR
	CAP OR PLUG
	BLIND FLANGE
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	AQUASTAT
WHA	WATER HAMMER ARRESTOR
PG	PRESSURE GAUGE WITH COCK
T	THERMOMETER
CO/WCO	CLEANOUT/WALL CLEANOUT
FCO	FLOOR CLEANOUT
YCO	YARD CLEANOUT
TT	TEST TEE
WH	WALL HYDRANT
HB	HOSE BIBB
YH	YARD HYDRANT
	THRUST BLOCK
FD	FLOOR DRAIN
FS	FLOOR SINK W/ GRATE AS SHOWN
	HUB DRAIN
	ROOF RECEPTOR
	ROOF DRAIN
	OVERFLOW DRAIN
	DECK DRAIN, PLANTER DRAIN

DOMESTIC PIPING

SYMBOL	DESCRIPTION
	DIRECTION OF FLOW
1% SLOPE	DIRECTION OF SLOPE
	PIPE UP OR UP & DN
	PIPE DOWN
	PIPE DROP
	TOP CONNECTION – BRANCH LINE
	BOTTOM CONNECTION – BRANCH LINE
	COLD WATER
	HOT WATER (120°F)
	HOT WATER CIRC (110°F)
	HOT WATER (140°F)
122	HOT WATER CIRC (122°F)
SAN	SANITARY SEWER, WASTE OR SOIL BELOW GRADE OR FLOOR
SD	STORM DRAIN
	PIPING BELOW GRADE
	WASTE, OR SOIL ABOVE GRADE OR FLOOR
	VENT
RD	ROOF DRAIN PIPING, THE PIPES FROM ROOF DRAIN SD (STORM DRAIN)
OD	OVERFLOW DRAIN PIPING
PD	PUMPED DISCHARGE
D	DRAIN LINE
IW	INDIRECT WASTE
GW	GREASE WASTE
G	NATURAL GAS (7"W.C.)
MG	MEDIUM PRESSURE NATURAL GAS (2 PSIG TO 5 PSIG)
LG	LOW PRESSURE NATURAL GAS
CA	COMPRESSED AIR
(E)	EXISTING PIPE
TW	TEMPERED WATER
TWR	TEMPERED WATER RETURN
6	PIPE SIZE (DIAMETER IN INCHES)
(E)	EXISTING WORK TO REMAIN
	EXISTING WORK TO BE REMOVED
(RL)	RELOCATE EXISTING
	CENTER LINE
	POINT OF CONNECTION OR POINT OF DISCONNECTION
W	WASTE STACK
V	VENT STACKS
CW	COLD WATER RISER
HW	HOT WATER RISER
HWR	HOT WATER RECIRC. RISER
G	GAS RISER
RD	ROOF DRAIN RISER
OD	OVERFLOW DRAIN RISER
CA	COMPRESSED AIR RISER
	PLUMBING EQUIPMENT
	MISCELLANEOUS EQUIPMENT
#	SHEET NOTE
1 / P2	DETAIL NO. / SHEET NO.
#	POUNDS OR NUMBER

PLUMBING DRAWING LIST

SHEET	DESCRIPTION
P0.0	PLUMBING LEAD SHEET (LEGENDS, SYMBOLS & ABBREVIATIONS)
P0.1	PLUMBING SCHEDULES
P2.0	BASEMENT PLUMBING PLAN
P2.1	1ST STORY PLUMBING PLAN
P2.2	2ND STORY PLUMBING PLAN
P2.3	3RD STORY PLUMBING PLAN
P2.4	LOW ROOF PLUMBING PLAN
P2.5	HIGH ROOF PLUMBING PLAN
P3.1	ENLARGED PLUMBING PLANS
P4.1	DOMESTIC WATER AND COMPRESSED AIR RISER DIAGRAMS
P4.2	SANITARY WASTE / VENT AND STORM DRAINAGE STACK DIAGRAMS
P5.1	PLUMBING DETAILS

PLUMBING BASIS OF DESIGN

1. DRAWING INTENT:
   "THE INTENT OF THE CONSTRUCTION DOCUMENT IS TO CONSTRUCT JACOBS HALL AS PART OF UNIVERSITY OF CALIFORNIA IN BERKELEY IN ACCORDANCE WITH LATEST REQUIREMENTS OF CALIFORNIA CODE OF REGULATIONS."
2. ALL WORK SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF TITLE 24. CALIFORNIA CODE OF REGULATIONS AND ALL APPLICABLE PARTS OF THE LATEST EFFECTIVE EDITIONS.
3. CONSTRUCTION SHALL CONFORM TO ALL GOVERNMENTAL AGENCIES AND CODES HAVING JURISDICTION INCLUDING BUT NOT LIMITED TO:

   2010 CALIFORNIA BUILDING CODE (CBC) PART 2, TITLE 24, CCR
   2010 CALIFORNIA MECHANICAL CODE (CMC) PART 4, TITLE 24, (CCR)
   2010 CALIFORNIA PLUMBING CODE (CPC) PART 5, TITLE 24, (CCR)
   2010 CALIFORNIA ENERGY CODE (CEC) PART 6, TITLE 24, (CCR)
   2010 CALIFORNIA GREEN BUILDING CODE (CGBC) PART 11, TITLE 24 (CCR)

4. ALL SEISMIC SUPPORTS SHALL BE DESIGNED BY A LICENSED PROFESSIONAL ENGINEER.
5. ALL PIPING AND SPECIALTIES SHALL BE MANUFACTURED IN THE UNITED STATES.

CONSTRUCTION NOTES

ALL MATERIAL, PIPING AND FITTINGS CONNECTED TO THE DOMESTIC WATER PIPING SHALL BE COMPLIANT WITH LEAD-FREE MANDATE.

POINT-OF-USE THERMOSTATIC MIXING VALVE SHALL BE PROVIDED AT EVERY PUBLIC LAVATORY PER ASSE 1070.

INSULATE ALL EXPOSED HOT WATER AND HOT WATER RETURN PIPING.

INSULATE ALL HOT WATER PIPING.

ACCESSIBLE (ADA-COMPLIANT) FIXTURES SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST ACCESSIBILITY REQUIREMENTS; REFER TO ARCHITECTURAL PLANS FOR DETAILS.

PROVIDE DRAIN PAN UNDER DRAINAGE PIPING ABOVE FOOD PREPARATION AREAS (TYP)

WHERE STRUCTURAL SEISMIC JOINT OCCURS, PIPING SHALL BE PROVIDED WITH SEISMIC JOINTS OR SEISMIC LOOP CONNECTIONS. REFER TO STRUCTURAL DRAWINGS FOR MAINTENANCE CLEARANCE AROUND ALL FLEXIBLE LOOPS.

ALL TERRACE DRAINS TO CONNECT/ROUTE TO EXISTING DRAINS IN LEVEL 2 ETCHEVERRY.

NEW TRENCH DRAIN AT WEST SIDE TO ROUTE TO CURB DRAIN; EXISTING TRENCH DRAIN TO REMAIN.

RAINFALL RATE = 2.0" PER HOUR (FROM CITY OF BERKELEY)

WATER PRESSURE = 76 / 72 PSI (90 PSI HIGH PER FINDINGS AS RECORDED BY UCB. REDUCE PRESSURE TO MEET CPC REQUIREMENTS).

NOT ALL SYMBOLS OR ABBREVIATIONS ARE NECESSARILY USED ON THIS PROJECT.

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No.	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : N.T.S.

SHEET TITLE
PLUMBING LEAD SHEET

SHEET No.
P0.0

PLUMBING FIXTURE UNIT TABLE

ITEM	QTY	WASTE F.U. EACH	WASTE F.U. TOTAL	WATER F.U. EACH	WATER F.U. TOTAL
WATER CLOSET	13	4 FU	52	5 FU	65
URINAL	5	2 FU	10	2 FU	10
LAVATORY	12	1 FU	12	1 FU	12
SINK	11	2 FU	22	2 FU	22
MOP SINK	3	3 FU	9	3 FU	9
DRINKING FOUNTAIN	3	1 FU	3	1 FU	3
FLOOR DRAIN	11	1 FU	11	0.5	5.5
FLOOR SINK	3	2 FU	6	0.5	1.5
HOSE BIBB	5	0 FU	0	2.5 + 1	6.5
TOTAL			125 DFU / 0.1693 CFS		134.5 FU / 76 GPM

WATER SIZING CHART

TOTAL CW FIXTURE UNITS	114.5	FU
EQUIVALENT FLOW	72	GPM
ADDITIONAL FLOW	–	
TOTAL FLOW DEMAND	72	GPM
MIN. WATER PRESSURE	HIGH: 76, LOW: 72 — 72	PSI
MAX. DISTANCE	250	FT
PRESSURE LOSS THRU – METER	–	PSI
PRESSURE LOSS THRU – BFP	–	PSI
HEAD LOSS (76 X 0.434)	33	PSI
RESIDUAL PRESSURE	25	PSI
PRESSURE AVAILABLE AFTER LOSSES	14	PSI
ALLOWABLE DROP PER 100FT.	2.5 / ~3	PSI

SIZING CHARTS

DOMESTIC WATER SIZING

CPC

WATER PRESSURE:
76 PSI HIGH / 72 PSI LOW

TOTAL DEVELOPED LENGTH:
250 FT; 2.5 PSI LOSS PER 100 FT AT 6 FPS MAX

PIPE SIZE:	FIXTURE UNITS FT	FIXTURE UNITS FV	GPM	VELOCITY (FPS)
1/2"	1	–	2	3
3/4"	6	–	5	4
1"	15	–	11	4
1-1/4"	26	–	18	5
1-1/2"	49	11	28	6
2"	165	69	58	6
2-1/2"	294	168	84	6
3"	585	490	140	6
4"	1091	1091	220	6

STORM DRAINAGE SIZING

CPC TABLE 11-2

LOCATION: BERKELEY, CA
RAINFALL RATE: 2" PER HOUR

PIPE SIZE:	1% SLOPE GPM	1% SLOPE SF	2% SLOPE GPM	2% SLOPE SF
3"	34	1644	48	2320
4"	78	3760	110	5300
5"	139	6680	196	9440
6"	222	10700	314	15100
8"	478	23000	677	32600
10"	860	41400	1214	58400
12"	1384	66600	1953	94000
15"	2473	119000	3491	168000

PLUMBING FIXTURES SCHEDULE

ITEM	DESCRIPTION	TRAP ARM	WASTE	VENT	CW	HW	AIR	REMARKS
WC-1	WATER CLOSET	INT	4"	2"	1"	---	---	WALL MOUNTED KOHLER KINGSTON #K4325 1.28 GPF WITH BATTERY-POWERED SENSOR FLUSH VALVE KOHLER #K-10956 AND K-4372 TOILET SEAT
WC-2	WATER CLOSET (ACCESSIBLE)	INT	4"	2"	1"	---	---	SAME AS WC-1 EXCEPT MOUNTED AT ACCESSIBLE HEIGHT; REFER TO ARCHITECTURAL PLANS FOR MOUNTING HEIGHT.
UR-1	URINAL	2"	2"	1½"	¾"	---	---	WALL MOUNTED KOHLER BARDON #K4904-ET 0.125 GPF WITH BATTERY-POWERED SENSOR FLUSH VALVE KOHLER #K-10949
UR-2	URINAL (ACCESSIBLE)	2"	2"	1½"	¾"	---	---	SAME AS UR-1 EXCEPT MOUNTED AT ACCESSIBLE HEIGHT; REFER TO ARCHITECTURAL PLANS FOR MOUNTING HEIGHT.
L-1	LAVATORY (ACCESSIBLE)	1¼"	1½"	1¼"	½"	½"	---	BRADLEY #LVRD2 STAINLESS STEEL ELONGATED BASIN WITH 30" SPACING FOR TWO USERS WITH EVERO GEO SERIES CONSTRUCTION VANDAL-PROOF WITH P-TRAP COMPLETE #S-53-327 BATTERY POWERED SENSOR-FAUCET WITH #S45-2760 TMV PRE PACK WITH FLEX HOSES AND STOPS
S-1	SINK (ACCESSIBLE)	1½"	2"	1½"	½"	½"	---	ELKAY #LRAD0252 1 SINGLE COMPARTMENT WITH CENTERED DRAIN HOLES WITH CHICAGO FAUCET #895-317E35XKABCP DECM MOUNTED 4" FIXED CENTERS AT 1.5 GPM
S-2	SINK (ACCESSIBLE)	1½"	2"	1½"	½"	½"	---	ELKAY #LK-50-3483 WNSF-81242 MOD WITHOUT CROSS BRACING SINGLE COMPARTMENT WITH CHICAGO FAUCET #540-LD317WXFABCP COMPLETE WITH DRAIN; 6-1/2" SINK DEPTH 6-1/2" AT 34" MOUNTING HEIGHT AND 30" KNEE CLEARANCE BELOW.
S-3	SINK	1½"	2"	1½"	½"	½"	---	ELKAY #SS8130L SINGLE COMPARTMENT WITH NO BOARD; WITH CHICAGO FAUCET #540-LDL15E1WXFABCP COMPLETE WITH DRAIN; 8" HIGH BACK SPLASH AND SINK DEPTH AT 14"
MS-1	MOP SINK	3"	3"	1½"	½"	½"	---	FLOOR MOUNTED FLORESTONE #83 WITH STAINLESS STEEL CAPS TERRAZZO SURFACE GROUND POLISHED 6" HEIGHT CHICAGO #897 PAILHOOK FAUCET COMPLETE WITH FIVE FOOT HOSE
DF-1	DRINKING FOUNTAIN	1¼"	1½"	1¼"	½"	---	---	ELKAY #EZH20 HIGH/LOW COMPRESSOR-FREE DRINKING FOUNTAIN COMPLETE WITH BOTTLE FILLER AND MOUNTING PLATE
HB-1	HOSE BIBB	---	---	---	¾"	---	---	ACORN #8121 MOUNTED BELOW LAVATORY COUNTER WITH VANDAL PROOF LOCK SHIELD BONNET FURNISHED WITH REMOVABLE HANDLE COMPLETE WITH ATMOSPHERIC TYPE VACUUM BREAKER POLISHED CHROME FINISH
HB-2	HOSE BIBB	---	---	---	¾"	---	---	ACORN #8104 WALL-MOUNTED AT EXTERIOR WITH FRAME AND DOOR; VANDAL PROOF LOCK SHIELD BONNET FURNISHED WITH REMOVABLE HANDLE COMPLETE WITH ATMOSPHERIC TYPE VACUUM BREAKER
HB-3	HOSE BIBB	---	---	---	¾"	---	---	ACORN #8136 ROOF-MOUNTED FOR MAINTENANCE; VANDAL PROOF LOCK SHIELD BONNET FURNISHED WITH REMOVABLE HANDLE COMPLETE WITH ATMOSPHERIC TYPE VACUUM BREAKER POLISHED CHROME FINISH
HB-4	HOSE BIBB	---	---	---	¾"	---	---	ACORN #8121 WALL-MOUNTED FOR MAINTENANCE IN THE EQUIPMENT ROOMS WITH VANDAL PROOF LOCK SHIELD BONNET FURNISHED WITH REMOVABLE HANDLE COMPLETE WITH ATMOSPHERIC TYPE VACUUM BREAKER POLISHED CHROME FINISH
FD-1	FLOOR DRAIN	2"	2"	1½"	½" TP	---	---	JR SMITH #2005Y WITH TRAP PRIMER CONNECTION
FS-1	FLOOR DRAIN	2"	2"	1½"	½" TP	---	---	JR SMITH #3160Y-C-U-13 CAST IRON FLANGED RECEPTOR WITH SEEPAGES HOLES WITH FLASHING CLAMP AND VANDAL PROOF SCREWS COMPLETE WITH ¾ GRATE AND TRAP PRIMER CONNECTION
RD-1	ROOF DRAIN	---	SEE PLANS FOR PIPE SIZE		---	---	---	JR SMITH #1015 15" DIAMETER DRAIN, DURA-COATED CAST IRON BODY WITH COMBINATION MEMBRANE FLASHING CLAMP/GRAVEL GUARD AND POLYETHYLENE-DOME, VANDAL-PROOF COMPLETE WITH UNDERDECK CLAMP AND SUMP RECEIVER.
PD-1	PLANTER DRAIN	---	SEE PLANS FOR PIPE SIZE		---	---	---	REFER TO LANDSCAPE PLANS FOR SPECIFICATION.
TD-1	TRENCH DRAIN	---	SEE PLANS FOR PIPE SIZE				½"	REFER TO ARCHITECTURAL AND LANDSCAPE PLANS FOR SPECIFICATION.
AO-1	AIR OUTLET	---	---	---	½"	---	---	CHICAGO #986-WSV909AGVCP PANEL MOUNTED SINGLE BALL VALVE.
TP-1	TRAP PRIMER	---	---	---	---	---	---	MIFAB #M-500 SERIES PRESSURE DROP ACTIVATED TRAP SEAL PRIMER; INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
WHA-1	WATER HAMMER ARRESTOR	---	---	---	---	---	---	MIFAB #MWH PISTON OPERATED WITH HARD DRAWN COPPER SEAMLESS COPPER BODY
TMV-1	THERMOSTATIC MIXING VALVE	---	---	---	---	---	---	POWERS #LFe480 LEAD-FREE BRASS BODY WITH INTEGRAL CHECKS WITH TEMPERATURE SET AT 105°F TO MEET ASSE 1070

NOTE: ABOVE SIZES ARE FIXTURE CONNECTION SIZES, SEE PLAN FOR BRANCH SIZES, WHICH MAY BE LARGER.

DOMESTIC WATER HEATER SCHEDULE (INSTANTANEOUS)

ITEM	SERVICE	MANUFACTURER AND MODEL	PHASE	AMP	KW	VOLTAGE	GPM	TEMP	REMARKS
IWH 1	DHW	EEMAX #EX4277T ML	1	14.8	4.1	277	0.5	105°	FOR RESTROOM LAVATORIES (DELTA T = 61°F AT 0.5 GPM)
IWH 2	DHW	EEMAX #ED020480T2T	3	24	20	480	2.0	110°	FOR LOUNGE SINKS (DELTA T = 68° AT 2.0 GPM)
IWH 3	DHW	EEMAX #ED024480T2T	3	29	24	480	2.5	120°	FOR MOP SINKS WITH 3 HEATING MODULES (DELTA T = 66°F AT 2.5 GPM)
IWH 4	DHW	EEMAX #EX90T	1	33	9	277	1.0	110°	FOR STUDIO SINKS (DELTA T = 68° AT 1.0 GPM)

EQUIPMENT SCHEDULE

ITEM	SERVICE	MANUFACTURER	STAGE	PRES.	CFM	PHASE	VOLT.	AMP.	GAL.	H.P.	REMARKS
GD 1	GARBAGE DISPOSER	IN-SINK ERATOR BADGER 5XP	–	–	–	1	120	9.52	–	3/4	CONTINUOUS FEED, GALVANIZED STEEL GRINDING ELEMENTS WITH TWO STAINLESS STEEL SWIVEL LUGS; 1725 RPM; COMPLETE WITH CHORD.

PIPE MATERIAL SCHEDULE

SERVICE		MATERIAL: COPPER TYPE L WITH 95/5 SOLDER PRESS, MECHANICAL JOINTS, SCH 10 W/GROOVE, GROOVE JOINTS	COPPER TYPE L WITH 95/5 SOLDER JOINTS, SCH 10 W/GROOVE, GROOVE JOINTS	COPPER TYPE K, WITH BRAZED JOINTS, SCH 40 'SS' (316L) W/WELDED JOINTS	CAST IRON, NO-HUB W/CMW FITTINGS AND SOLID COUPLINGS	CAST IRON, HUB AND SPIGOT	SCH 40 PVC DWV, W/FLOW FITTINGS AND SOLVENT/CEMENT JOINTS	SCH 40 BLACK STEEL WITH THREADED OR BEVELED WELD FITTINGS AND POLYETHYLENE	PVC, CPVC, ABS PIPE, ASTM D2513, YELLOW FINISH	MAXIMUM OPERATING PRESSURE, PS	REMARKS
WATER (DOMESTIC)	ABOVE GROUND	●								80	6FT/SEC MAX, 5FT/SEC FOR HW
	BELOW GROUND			●							
CONDENSATE	ABOVE GROUND		●							GRAVITY	SLOPE @ ¼"/FT
	BELOW GROUND										
DRAINAGE – STORM DRAIN, WASTE & VENT	ABOVE GROUND				●					GRAVITY	SLOPE @ ¼"/FT, FOR 3"/HR RAINFALL ½"/FT SLOPE AS NOTED
	BELOW GROUND				●						
COMPRESSED AIR	ABOVE GROUND	●									
	BELOW GROUND										

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No.	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

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PHASE : CD
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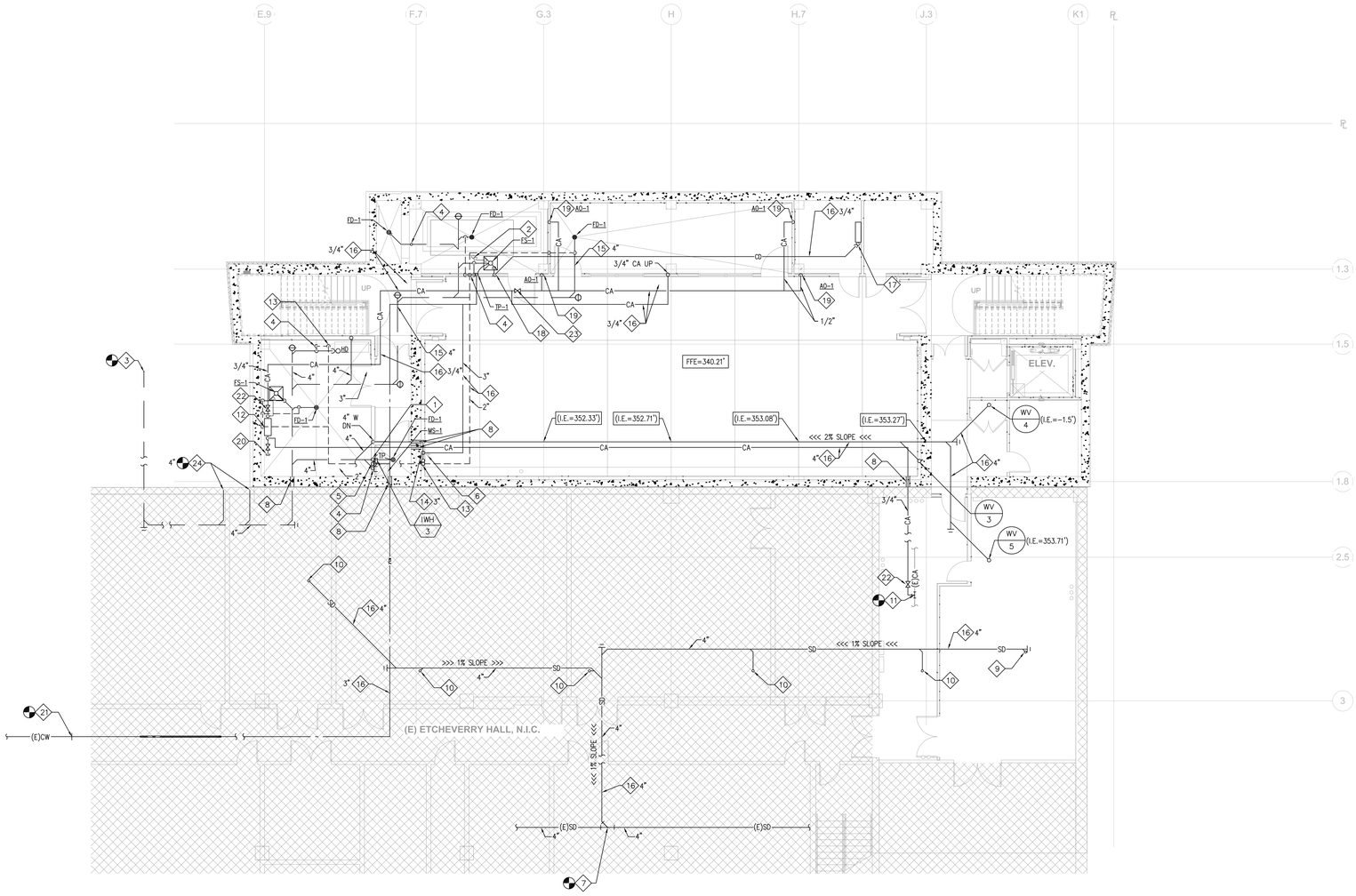
PERMIT No :
SCALE : N.T.S.

SHEET TITLE

PLUMBING SCHEDULES

SHEET No

P0.1



KEY NOTES

1. 2" V BEL. FLOOR
2. 1-1/2" CD FROM HVAC UNIT; REFER TO MECH DRAWINGS FOR EXACT SIZE, LOCATION AND CAPACITY OF HVAC UNIT. TERMINATE 1" ABOVE FLOOD LEVEL RIM OF FLOOR SINK.
3. EXTEND AND CONNECT 4" W AT ETCHEVERY'S BASEMENT RESTROOM. FIELD VERIFY EXACT LOCATION PRIOR TO CONNECTION.
4. 2" VENT UP.
5. 1" CW FROM ABOVE.
6. ¾" CW WITH S.O.V. AND 2" V STUBS INSTALLED AS HIGH AS POSSIBLE FOR FUTURE CONNECTION.
7. 4" SD; EXTEND AND CONNECT TO EXISTING (SODA) DRAINS THROUGH L2 LEVEL OF ETCHEVERRY. FIELD VERIFY EXACT LOCATION PRIOR TO CONNECTIONS.
8. WATERTIGHT SLEEVES THROUGH CONCRETE WALL.
9. 3" SD FROM PLANTER DRAIN ABOVE.
10. 3" SD FROM TRENCH DRAIN ABOVE.
11. EXTEND AND CONNECT 3/4" CA TO EXISTING COMPRESSED AIR LINE AT ETCHEVERRY'S BASEMENT LEVEL CEILING.
12. 3/4" CA DOWN TO REGULATOR AND FILTER ASSEMBLY; REFER TO DETAIL 4 ON SHEET P5.1. SET PRESSURE AT 100-110 PSI.
13. 2-1/2" V UP IN WALL.
14. 1-1/4" CW UP IN WALL.
15. PIPING BELOW FLOOR.
16. PIPING OVERHEAD.
17. ¾" CD FROM FAN COIL UNIT.
18. ¾" CD DN IN WALL; TERMINATE 1" ABOVE FLOOD LEVEL RIM OF FLOOR SINK.
19. 1/2" CA DN IN WALL TO AIR OUTLET; SEE DETAIL 4/P5.1. FOR EXACT LOCATION OF EQUIPMENT, REFER TO ARCHITECTURAL PLANS.
20. QUICK CONNECT WITH S.O.V. FOR USE BY UNIVERSITY TO BY-PASS COMPRESSED AIR SUPPLY FOR THE BUILDING DEMAND.
21. EXTEND AND CONNECT 3" CW AT L2 CORRIDOR OF ETCHEVERRY BASEMENT.
22. BUILDING SERVICE VALVE.
23. BASEMENT SERVICE VALVE.
24. EXTEND AND CONNECT FOUNDATION AND UNDER SLAB DRAIN (BY OTHERS).

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SCALE : 1/8"=1'-0"

SHEET TITLE

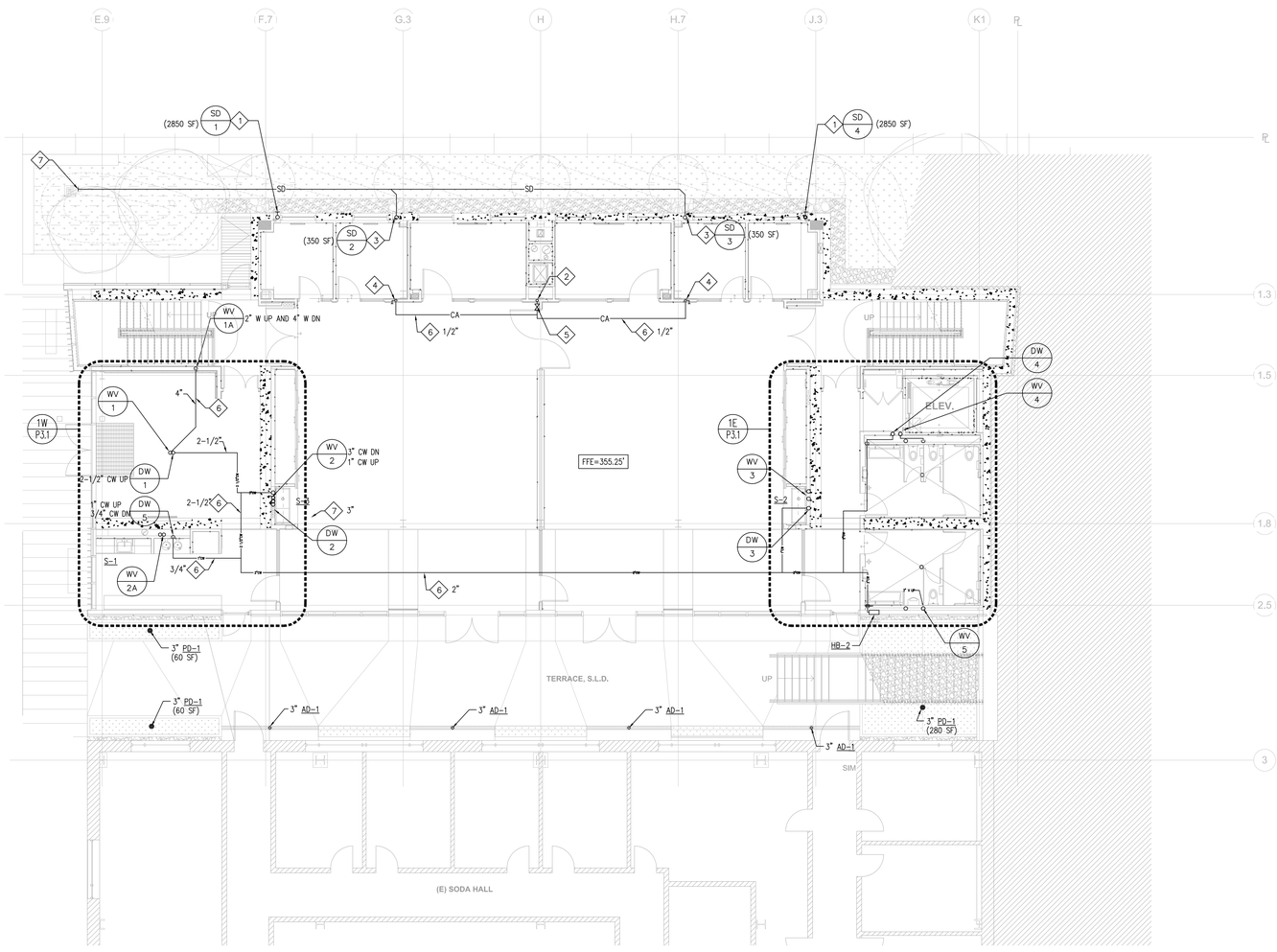
BASEMENT LEVEL PLUMBING PLAN

SHEET No.

P2.0

KEY NOTES

1. 4" SD FROM ABOVE; SPILL ABOVE PLANTER AND TERMINATE 9" ABOVE FINISHED GRADE.
2. 3/4" CA UP AND DN IN WALL.
3. 3" SD FROM ABOVE.
4. 1/2" CA DN IN WALL TO AIR OUTLET; SEE DETAIL 4/P5.1.
5. 1ST STORY SERVICE VALVE.
6. PIPING OVERHEAD.
7. 3" SD TO CURB DRAIN.



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SCALE :

SHEET TITLE

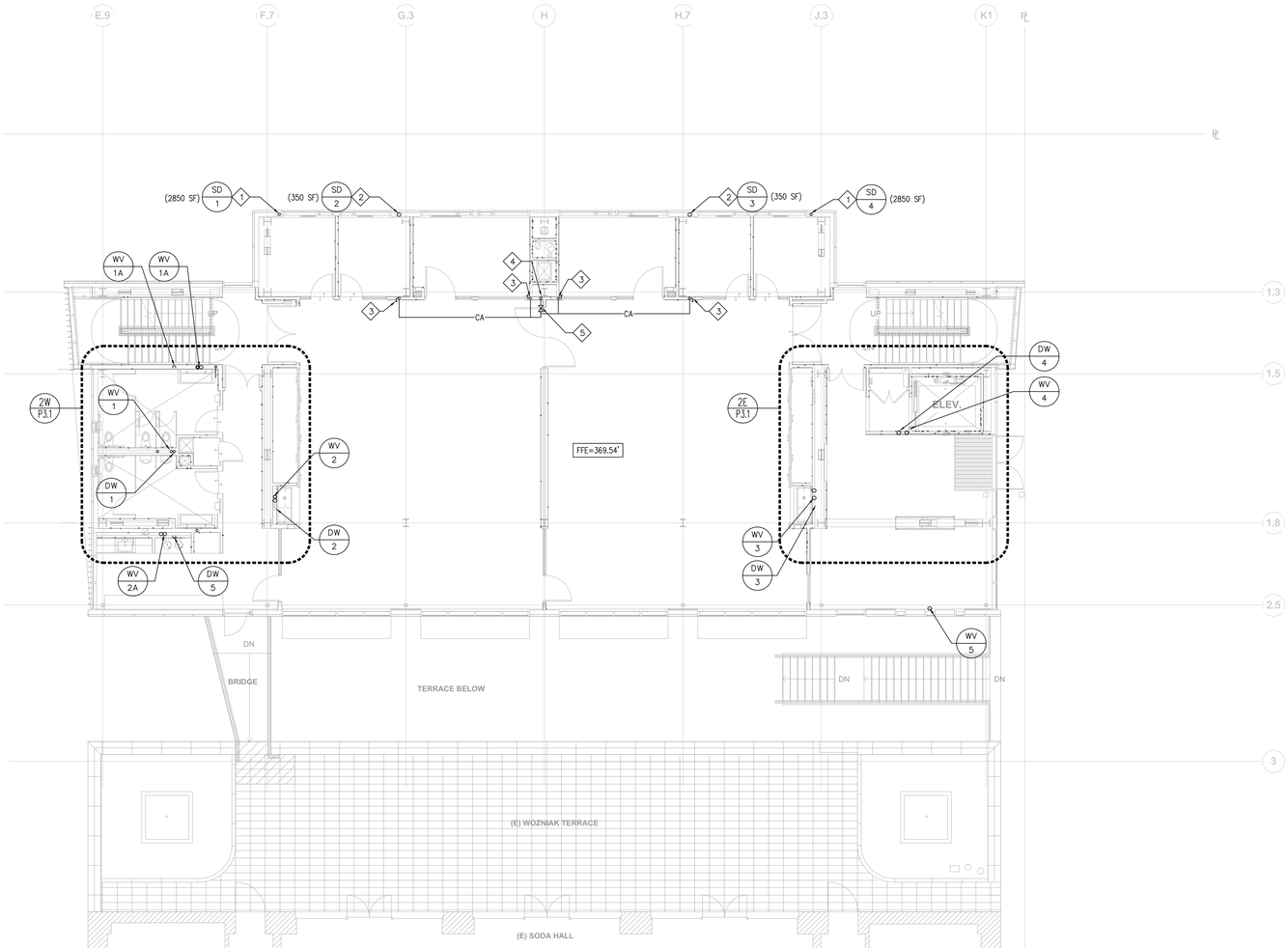
1ST STORY PLUMBING PLAN

SHEET No

P2.1

KEY NOTES

1. 4" SD UP AND DN IN WALL.
2. 3" SD UP AND DN IN WALL.
3. ½" CA DN IN WALL TO AIR OUTLET; SEE DETAIL 4/P5.1.
4. 3/4" CA UP AND DN IN WALL.
5. 2ND STORY SERVICE VALVE.



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SCALE : ⅛"=1'-0"

SHEET TITLE

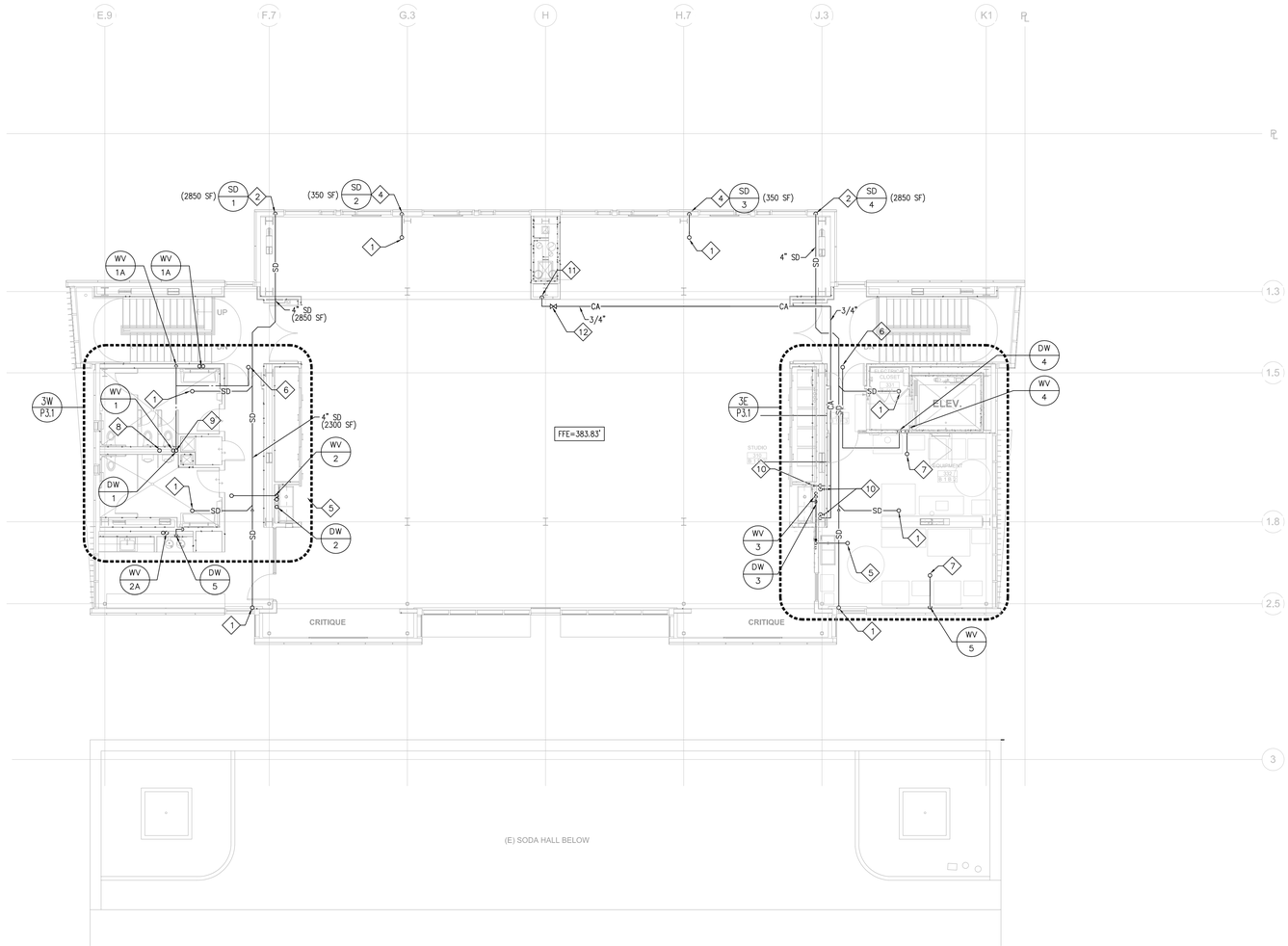
2ND STORY PLUMBING PLAN

SHEET No

P2.2

KEY NOTES

1. 3" SD FROM ABOVE.
2. 4" SD DN IN WALL.
3. 3" SD FROM ABOVE.
4. 3" SD DN IN WALL.
5. 2-1/2" V UP THRU ROOF.
6. ¾" CW UP THRU ROOF.
7. 3" V UP THRU ROOF.
8. 4" V UP THRU ROOF.
9. 3" CW RISER DN IN WALL.
10. 3/4" CA DN IN WALL TO AIR OUTLET; SEE DETAIL 4/P5.1.
11. 3/4" CA DN IN WALL.
12. 3RD STORY SERVICE VALVE.



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SCALE : ⅛"=1'-0"

SHEET TITLE

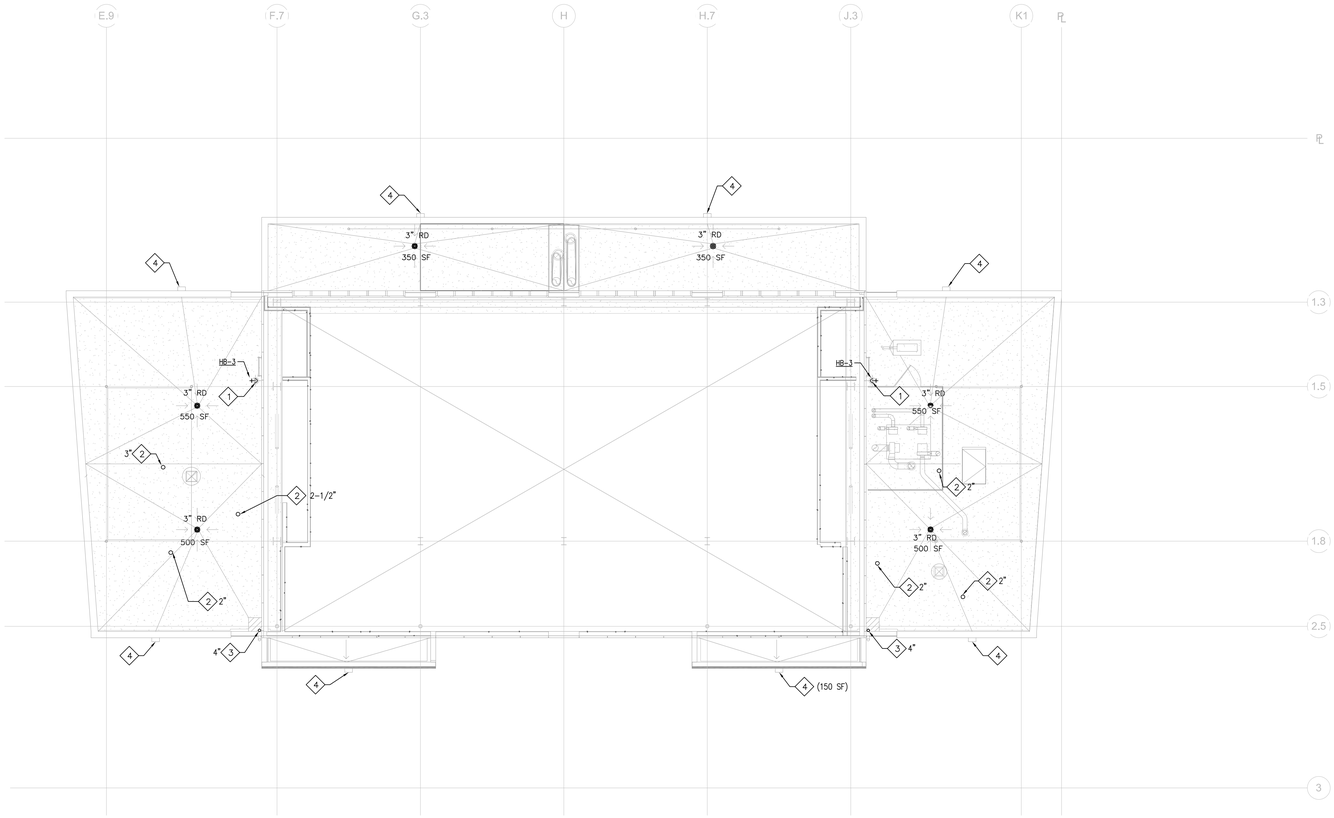
3RD STORY PLUMBING PLAN

SHEET No

P2.3

KEY NOTES

1. ¾" CW DN TO CEILING BELOW.
2. VENT THRU ROOF.
3. 4" DOWNSPOUT UP AND DN FROM GUTTER DRAIN AT HIGH ROOF; REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION.
4. SCUPPER DRAIN FOR OVERFLOW (40 SQUARE INCHES PER CPC); REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION.



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PERMIT No :
SCALE : ⅛"=1'-0"

SHEET TITLE

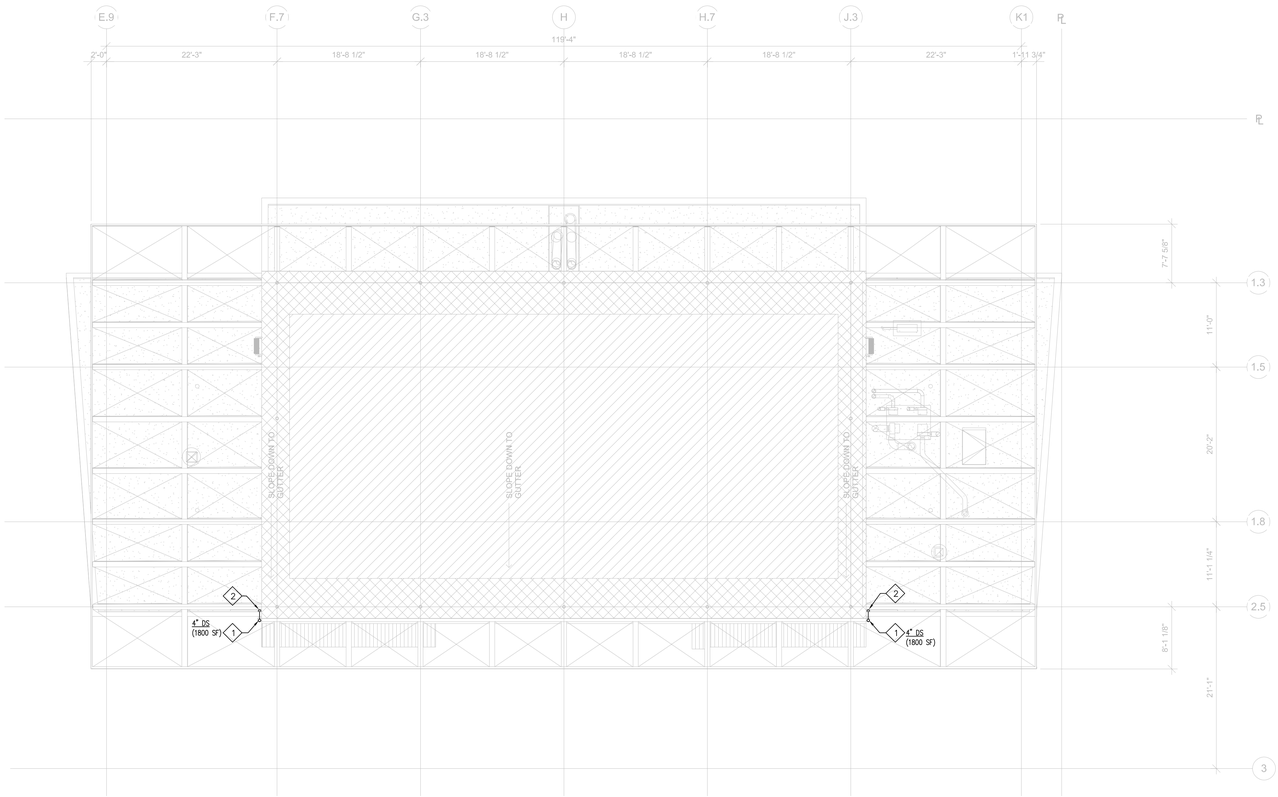
LOW ROOF PLUMBING PLAN

SHEET No.

P2.4

KEY NOTES

1. GUTTER DRAIN; REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION.
2. GUTTER DRAIN LEADER DN; SEE SHEET P2.4 FOR CONTINUATION.



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DATE : 15 August 2014
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PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : 1/8"=1'-0"

SHEET TITLE

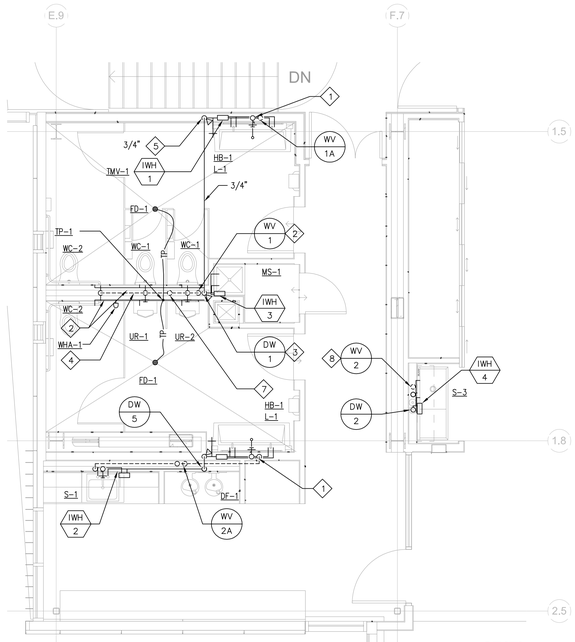
HIGH ROOF PLUMBING PLAN

SHEET No

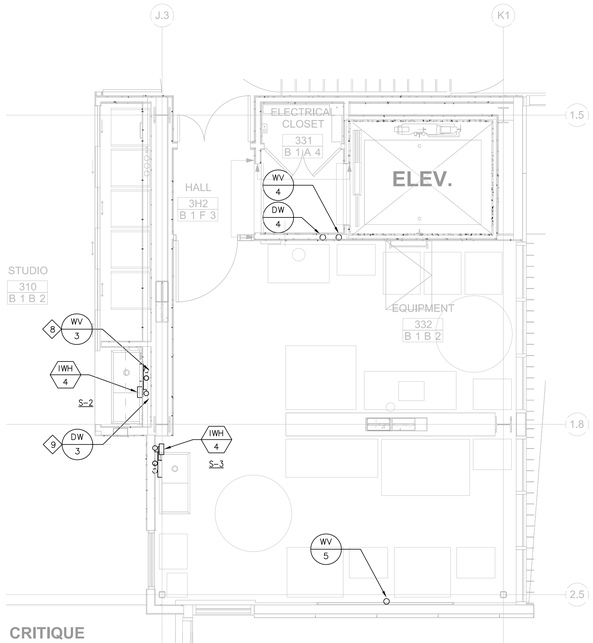
P2.5

KEY NOTES

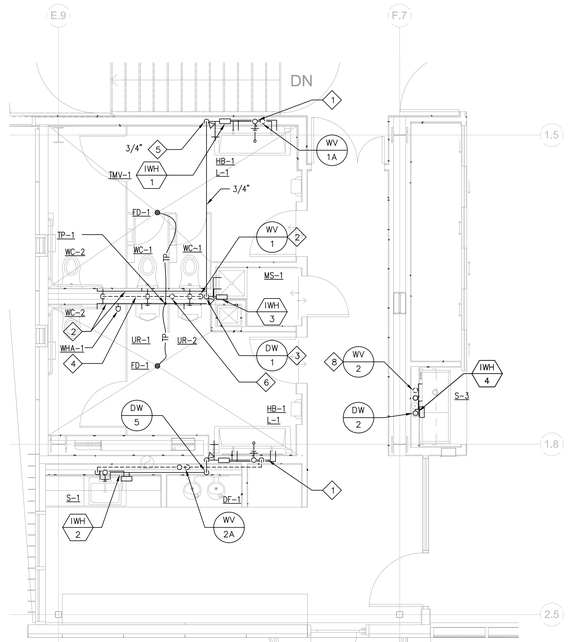
1. ¾" CW AND 2" V HDRS AND 2" W INI WALL.
2. 4" W AND V STACKS IN WALL (84 DFU).
3. 2-1/2" CW RISER (93.5 FU / 66 GPM).
4. 2-1/2" V HDR IN WALL.
5. CW DN IN WALL TO HDR IN WALL WITH S.O.V. BEHIND ACCESS PANEL.
6. 3" V UP IN WALL.
7. 4" V UP THRU ROOF.
8. 2"" W AND 2" V STACKS IN WALL (4 FU).
9. 1" CW RISER (8 FU / 7 GPM).
10. ¾" CW FROM BELOW.
11. 2-1/2" V FROM BELOW.
12. PIPING BELOW FLOOR.
13. PIPING OVERHEAD..



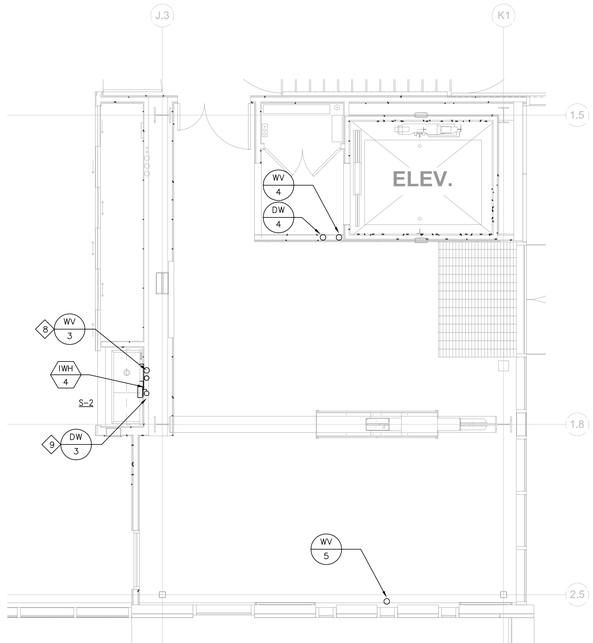
3W 3RD STORY LOUNGE AND RESTROOM ENLARGED PLANS
SCALE: 1/4"=1'-0"



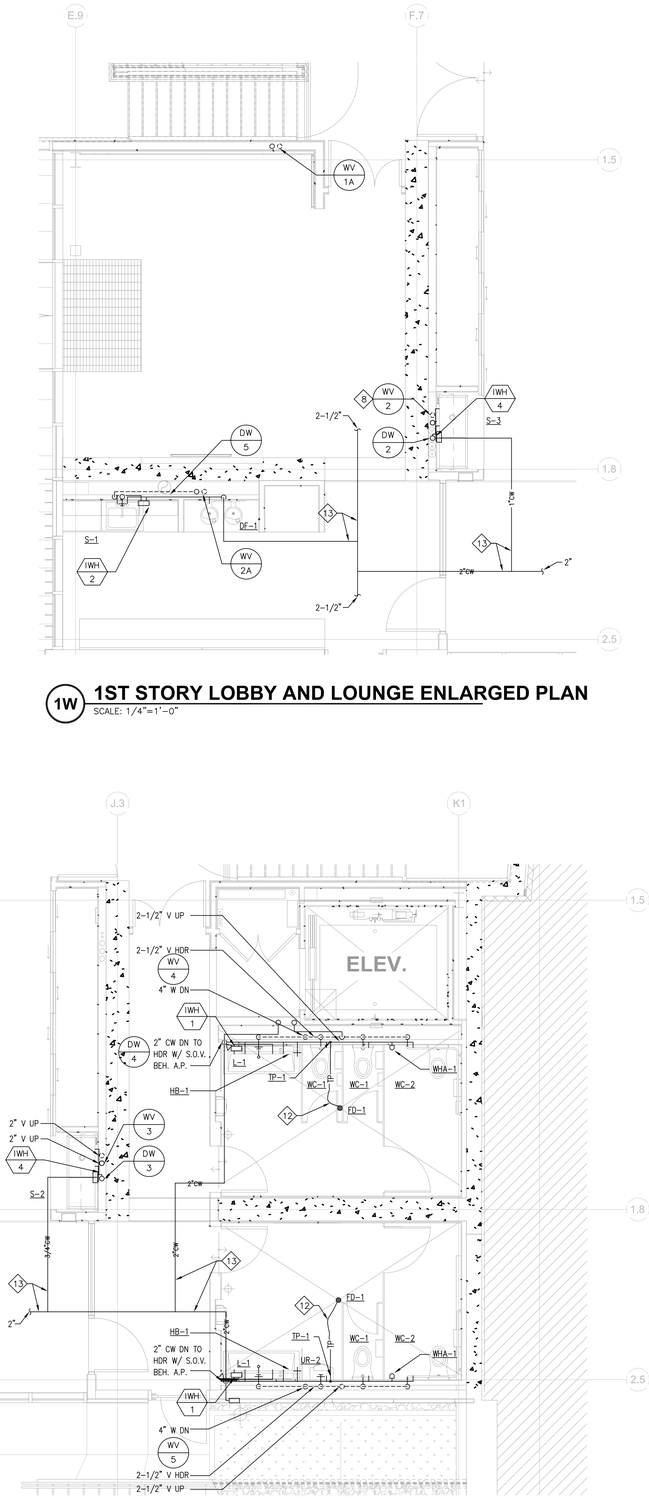
3E 3RD ENLARGED PLAN (EAST SIDE)
SCALE: 1/4"=1'-0"



2W 2ND STORY LOUNGE AND RESTROOM ENLARGED PLANS
SCALE: 1/4"=1'-0"



2E 2ND ENLARGED PLAN (EAST)
SCALE: 1/4"=1'-0"



1W 1ST STORY LOBBY AND LOUNGE ENLARGED PLAN
SCALE: 1/4"=1'-0"

1E 1ST STORY RESTROOMS ENLARGED PLANS
SCALE: 1/4"=1'-0"

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PROJECT

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No	REVISION	DATE
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14
	100% CDs / Permit Submission	08/15/14

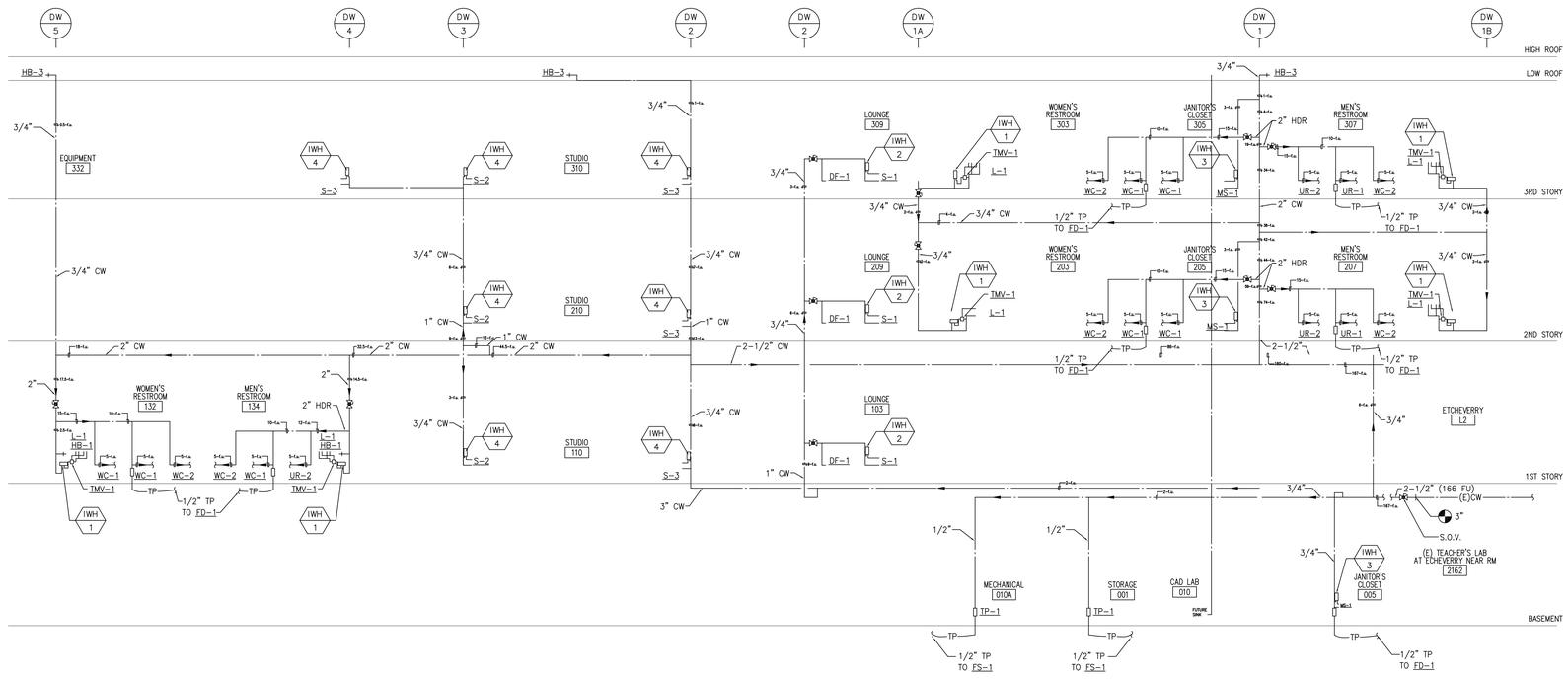
DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : AS NOTED

SHEET TITLE

ENLARGED PLUMBING PLANS

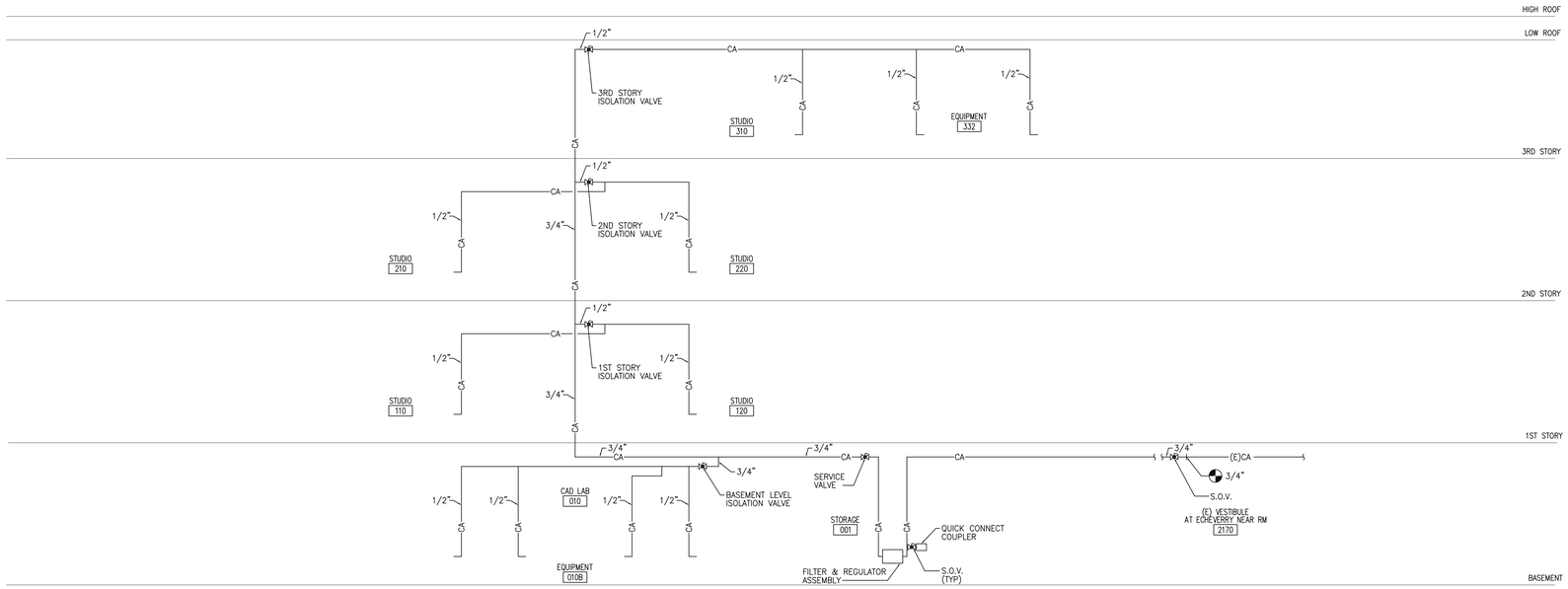
SHEET No

P3.1



1 DOMESTIC WATER RISER DIAGRAM

SCALE: NONE



2 COMPRESSED AIR RISER DIAGRAM

SCALE: NONE

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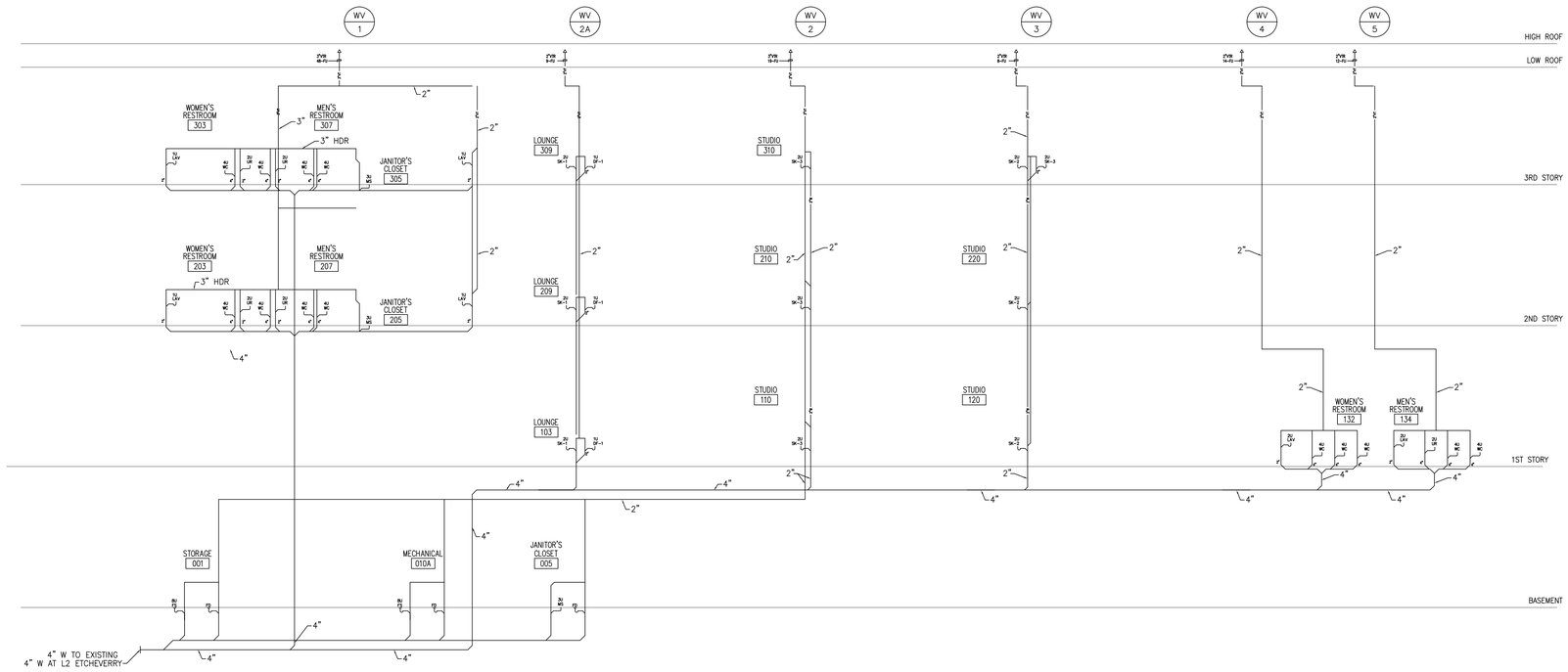
SCALE : 1/4"=1'-0"

SHEET TITLE

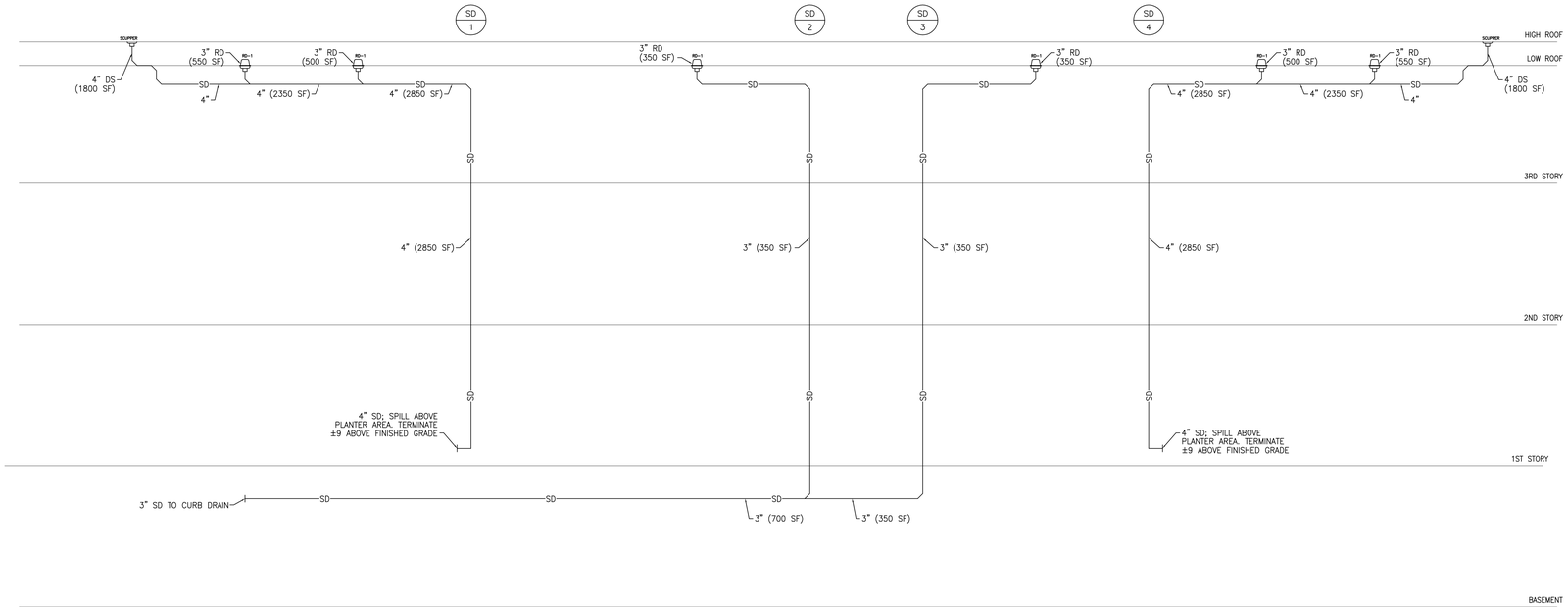
DOMESTIC WATER AND COMPRESSED AIR RISER DIAGRAMS

SHEET No

P4.1



1 **SANITARY WASTE / VENT STACK DIAGRAM**
SCALE: NONE



2 **STORM DRAINAGE STACK DIAGRAM**
SCALE: NONE

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DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : N.T.S.

SHEET TITLE
SANITARY WASTE / VENT AND STORM DRAINAGE STACK DIAGRAMS

SHEET No
P4.2

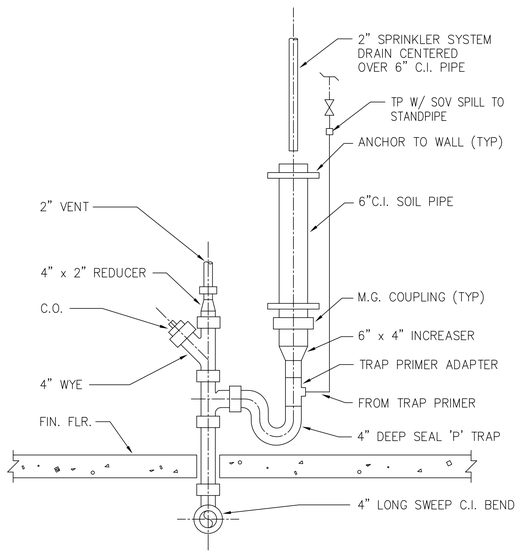
10 NOT USED
SCALE: NONE

11 NOT USED
SCALE: NONE

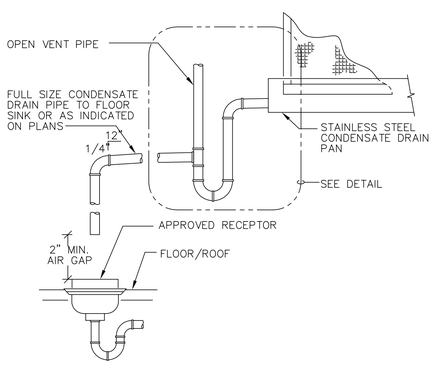
12 NOT USED
SCALE: NONE

7 NOT USED
SCALE: NONE

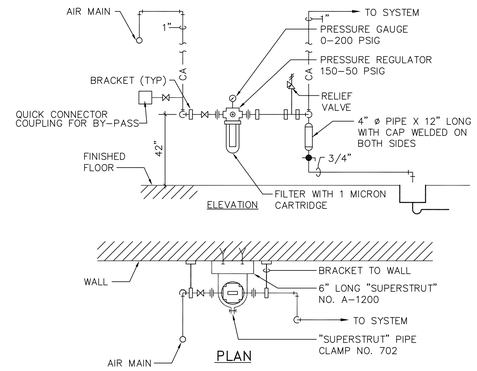
8 CONDENSATE DRAIN DETAIL
SCALE: NONE



9 HUB DRAIN DETAIL
SCALE: NONE

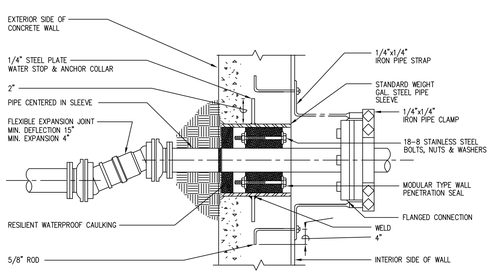


NOTE:
THE CONDENSATE PIPE SHALL BE INSULATED

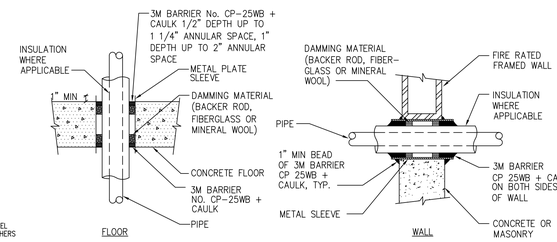


4 COMPRESSED AIR REGULATOR / FILTER ASSEMBLY DETAIL
SCALE: NONE

5 TYPICAL AIR OUTLET DETAIL
SCALE: NONE



6 PIPE PENETRATION THRU WALLS BELOW GRADE DETAIL
SCALE: NONE



SPECIFICATIONS:

PENETRATIONS IN FIRE RESTRICTIVE WALLS, PARTITIONS AND FLOORS WHERE PROTECTED OPENINGS ARE REQUIRED SHALL BE FIRE STOPPED USING APPROVED MATERIALS, SECURELY INSTALLED AND CAPABLE OF MAINTAINING THIER INTEGRITY AND PREVENTING THE MOVEMENT OF FLAMES AND/OR GASES THROUGH THE VOID SPACES BETWEEN PENETRATING MATERIALS AND WALLS, PARTITIONS AND FLOORS WHEN TESTED IN ACCORDANCE WITH ASTM STANDARD E-814 OR UL STANDARD 1479 (CBC SECTIONS 709.6, 709.7 & 714).

PROVIDE DESIGN DETAILS ON DRAWINGS DEPICTING APPROVED (LISTED) METHODS AND MATERIALS USED TO PROTECT PENETRATIONS WALLS, PARTITIONS AND FLOORS.

DESIGNS ARE LISTED BY UNDERWRITER'S LABORATORIES (FIRE RESISTANCE DIRECTORY) AND THE CALIFORNIA STATE FIRE MARSHAL (BUILDING MATERIAL LISTINGS). SPECIFIC DESIGN INFORMATION IS AVAILABLE FROM U.L OR THE PRODUCT MANUFACTURER.

NOTES:

PENETRATIONS SHALL HAVE A T & F RATING IF LOCATED IN OPEN FLOOR AREA, "F"ONLY REQUIRED IF CONTAINED WITHIN A WALL ASSEMBLY, CBC. SEC. 710.2.3

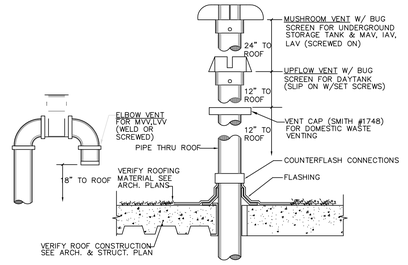
3M FIRE BARRIER PRODUCTS:
CALIFORNIA STATE FIRE MARSHAL LISTING No. 4485-941:100

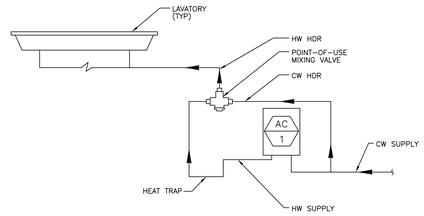
UNINSULATED PIPE:
U.L. DESIGN No. CAJ1001(CONC. WALL OR FLOOR)
U.L. DESIGN No. WL1001 (STUD WALL)

INSULATED PIPE:
U.L. DESIGN No. CAJ5000(CONC. WALL OR FLOOR)
U.L. DESIGN No. WL5001 (STUD WALL)

3 PIPE PENETRATIONS FOR FIRE STOP ASSEMBLY DETAIL
SCALE: NONE

1 VENT THRU ROOF DETAIL
SCALE: NONE





NOTE:

PROVIDE MIXING VALVE AT THE SUPPLY HEADER FOR GENERAL USE OF THE PUBLIC LAVATORIES PER CPC SECTION 421.2, SET TEMPERATURE DELIVERY TO EACH LAVATORY AT 110°F.

2 POINT-OF-USE TEMPERING VALVE
SCALE: NONE

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SHEET TITLE
PLUMBING DETAILS

SHEET No
P5.1

SYMBOLS LIST

SOME OF THESE SYMBOLS SHOWN MAY NOT BE USED ON THIS PROJECT

POWER DISTRIBUTION

- SWITCHBOARD, DISTRIBUTION BOARD, SUBSTATION OR MOTOR CONTROL CENTER, FLOOR MOUNTED.
- PANELBOARD, 277/480V, SURFACE MOUNTED ON WALL.
- PANELBOARD, 277/480V, FLUSH MOUNTED IN WALL.
- PANELBOARD, 120/208V, SURFACE MOUNTED ON WALL.
- PANELBOARD, 120/208V, FLUSH MOUNTED IN WALL.
- DRY-TYPE STEP-DOWN TRANSFORMER, FLOOR MOUNTED 3Ø,480-120/208V, UON.
- ELECTRIC MOTOR, NIEC. MAKE POWER CONNECTIONS ONLY AS NOTED ON PLANS.
- (F) INDOOR EXHAUST FAN MOTOR, SINGLE PHASE, MAKE POWER CONNECTIONS TO INCLUDE JUNCTION BOX MOUNTED MANUAL MOTOR STARTER AND DISCONNECT ADJACENT TO FAN WITH 2 #12 CONDUCTORS PLUS GROUND IN 1/2" FLEXIBLE CONDUIT BETWEEN STARTER AND MOTOR.
- (V) INDOOR FAN POWERED VAV BOX MOTOR, SINGLE PHASE, MOUNTED FROM STRUCTURE ABOVE, NIEC. MAKE POWER CONNECTIONS TO INCLUDE JUNCTION BOX MOUNTED MANUAL MOTOR STARTER AND DISCONNECT ADJACENT TO VAV BOX WITH 2 #12 CONDUCTORS PLUS GROUND IN 1/2" FLEXIBLE CONDUIT BETWEEN STARTER AND MOTOR.
- [P] PULLBOX OR HANDHOLE, SIZE AND TYPE AS NOTED ON PLANS.
- [A] [VR] SAFETY DISCONNECT SWITCH, POLE AS NOTED, ADJACENT NUMBER INDICATES FUSE SIZE WHEN APPLICABLE, LABELING CONVENTION AS FOLLOWS:
  - A: 30A, NON-FUSED
  - B: 60A, NON-FUSED
  - C: 100A, NON-FUSED
  - D: 200A, NON-FUSED
  - E: 400A, NON-FUSED
  - F: 600A, NON-FUSED
  - G: 800A, NON-FUSED
  - AF: 30A, FUSED
  - BF: 60A, FUSED
  - CF: 100A, FUSED
  - DF: 200A, FUSED
  - EF: 400A, FUSED
  - FF: 600A, FUSED
  - GF: 800A, FUSED
- MAGNETIC MOTOR STARTER. ADJACENT NUMBER INDICATES NEMA SIZE OF STARTER.
- COMBINATION MAGNETIC MOTOR STARTER/SAFETY DISCONNECT SWITCH. ADJACENT NUMBER INDICATES NEMA SIZE OF STARTER.
- PACKAGE MOTOR CONTROLLER OR STARTER FURNISHED AND INSTALLED UNDER ANOTHER DIVISION WITH EQUIPMENT CONTROLLED. PROVIDE SINGLE-POINT POWER SERVICE CONNECTION UNDER THIS DIVISION AS NOTED ON PLANS.
- VFD VARIABLE FREQUENCY DRIVE FURNISHED AND INSTALLED UNDER ANOTHER DIVISION. PROVIDE POWER SERVICE CONNECTION UNDER THIS DIVISION AS NOTED ON PLANS.
- VFD VARIABLE FREQUENCY DRIVE WITH INTEGRAL DISCONNECT FURNISHED AND INSTALLED UNDER ANOTHER DIVISION. PROVIDE POWER SERVICE CONNECTION UNDER THIS DIVISION AS NOTED ON PLANS.
- DRIVEN GROUND ROD.
- DRIVEN GROUND ROD IN GROUND WELL WITH COVER.
- ELECTRICAL VEHICLE CHARGING STATION, WALL MOUNTED.
- ELECTRICAL VEHICLE CHARGING STATION, PEDESTAL MOUNTED.
- 2,4,6 BRANCH CIRCUIT POWER DISTRIBUTION BOX OF MANUFACTURED WIRING SYSTEM WITH MODULAR CONNECTORS FOR INTERFACE TO BRANCH CIRCUIT MODULAR CABLE SETS AND CABLE OR CONDUIT HOMERUN, BOX MOUNTED FROM STRUCTURE ABOVE IN ACCESSIBLE CEILING SPACE. ADJACENT NUMBERS INDICATE CIRCUITS AVAILABLE AT BOX.
- 2,4,6 DEVICE BRANCH CIRCUIT POWER DISTRIBUTION BOX FOR INTERFACE BETWEEN MULTI-CIRCUIT HOMERUN AND MC CABLE BRANCH CIRCUITING. MINIMUM BOX SIZE IS 10"X10"X4" DEEP. BOX MOUNTED FROM STRUCTURE ABOVE IN ACCESSIBLE CEILING SPACE. ADJACENT NUMBERS INDICATE CIRCUITS AVAILABLE AT BOX.
- INDICATES CABLE TERMINATION LUGS AT EQUIPMENT BUS.
- BOLTED PRESSURE OR HIGH PRESSURE CONTACT SWITCH.
- FUSED SWITCH.
- MEDIUM-VOLTAGE LOAD INTERRUPTER SWITCH.
- GROUP MOUNTED MOLDED CASE CIRCUIT BREAKER.
- INDIVIDUALLY FIXED MOUNTED INSULATED-CASE OR POWER CIRCUIT BREAKER.
- INDIVIDUALLY DRAW-OUT MOUNTED INSULATED-CASE OR POWER CIRCUIT BREAKER.
- MV MEDIUM-VOLTAGE, INDIVIDUALLY DRAW-OUT MOUNTED VACUUM CIRCUIT BREAKER.
- G INDICATES INTEGRAL GROUND FAULT RELAY WHEN ASSOCIATED WITH CIRCUIT BREAKER.
- C INDICATES COMMUNICATION NETWORK WIRING WHEN ASSOCIATED WITH CIRCUIT BREAKER.
- ED INDICATES ELECTRICALLY OPERATED WHEN ASSOCIATED WITH CIRCUIT BREAKER.
- ST INDICATES SHUNT TRIP WHEN ASSOCIATED WITH OVERCURRENT PROTECTION DEVICES.
- K_1 INDICATES KIRK-KEY INTERLOCK WHEN ASSOCIATES WITH OVERCURRENT PROTECTION DEVICES. ADJACENT NUMBER CORRESPONDS WITH DEVICE INTERLOCK.
- GFPT GROUND FAULT RELAY WITH SHUNT TRIP.
- GFA GROUND FAULT ALARM, NO SHUNT TRIP.
- UM UTILITY METER.
- TRANSFORMER.
- CONNECTION TO GROUND.
- CURRENT TRANSFORMERS.
- POTENTIAL TRANSFORMERS.
- AUTOMATIC OR MANUAL TRANSFER SWITCH.
- NORM. EM. AUTOMATIC TRANSFER/BY-PASS ISOLATION SWITCH.
- G EMERGENCY GENERATOR.
- BATTERIES.
- NEUTRAL SERVICE DISCONNECT LINK.
- SPD SURGE PROTECTION DEVICE, 'SPD'.
- C HI CONTROL CONTACTOR.
- NORMALLY OPEN CONTACT.
- NORMALLY CLOSED CONTACT.
- DMU DIGITAL METERING UNIT.
- WHM WATT HOUR METER.
- GND GROUND BUS.
- NEU NEUTRAL BUS.

WIRING DEVICES

- JUNCTION BOX, WALL MOUNTED, +18" UON.
- JUNCTION BOX, MOUNTED IN FLUSH FLOOR BOX.
- J JUNCTION BOX, MOUNTED FLUSH IN CEILING.
- JUNCTION BOX, SURFACE OR PENDANT MOUNTED TO STRUCTURE IN ACCESSIBLE CEILING SPACE.
- J JUNCTION BOX, MOUNTED ON CONDUIT STANCHION FLOOR PENETRATION, +12" UON.
- SINGLE-PLEX CONVENIENCE RECEPTACLE DEVICE, WALL MOUNTED, +18" UON.
- DUPLEX CONVENIENCE RECEPTACLE DEVICE, WALL MOUNTED, +18" UON.
- DOUBLE DUPLEX CONVENIENCE RECEPTACLE DEVICE, WALL MOUNTED, +18" UON.
- DENOTES WALL MOUNTED OVER COUNTER, COORDINATE EXACT HEIGHT WITH ARCHITECTURAL ELEVATIONS.
- G 'G' DENOTES GROUND FAULT CURRENT INTERRUPTER (GFCI), 'A' DENOTES ARC FAULT CURRENT INTERRUPTER (AFCI).
- SHADING DENOTES SPLIT WIRED DEVICE.
- SHADING DENOTES DEVICE CONNECTED TO EMERGENCY POWER CIRCUIT.
- SHADING DENOTES DEVICE WITH ISOLATED GROUND.
- SHADING DENOTES SPECIALTY DEVICE, TYPE AS NOTED ON PLANS.
- DUPLEX CONVENIENCE RECEPTACLE DEVICE, MOUNTED IN FLUSH FLOOR BOX.
- DOUBLE DUPLEX CONVENIENCE RECEPTACLE DEVICE, MOUNTED IN FLUSH FLOOR BOX.
- DUPLEX CONVENIENCE RECEPTACLE DEVICE, MOUNTED IN FIRE-RATED POKE-THRU FLOOR FITTING.
- DOUBLE DUPLEX CONVENIENCE RECEPTACLE DEVICE, MOUNTED IN FIRE-RATED POKE-THRU FLOOR FITTING.
- DUPLEX CONVENIENCE RECEPTACLE DEVICE, MOUNTED FLUSH IN CEILING.
- DOUBLE DUPLEX CONVENIENCE RECEPTACLE DEVICE, MOUNTED FLUSH IN CEILING.
- DUPLEX CONVENIENCE RECEPTACLE DEVICE, MOUNTED ON CONDUIT STANCHION FLOOR PENETRATION, +12" UON.
- DUPLEX CONVENIENCE RECEPTACLE DEVICE, MOUNTED IN FLOOR MONUMENT.
- COMBINATION POWER/TELECOMMUNICATION DEVICE, MOUNTED IN FLUSH FLOOR BOX. TYPE AS NOTED ON PLANS OR IN SPECIFICATIONS.
- DUPLEX CONVENIENCE RECEPTACLE DEVICE, CORD OR REEL HUNG FROM STRUCTURE ABOVE. TYPE AS NOTED ON PLANS.
- P ELECTRIFIED FURNITURE PARTITION POWER FEED, WALL MOUNTED, +18" UON. CONSISTS OF 4 11/16" SQ. X 2 1/8" DEEP. JUNCTION BOX, SINGLE GANG RING, AND STAINLESS STEL COVER PLATE WITH KO TO ACCEPT FURNITURE WHIP.
- ELECTRIFIED FURNITURE PARTITION COMBINATION POWER/TELECOMMUNICATION FEEDS, MOUNTED IN FLUSH FLOOR BOX WITH KO'S IN COVER TO ACCEPT FURNITURE WHIPS
- P ELECTRIFIED FURNITURE PARTITION POWER FEED, MOUNTED IN FIRE-RATED POKE-THRU FLOOR FITTING WITH KO IN COVER TO ACCEPT FURNITURE WHIP.
- POWER/TELECOMMUNICATION POLE, MOUNTED TO EXTEND FROM FLOOR TO CEILING. TYPE AS NOTED ON PLANS.
- S SINGLE-POLE, SINGLE-THROW SWITCH, WALL MOUNTED, +42" UON.
- S^3 THREE-WAY SWITCH, WALL MOUNTED, +42" UON.
- S^4 FOUR-WAY SWITCH, WALL MOUNTED, +42" UON.
- S^K KEY-OPERATED, SINGLE-POLE, SINGLE-THROW SWITCH, WALL MOUNTED, +42" UON.
- S^P PILOT LIGHT, SINGLE-POLE, SINGLE-THROW SWITCH, WALL MOUNTED, +42" UON.
- S^T MANUAL MOTOR STARTER SWITCH WITH THERMAL OVERLOAD ELEMENT, MOUNTED ADJACENT TO MOTOR.
- S^M MANUAL MOTOR STARTER/DISCONNECT SWITCH, MOUNTED ADJACENT TO MOTOR.
- S^F SWITCH FURNISHED UNDER ANOTHER DIVISION, BUT INSTALLED AND WIRED UNDER THIS DIVISION, WALL MOUNTED, +42" UON.
- S^D WALL BOX DIMMER SWITCH, +42" UON. SIZED PER CONNECTED LOAD ON PLANS AND FURNISHED FOR LAMP SOURCE SERVED. PROVIDED FOR DE-RATING WHEN INSTALLED GANGED LOCATIONS.
- S^{TC} SINGLE-POLE, TIMER CONTROLLED SWITCH, WALL MOUNTED, +42" UON.
- S^{EP} SINGLE-POLE, SINGLE-THROW, EXPLOSION PROOF SWITCH, WALL MOUNTED, +42" UON.
- SH LINE-VOLTAGE SWITCHING STATION, WALL MOUNTED, 42" UON. REFER TO PLANS FOR DEVICE QUANTITIES AND TYPES.
- LH LOW-VOLTAGE LIGHTING CONTROL SWITCHING STATION, WALL MOUNTED, +42" UON. REFER TO PLANS AND SCHEDULES FOR DEVICE QUANTITIES AND RELAYS CONTROLLED
- MH P LIGHTING CONTROL OCCUPANCY SENSOR WITH DUAL LEVEL SWITCHING, WALL MOUNTED, +42" UON. "P" INDICATES THAT ADDITIONAL POWER PACK MAY BE REQUIRED FOR CONTROL OF BOTH NORMAL AND EMERGENCY LIGHTING.
- MH LIGHTING CONTROL OCCUPANCY SENSOR WITH SINGLE LEVEL SWITCHING, WALL MOUNTED, +42" UON.
- M P LIGHTING CONTROL OCCUPANCY SENSOR, CEILING MOUNTED FOR AREA COVERAGE. "P" INDICATES THAT ADDITIONAL POWER PACK MAY BE REQUIRED FOR CONTROL OF BOTH NORMAL AND EMERGENCY LIGHTING.
- DH PRESET SCENE CONTROL LIGHTING STATION WITH DIMMING CAPABILITIES, WALL MOUNTED, +42" UON. REFER TO PLANS AND SCHEDULES FOR CONTROL.
- EM EGRESS LIGHTING TRANSFER DEVICE. UL924.
- CONTROL STATION, WALL MOUNTED, +42" UON.
- PE PHOTOELECTRIC CELL
- DS DAYLIGHT SENSOR
- WAP WIRELESS ACCESS POINT.
- DATA PORT MOUNTED IN FIRE RATED POKE THRU FITTING.
- LCX AREA LIGHTING CONTROL MODULE 0-10V DIMMING CAPABILITIES. 'X' DENOTES NUMBER OF 20A RELAYS IN MODULE. MOUNT DEVICE ABOVE ACCESSIBLE CEILING.
- RCX AREA RECEPTACLE CONTROL MODULE. 'X' DENOTES NUMBER OF 20 A RELAYS IN MODULE. MOUNT DEVICE ABOVE ACCESSIBLE CEILING.
- 924 EMERGENCY EGRESS LIGHTING DEVICE.
- CR CARD READER. REFERENCE SECURITY DRAWINGS FOR TYPICAL REQUIREMENTS FOR CARD READERS.
- SECURITY CAMERA. COORDINATE REQUIREMENTS WITH SECURITY VENDOR.

LIGHTING

NOTE: REFER TO LIGHTING SPECIFICATION 265001 FOR FIXTURE SCHEDULE.

- LIGHT FIXTURE, RECESSED IN CEILING.
- LIGHT FIXTURE, SURFACE OR PENDANT MOUNTED.
- LIGHT FIXTURE, WALL MOUNTED.
- STRIP LIGHT FIXTURE, SURFACE OR PENDANT MOUNTED.
- STRIP LIGHT FIXTURE, SURFACE MOUNTED IN ARCHITECTURAL CEILING COVE.
- STRIP LIGHT FIXTURE, SURFACE MOUNTED VERTICALLY ON WALL OR IN COVE.
- DOWNLIGHT FIXTURE, RECESSED IN CEILING.
- DOWNLIGHT/INDUSTRIAL FIXTURE, SURFACE OR PENDANT MOUNTED.
- SINGLE DIRECTIONAL, WALLWASH LIGHT FIXTURE, RECESSED IN CEILING.
- DUAL DIRECTIONAL, WALLWASH LIGHT FIXTURE, RECESSED IN CEILING.
- SINGLE DIRECTIONAL, WALLWASH LIGHT FIXTURE, SURFACE OR PENDANT MOUNTED.
- DUAL DIRECTIONAL, WALLWASH LIGHT FIXTURE, SURFACE OR PENDANT MOUNTED.
- ADJUSTABLE ACCENT LIGHT FIXTURE, RECESSED IN CEILING.
- ADJUSTABLE ACCENT LIGHT FIXTURE, SURFACE OR PENDANT MOUNTED.
- LINEAR WALLWASH LIGHT FIXTURE, RECESSED IN CEILING.
- LINEAR WALLWASH LIGHT FIXTURE, SURFACE OR PENDANT MOUNTED.
- LINEAR, MULTI-HEAD, ADJUSTABLE ACCENT LIGHT FIXTURES, RECESSED IN CEILING.
- SCONCE LIGHT FIXTURE, WALL MOUNTED.
- DECORATIVE CHANDELIER OR BOWL TYPE FIXTURE, PENDANT MOUNTED.
- J LINEAR TRACK SYSTEM WITH PLUG-IN ADJUSTABLE LIGHT FIXTURE HEADS. TRACK SHALL BE EITHER RECESSED, SURFACE OR PENDANT MOUNTED TO CEILING AS NOTED IN FIXTURE SCHEDULE.
- EXIT SIGN LIGHT FIXTURE, CEILING OR WALL MOUNTED WITH DIRECTIONAL ARROWS AS NOTED ON PLANS. WORD 'EXIT' TO BE LOCATED IN SHADED FACE(S). TYPE F9.
- COMBO EXIT SIGN AND EGRESS LIGHTING FIXTURE, CEILING OR WALL MOUNTED WITH ARROWS AS NOTED ON PLANS OR IN FIXTURE SCHEDULE.
- EMERGENCY SELF-POWERED BATTERY PACK WITH LIGHT FIXTURE HEADS AS NOTED ON PLANS OR IN FIXTURE SCHEDULE.
- HALF SHADING OF ANY FIXTURE INDICATES LIFE SAFETY/EGRESS LIGHTING.
- FULL SHADING OF ANY FIXTURE INDICATES STANDBY/CRITICAL LIGHTING.

EXTERIOR:

- SINGLE-HEAD AREA LIGHT FIXTURE WITH BRACKET ARM AND POLE, MOUNTED TO CONCRETE BASE.
- TWO-HEAD AREA LIGHT FIXTURES WITH BRACKET ARMS AND POLE, MOUNTED TO CONCRETE BASE.
- SINGLE-HEAD AREA POST-TOP LIGHT FIXTURE WITH POLE, MOUNTED TO CONCRETE BASE.
- AREA LIGHT FIXTURE, SURFACE OR RECESSED MOUNTED TO WALL.
- LIGHT FIXTURE BOLLARD, MOUNTED TO CONCRETE BASE.
- GROUND WELL MOUNTED FLUSH IN FINISHED GRADE.
- FLOODLIGHT FIXTURE, STANCHION MOUNTED ABOVE GRADE.
- LINEAR SIGN LIGHT FIXTURE, STANCHION MOUNTED ABOVE GRADE.
- STEPLIGHT FIXTURE, WALL MOUNTED.

TELECOMMUNICATION

- TELECOMMUNICATION DEVICE, IN WALL MOUNTED JUNCTION BOX AT 18" AFF. PROVIDE 2 PORT DATA JACK UNLESS OTHERWISE NOTED BY "4D" FOR 4 PORT JACKS.
- DATA REQUIRED FOR CEILING MOUNTED EQUIPMENT.

FIRE ALARM

- FATC AREA LIGHTING CONTROL MODULE 0-10V DIMMING CAPABILITIES. 'X' DENOTES NUMBER OF 20A RELAYS IN MODULE. MOUNT DEVICE ABOVE ACCESSIBLE CEILING.
- MOTOR OPERATED FIRE/SMOKE DAMPER 'FSD'. NIEC. SYMBOL DENOTES INTERFACE FOR POWER, CONTROL AND FA MONITORING. PROVIDE LOCAL POWER DISCONNECT.

RACEWAYS

- CONDUIT RUN EXPOSED ON WALL OR CEILING.
- CONDUIT RUN CONCEALED IN SLAB, UNDER SLAB OR UNDERGROUND.
- CONDUIT RUN CONCEALED IN WALL OR ABOVE CEILING.
- CONDUIT HOMERUN, CONTINUOUS RUN TO PANEL OR EQUIPMENT CABINET.
- FLEXIBLE METALLIC CONDUIT.
- CONDUIT TURNED UP
- CONDUIT TURNED DOWN.
- CONDUIT CAPPED OR STUBBED WITH INSULATED BUSHINGS.
- CONDUIT SLEEVE, WITH INSULATING BUSHINGS.
- CROSSMARKS ON BRANCH CIRCUIT CONDUIT RUNS INDICATE THE QUANTITY OF CONDUCTORS AS FOLLOWS (GROUND CONDUCTORS ARE NOT NOTED, BUT SHOULD BE INCLUDED IN EVERY CONDUIT WITH POWER CONDUCTORS):
  1. NO CROSSMARKS INDICATES TWO #12 AWG CONDUCTORS, UON.
  2. THREE TO SIX CROSSMARKS INDICATES THE QUANTITY OF #12 AWG CONDUCTORS, UON.
  3. SEVEN OR MORE CROSSMARKS INDICATES THE QUANTITY OF #10 AWG CONDUCTORS, UON.
- MULTI-OUTLET TWO PIECE SURFACE RACEWAY; TYPE, DEVICE SPACING AND MOUNTING AS NOTED ON PLANS.
- TWO PIECE SURFACE METAL RACEWAY, MOUNTED AS NOTED IN PLANS.
- CABLE TRAY, CABLE RUNWAY OR LADDER RACK SUSPENDED FROM STRUCTURE ABOVE. REFER TO PLANS FOR SIZE AND MOUNTING.
- J-HOOK

CONVENTIONS

- 1 NUMBERED NOTE, APPLIES TO ALL DRAWINGS.
- 1 NUMBERED SHEET NOTE, APPLIES TO DRAWING CONTAINING NOTES ONLY.
- 1 OVERCURRENT PROTECTIVE DEVICE SPACE IDENTIFICATION TAG. REFERS TO LOCATION OF PROTECTIVE OR CONTROL DEVICE WITHIN SWITCHBOARDS, DISTRIBUTION BOARDS, MOTOR CONTROL CENTERS, ETC.
- NAME EQUIPMENT IDENTIFICATION TAG: ITEM FURNISHED AND INSTALLED UNDER ANOTHER SECTION AND WIRED UNDER THIS SECTION.
- P2 CABLE AND/OR RACEWAY TAG, FUNCTION AS NOTED BELOW:
  P = POWER T = TELEPHONE C = COMMUNICATION
- 2004 FEEDER SIZE. REFER TO FEEDER SCHEDULE.
- DETAIL REFERENCE: A / EXX.XX — SHEET NUMBER, DETAIL DESIGNATION
- 2-F3 FIXTURE IDENTIFICATION TAG: FIXTURE TYPE, QUANTITY

ALTERNATES

1. REFERENCE ARCHITECTURAL DRAWINGS FOR DEDUCT ALTERNATE SCOPE WITHOUT BASEMENT LEVEL.

ABBREVIATIONS

A	AMPERES
AFC	ABOVE FINISHED CEILING
AFI	ARC FAULT CIRCUIT INTERRUPTER
AF	AMPERE OVERCURRENT TRIP (WHEN APPLIED TO CIRCUIT BREAKERS) OR AMPERE FUSE SIZE (WHEN APPLIED TO FUSES)
AFF	ABOVE FINISHED FLOOR
AIC	ASYMMETRIC INTERRUPTING CURRENT
AL	ALUMINUM
AT	AMPERE OVERCURRENT TRIP (WHEN APPLIED TO CIRCUIT BREAKERS)
ATS	AUTOMATIC TRANSFER SWITCH
BAS	BUILDING AUTOMATION SYSTEM
BFC	BELOW FINISHED CEILING
BOC	BACK OF CURB
BPS	BOLTED PRESSURE CONTACT SWITCH
C	CONDUIT
CCTV	CLOSED CIRCUIT TELEVISION
CL	CURRENT LIMITING CIRCUIT BREAKER OR FUSE
CP	CIRCULATION PUMP
CKT	CIRCUIT
CT	CURRENT TRANSFORMER
CU	COPPER
DF	DRINKING FOUNTAIN
DW	DISH WASHER
(E)	EXISTING TO REMAIN
EC	ELECTRICAL CONTRACTOR
EF	EXHAUST FAN
EP	EXPLOSION PROOF
EPO	EMERGENCY POWER OFF
EMCS	ENERGY MANAGEMENT CONTROL SYSTEM
EMT	ELECTRICAL METALLIC TUBING
ETD	EMERGENCY TRANSFER DEVICE
EVCS	ELECTRIC VEHICLE CHARGING STATION
EWH	ELECTRIC WATER HEATER
F	FUSED
(F)	FUTURE
FACP	FIRE ALARM CONTROL PANEL
FAJB	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
FLA	FULL LOAD AMPERES
FMC	FLEXIBLE METAL CONDUIT
FSD	FIRE/SMOKE DAMPER
FSEC	FOOD SERVICE EQUIPMENT CONTRACTOR
FRAP	FIREMAN'S REMOTE ANNUNCIATOR PANEL
G	GROUND
GB	GROUND BUS
GD	GARBAGE DISPOSAL
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
GRAP	GENERATOR REMOTE ANNUNCIATOR PANEL
GWH	GAS WATER HEATER
HPC	HIGH PRESSURE CONTACT SWITCH
HVAC	HEATING,VENTING AND AIR CONDITIONING
IMC	INTERMEDIATE METAL CONDUIT
IWH	INSTANTANEOUS OR POINT OF USE WATER HEATER
JB	JUNCTION BOX
LSCP	LIFE SAFETY CONTROL PANEL
LCP	LIGHTING CONTROL PANEL
MBGB	MAIN BUILDING GROUND BUS
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MLO	MAIN LUGS ONLY
MT	EMPTY
MTC	EMPTY CONDUIT
MTGB	MAIN TELECOM GROUND BUS
MTS	MANUAL TRANSFER SWITCH
MW	MICROWAVE
(N)	NEW
NC	NORMALLY CLOSED
NF	NON-FUSED
NIEC	NOT IN ELECTRICAL CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OC	ON CENTER
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
PDU	POWER DISTRIBUTION UNIT
PIV	POST INDICATING VALVE
PNL	PANEL
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
RF	REFRIGERATOR
(R)	EXISTING TO BE REMOVED
(RL)	RELOCATED
(RR)	REMOVE AND RELOCATE
RSC	RIGID STEEL CONDUIT
SAD	SEE ARCHITECTURAL DRAWINGS
SPD	SURGE PROTECTION DEVICE
TC	TIME CLOCK
TGB	TELECOMMUNICATIONS GROUND BUS
TP	TWISTED-PAIR
TX	TRANSFORMER
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
UR	UNDERCOUNTER REFRIGERATOR
V	VOLTS
VA	VOLTS-AMPS
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE
VM	VENDING MACHINE
W	WATTS
WAP	WIRELESS ACCESS POINT
WH	WATER HEATER
WP	WEATHERPROOF
2SP	TWO SPEED
1Ø	1 PHASE
3Ø	3 PHASE
1P	1 POLE
2P	2 POLE
3P	3 POLE
3W	3 WIRE
4W	4 WIRE

DRAWING INDEX

DRAWING NUMBER	DRAWING TITLE	ISSUE TITLE	50% CD SET	PROGRESS SET	100% CDs / PERMIT			
		DATE	06.26.14	07.25.14	08.15.14			
E0.01	ELECTRICAL SYMBOLS LIST & SHEET INDEX		●	●	●			
E0.02	NOTES AND SCHEDULES		●	●	●			
E0.03	SCHEDULES - PANEL		●	●	●			
E0.04	SCHEDULES - PANEL		●	●	●			
E0.05	SCHEDULES - LIGHTING		●	●	●			
E1.01	SITE PLAN - ELECTRICAL		●	●	●			
E1.02	EXISTING BUILDING ROUTING PLAN		●	●	●			
E2.00	BASEMENT FLOOR PLAN - POWER		●	●	●			
E2.01	1ST FLOOR PLAN - POWER		●	●	●			
E2.02	2ND FLOOR PLAN - POWER		●	●	●			
E2.03	3RD FLOOR PLAN - POWER		●	●	●			
E2.04	LOWER AND UPPER ROOF PLANS - POWER		●	●	●			
E3.00	BASEMENT FLOOR PLAN - LIGHTING		●	●	●			
E3.01	1ST FLOOR PLAN - LIGHTING		●	●	●			
E3.02	2ND FLOOR PLAN - LIGHTING		●	●	●			
E3.03	3RD FLOOR PLAN - LIGHTING		●	●	●			
E4.01	ENLARGED ELECTRICAL AND TELCOM ROOM PLANS		●	●	●			
E5.01	POWER RISER DIAGRAM		●	●	●			
E6.01	ELECTRICAL DETAILS		●	●	●			
E6.02	ELECTRICAL DETAILS		●	●	●			
E6.03	TELCOM DETAILS		●	●	●			

ISSUE KEY:

- ● ISSUED AS PART OF A SET

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% CDs / Permit	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : NONE

SHEET TITLE

ELECTRICAL SYMBOLS & SHEET INDEX

SHEET No

E0.01

GENERAL NOTES

1. INSTALL AND CONNECT A CODE SIZED INSULATED OR BARE COPPER GROUNDING CONDUCTOR IN ALL BRANCH CIRCUITS AND FEEDERS.
2. PROVIDE DEDICATED NEUTRALS FOR EVERY CIRCUIT.
3. REFER TO POWER AND SIGNAL DRAWINGS FOR THE LOCATION OF ALL PANELBOARDS.
4. FURNISH AND INSTALL ALL PANELBOARDS WITH CIRCUIT BREAKERS AS SHOWN ON PANEL SCHEDULES.
5. SUBSCRIPTS ON SWITCH SYMBOLS (Sa) DENOTE THE OUTLETS CONTROLLED.
6. ALL SHAFT PENETRATIONS SHALL COMPLY WITH 2010 CBC SECTION 708.8.1.
7. REFER TO ELECTRICAL ONE LINE DIAGRAM AND FEEDER SCHEDULE FOR THE SIZE OF CONDUITS AND CONDUCTORS BETWEEN MAJOR POWER COMPONENTS OF THE ELECTRICAL SYSTEM.
8. REFER TO MOTOR CONTROL CENTER SCHEDULES FOR SIZE AND QUANTITY OF BRANCH CIRCUIT CONDUCTOR HOMERUNS TO ALL MCC'S.
9. REFER TO TELEPHONE RISER DIAGRAM FOR TELEPHONE CLOSET INTER-CONNECTIONS AND TELEPHONE RISER CONDUIT SIZES.
10. MOUNTING HEIGHTS SHOWN ARE FROM FINISHED FLOOR TO THE CENTERLINE OF THE DEVICE. ALL MOUNTING HEIGHTS SHALL BE AS SHOWN ON THE SYMBOLS LIST UNLESS OTHERWISE NOTED ON THE PLANS OR IN THE SPECIFICATIONS.
11. AREA SHOWN CROSSHATCHED IS NOT PART OF THIS CONTRACT, UNLESS OTHERWISE NOTED.
12. CONTRACTOR IS RESPONSIBLE TO SUBMIT REVISED LAYOUT OF EQUIPMENT IN MAIN ELECTRICAL ROOM OR ELECTRICAL CLOSET FOR WRITTEN APPROVAL BY ENGINEER IF PROPOSED INSTALLATION LAYOUT DIFFERS FROM CONSTRUCTION DOCUMENTS. SUBMISSION MUST BE APPROVED PRIOR TO RELEASE OF ORDER FOR EQUIPMENT AND PRIOR TO INSTALLATION.
13. CONTRACTOR SHALL NOTIFY ARCHITECT TWO WEEKS PRIOR TO CORE DRILLING FOR FLOOR MONUMENTS TO PERMIT ON SITE VERIFICATION OF OUTLET POSITIONS. FLOOR SLAB SHALL BE MARKED TO INDICATE THE LOCATION OF EACH OUTLET PENETRATION TO ASSIST THE ARCHITECT IN PERFORMING HIS REVIEW. CORE DRILLING SHALL COMMENCE ONLY AFTER FIELD LAYOUTS HAVE BEEN REVIEWED AND APPROVED.
14. THE CONTRACTOR SHALL VISIT THE JOBSITE AND VERIFY ALL EXISTING CONDITIONS BEFORE BIDDING AND SHALL INCLUDE IN THE BID THE NECESSARY COSTS TO CONSTRUCT THIS PROJECT IN ACCORDANCE WITH THE ELECTRICAL DRAWINGS, SPECIFICATIONS AND ALL APPLICABLE CODES.
15. ALL ELECTRICAL MATERIALS AND EQUIPMENT SHALL BE LISTED BY UNDER-WRITERS LABORATORIES AND BEAR THEIR LABEL.
16. ALL MECHANICAL LINE AND LOW VOLTAGE CONTROL AND INTERLOCK WIRING SHALL BE PROVIDED UNDER DIVISION 23. THIS SHALL ALSO INCLUDE THE SHUTDOWN WIRING FROM THE FIRE ALARM OUTPUT RELAY ON ONE OF THE DUCT DETECTORS SERVING EACH AC UNIT.
17. CONTRACTOR SHALL REMOVE ALL LEFT OVER CONDUIT, WIRE, SCRAPS, ETC. AND LEAVE PREMISES CLEAN AND FREE OF TRASH OR DEBRIS RESULTING FROM HIS WORK.
18. CONTRACTOR SHALL REPORT TO THE OWNER'S ENGINEER ANY OBSERVATIONS OF CONDITIONS WHICH ARE DISCOVERED IN THE BUILDING WHICH WOULD PREVENT THE CORRECT INSTALLATION OF THE ELECTRICAL SYSTEM.
19. PROVIDE INDIVIDUAL GFCI RECEPTACLES AT EACH LOCATION SHOWN. DO NOT USE FEED-THRU GFCI TYPE RECEPTACLES. LOCATE RECEPTACLE AT END OF A BRANCH CIRCUIT WIRE.
20. WIRING SPACE IN PANELBOARDS, DISTRIBUTION PANELS AND SWITCHBOARDS SHALL NOT BE USED FOR CONDUCTOR SPLICES.
21. COORDINATE EXACT LOCATIONS OF ALL ARCHITECTURAL, MECHANICAL AND PLUMBING EQUIPMENT WITH ARCHITECTURAL, MECHANICAL AND PLUMBING PLANS & SPECIFICATIONS.
22. SIZE OVERCURRENT PROTECTION FOR ALL MECHANICAL AND PLUMBING EQUIPMENT PER THE MANUFACTURER'S INSTALLATION MANUAL.
23. ALL CONDUITS SHALL BE CONCEALED IN ALL FINISHED INTERIOR AREAS. EXPOSED CONDUIT, J-BOXES, PULL CANS AND PANELS SHALL BE PRIMED AND PAINTED PER THE ARCHITECTS PAINTING SECTION REQUIREMENTS.
24. ALL RECESSED PANELBOARDS SHALL HAVE A MINIMUM OF (4) 3/4"C., SPARES STUBBED INTO THE ACCESSIBLE CEILING SPACE, UON.
25. IN ADDITION TO THE WORK SHOWN ON THESE PLANS, THE CONTRACTOR SHALL PROVIDE ALL CONDUIT, BACK BOXES, AND RACEWAY FOR THE FIRE ALARM SYSTEM, SECURITY SYSTEM, AV SYSTEM, AND TELECOM SYSTEM IF APPLICABLE ON THIS PROJECT. PLEASE REFER THE LOW VOLTAGE SYSTEM DRAWINGS AND SPECIFICATIONS FOR BOTH DEVICE LOCATIONS, ADDITIONAL INFORMATION, AND COMPLETE SCOPE OF WORK.
26. PROVIDE POWER 120V/24V TRANSFORMER AS REQUIRED TO POWER VAV/BY-PASS DAMPERS, RESTROOM PLUMBING CONTROLS, DUCT SMOKE DETECTORS, MAGNETIC DOOR HOLDERS AND FIRE SMOKE DAMPERS FOR MECHANICAL EQUIPMENT. SEE MECHANICAL AND PLUMBING PLANS & SPECIFICATIONS FOR CONNECTION TO MECHANICAL AND PLUMBING EQUIPMENT REQUIREMENT. PROVIDE CIRCUIT FORM NEAREST AVAILABLE PANEL, UON.
27. ALL FIXTURES, PANELS AND DEVICES SHALL BE PROVIDED WITH STRUCTURAL BLOCKING, FASTERNERS AND TIES AS APPROVED BY THE DIVISION OF THE STATE ARCHITECT.
28. ALL 120V CIRCUITS 100' OR MORE IN LENGTH SHALL BE #10 AWG MINIMUM, U.O.N.
29. THE CONTRACTOR SHALL VISIT THE PROJECT SITE PRIOR TO BIDDING AND ALLOW FOR ALL FIELD CONDITIONS. OBTAIN CONTRACT DOCUMENTS FOR ALL OTHER TRADES AND BE RESPONSIBLE FOR ALL ELECTRICAL WORK NOTED AND CALLED OUT ON THE CONTRACT DOCUMENTS. COORDINATE ELECTRICAL WORK WITH ALL OTHER TRADES ON PROJECT. COORDINATE ALL CONDUIT RUNS, ELECTRICAL EQUIPMENT AND PANEL LOCATIONS WITH ALL OTHER WORK TO AVOID CONFLICTS.
30. COMPLY WITH ALL APPLICABLE CODES AND REGULATIONS. MATERIALS AND EQUIPMENT SHALL BE U.L. AND CALIFORNIA STATE FIRE MARSHAL (CSFM) LISTED AND LABELED FOR THE APPLICATION.
31. BEFORE BEGINNING CONSTRUCTION, PROVIDE TO THE ARCHITECT A CONSTRUCTION SCHEDULE OF ELECTRICAL WORK. THE CONSTRUCTION SCHEDULE SHALL IDENTIFY ALL SIGNIFICANT MILESTONES WITH COMPLETION DATES.
32. OBTAIN AND PAY FOR ALL PERMITS, LICENSES AND INSPECTION FEES REQUIRED BY THIS CONTRACT WORK, UNLESS OTHERWISE NOTED.
33. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY OF PERSONS AND PROPERTY AND SHALL PROVIDE INSURANCE COVERAGE AS NECESSARY FOR LIABILITY, PERSONAL, PROPERTY DAMAGE. TO FULLY PROTECT THE OWNER, ARCHITECT AND ENGINEER FROM ANY AND ALL CLAIMS RESULTING FROM THIS WORK.
34. MAINTAIN RECORD DRAWINGS AT THE PROJECT SITE INDICATING ALL MODIFICATIONS TO ELECTRICAL SYSTEMS. AT THE CONCLUSION OF THE PROJECT, PROVIDE ACCURATE "AS-BUILT" DRAWINGS ACCEPTABLE TO THE ARCHITECT.
35. ALL MATERIALS PROVIDED FOR THE PROJECT SHALL BE NEW, UNLESS OTHERWISE NOTED. PROVIDE ALL INCIDENTAL MATERIALS REQUIRED FOR A COMPLETE INSTALLATION.
36. PROVIDE ALL REQUIRED "CUTTING, PATCHING, BACK FILL AND REPAIRS" NECESSARY TO RESTORE DAMAGED SURFACES TO EQUAL OR BETTER THAN ORIGINAL CONDITIONS EXISTING AT START OF WORK.
37. ALL ELECTRICAL EQUIPMENT INSTALLED OUTDOORS SHALL BE WEATHERPROOF. EXTERIOR CONDUIT RUNS INTO BUILDINGS SHALL BE INSTALLED WITH FLASHING, CAULKED AND SEALED. CONDUITS FOR EXTERIOR ELECTRICAL DEVICES SHALL BE RUN INSIDE BUILDING, UNLESS OTHERWISE NOTED. UNDERGROUND AND EXTERIOR CONDUIT SHALL HAVE WATERTIGHT FITTINGS.
38. ALL CONDUITS SHALL BE A MINIMUM 3/4," UNLESS OTHERWISE NOTED. POWER AND LIGHTING BRANCH CIRCUITS SHALL HAVE A MINIMUM TWO (2) #12 AWG AND ONE (1) #12 AWG GROUND TYPE THWN/THHN. ALL POWER WIRING SHALL BE RUN IN CONDUIT. THE USE OF ROMEX (NMC) OR BX (AC) CABLE IS NOT PERMITTED. PROVIDE ALL WIRES AND WIRE SIZES REQUIRED BY LATEST CODES.
39. CONDUITS SHALL NOT BE USED AS A GROUND PATH. ALL CONDUITS SHALL CONTAIN A GROUNDING CONDUCTOR, SIZED PER NEC/CEC REQUIREMENTS.
40. THERE SHALL BE NO ROOF PENETRATIONS WITHIN 5'-0" OF FIRE RATED OR AREA SEPARATION WALLS. VERIFY EXACT LOCATIONS OF THESE WALLS WITH ARCHITECTURAL DRAWINGS.
41. INCLUDE UTILITY COMPANY'S "CONTRACT-DOCUMENTS" WITH THE BID. REMAIN IN CONTACT WITH THE UTILITY COMPANY'S ENGINEERING DEPARTMENT THROUGHOUT THE PROJECT TO INSURE COORDINATION AND SCHEDULING OF WORK.
42. PROVIDE A PULL CORD IN EVERY EMPTY CONDUIT FOR USE IN FUTURE CONSTRUCTION.
43. VERIFY ALL VOLTAGES OF MECHANICAL EQUIPMENT WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN.
44. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SITE LOCATING ALL EXISTING UNDED-GROUND SYSTEMS IN THE AREA OF UNDER GROUND WORK. REPAIR ALL DAMAGED SYSTEMS TO OWNERS SATISFACTION. MAINTAIN EXTREME CARE DURING TRENCHING AS EXISTING SYSTEMS ARE KNOWN TO EXIST IN THE AREA. THE DRAWINGS AND SPECIFICATIONS ARE FOR THE ASSISTANCE AND GUIDANCE OF THE CONTRACTOR. EXACT LOCATIONS, DISTANCES AND ELEVATIONS WILL BE GOVERNED BY ACTUAL CONDITIONS. COORDINATE THE CONTRACT DOCUMENTS AND FIELD CONDITIONS TO DETERMINE EXACT ROUTING AND FINAL TERMINATIONS FOR ALL WORK.
45. CONDUIT AND WIRING ARE SHOWN ON THESE PLANS DIAGRAMMATICALLY. EXACT LOCATIONS SHALL BE DETERMINED IN THE FIELD TO SUIT SITE CONDITIONS.
46. SEISMIC ANCHORAGE OF ALL ELECTRICAL EQUIPMENT SHALL BE PROVIDED IN ACCORDANCE WITH TITLE 24, CBC
47. PLANS SHALL BE APPROVED BY THE "DIVISION OF THE STATE ARCHITECT" (DSA) PRIOR TO BEGINNING WORK. SUBMIT SHOP DRAWINGS TO THE ENGINEER FOR REVIEW PRIOR TO PURCHASE.
48. SUFFICIENT ACCESS AND WORKING SPACE SHALL BE PROVIDED AND MAINTAINED ABOUT ALL ELECTRIC EQUIPMENT TO PERMIT READY AND SAFE CORPERATION AND MAINTENANCE OF SUCH EQUIPMENT PER CEC ARTICLE 110-26.
49. PROVIDE DEDICATED CONDUIT/PATHWAYS FOR ALL 0-10v LIGHTING CONTROL SIGNALS SEPARATE FROM ALL LINE VOLTAGE RACEWAY.
50. PROVIDE SEPARATE DLM CONDUIT RACEWAY FOR THE LOW VOLTAGE LIGHTING CONTROL SIGNAL WIRING FROM ALL LINE VOLTAGE RACEWAY.
51. ALL INDOOR FLOOR MOUNTED ELECTRICAL EQUIPMENT SHALL HAVE A 4" HOUSEKEEPING PAD. ALL OUTDOOR ELECTRICAL EQUIPMENT SHALL HAVE A 6" HOUSEKEEPING PAD.
52. OFFSET ALL RECESSED JUNCTION BOXES BY A MINIMUM OF 16" IN WALLS WITH SOUND ISOLATION.

CIRCUITING NOTES

1. CONTRACTOR IS RESPONSIBLE FOR PROVIDING RACEWAYS, BOXES AND CONDUCTORS FOR ALL LIGHTING, POWER, SIGNAL AND CONTROL SYSTEMS ON THE PROJECT.

CONDUIT NOTES

C1. ALL CONDUIT AND RACEWAY PENETRATIONS THROUGH FIRE RATED WALLS AND FLOORS SHALL BE SEALED TO MAINTAIN THE FIRE SEPARATION RATING.

C2. CONDUITS IMBEDDED IN SLABS SHALL BE NO LARGER THAN 1-1/4" TRADE SIZE OR 1/3 OF SLAB DEPTH, WHICHEVER IS SMALLER. SPACE CONDUIT 5" APART (CENTER-TO-CENTER). COORDINATE LOCATION WITHIN SLAB WITH STRUCTURAL ENGINEER PRIOR TO INSTALLATION.

C3. REFER TO STRUCTURAL DRAWINGS FOR CONDUIT INSTALLATION REQUIREMENTS AND LIMITATIONS AT FOOTINGS AND FOR CONDUIT RUNS IN OR THROUGH CONCRETE SLABS, JOISTS AND BEAMS.

C4. ALL CONDUITS CROSSING EXPANSION JOINTS SHALL BE PROVIDED WITH SPECIFIED EXPANSION/DEFLECTION FITTINGS.

C5. INSTALL A POLYETHYLENE PULLING ROPE IN ALL EMPTY CONDUITS.

C6. ALL TELCOM CONDUITS SHALL BE 1.25" MIN. AND TERMINATE IN A 5 SQ. PRE-GALVANIZED STEEL TELCOM BOX WITH CABLE MANAGEMENT POSTS. 2-7/8" DEEP. (T&B #821811T-1-114, UPC#78599107263)

LIGHTING NOTES

L1. REFER TO LIGHTING SPECIFICATION 265001 FOR FIXTURE SCHEDULE.

L2. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATION OF CEILING MOUNTED LIGHT FIXTURES AND LIFE SAFETY DEVICES. THESE DRAWINGS INDICATE APPROXIMATE LOCATIONS ONLY.

L3. REFER TO ARCHITECTURAL ELEVATIONS FOR EXACT LOCATIONS OF WALL MOUNTED LIGHT FIXTURES. THESE DRAWINGS INDICATE APPROXIMATE LOCATIONS ONLY.

L4. SEE ARCHITECTURAL DOCUMENTS FOR EXACT PLACEMENT OF ALL LIGHT FIXTURES, EXPOSED CONTROL DEVICES AND LIGHT SWITCHES. VERIFY CEILING TYPE WITH ARCHITECTURAL DOCUMENTS AND COORDINATE TRIMS. PROVIDE ALL REQUIRED FIXTURE MOUNTING HARDWARE. COORDINATE FIXTURE TYPES WITH MOUNTING SURFACE PRIOR TO ORDERING.

L5. PENDANT FIXTURES SHALL BE FREE TO SWING A MINIMUM OF 45 DEGREES FROM THE VERTICAL IN ALL DIRECTIONS WITHOUT CONTACTING OBSTRUCTIONS, OTHERWISE PROVIDE SEISMIC RESTRAINT.

L6. RUN ALL INTERIOR CONDUIT IN FINISHED INTERIOR AREAS CONCEALED UNLESS OTHERWISE NOTED.

L7. PROVIDE U.L. LISTED FIRE STOP ENCLOSURES FOR ALL RECESSED FIXTURES IN FIRE RATED CEILINGS.

L8. PROVIDE SINGLE PLATE WALL COVER FOR MULTIPLE SWITCHES. SEE DRAWINGS FOR NUMBER OF SWITCHES IN SPECIFIC LOCATIONS.

L9. SEE 277V SHEETS FOR LIGHT FIXTURE MOUNTING DETAILS.

L10. ALL CIRCUITS GREATER THAN 200' IN LENGTH SHALL BE #10 AWG MINIMUM, U.O.N.

L11. CEILING MOUNTED OCCUPANCY SENSORS ARE SHOWN TO INDICATE DESIGN INTENT. FULL SHOP DRAWINGS ARE REQUIRED INDICATING ALL REQUIRED COMPONENTS; POWER PACKS AND CONNECTIONS.

SITE NOTES

S1. DRAWINGS INDICATE GENERAL ARRANGEMENT OF SYSTEMS AND WORK. FOLLOW DRAWINGS IN LAYING OUT WORK AND CHECK DRAWINGS OF OTHER TRADES TO VERIFY SPACE CONDITIONS. FINAL LOCATIONS SHALL BE ADJUSTED TO MEET FIELD CONDITIONS AND THE REQUIREMENTS OF PGE CO., THE TELEPHONE CO. ATT AND THE ELECTRICAL INSPECTOR.

S2. COORDINATE ALL INCOMING ELECTRICAL SERVICE WORK WITH CAMPUS FACILITIES PRIOR TO INSTALLATION.

S3. COORDINATE ALL INCOMING TELEPHONE SERVICE WORK WITH IST PRIOR TO INSTALLATION.

S4. PRIMARY SERVICE ENTRANCE CONDUIT(S) SHALL BE FURNISHED AND INSTALLED UNDER THIS CONTRACT. SIZE, NUMBER AND TERMINATION POINT OF CONDUITS SHALL BE VERIFIED WITH UCB, CABLE FURNISHED, INSTALLED AND TERMINATED BY ATT.

S5. POURED-IN-PLACE OR PRECAST CONCRETE UTILITY TRANSFORMER PAD SHALL BE FURNISHED AND INSTALLED BY CONTRACTOR. PAD SHALL CONFORM TO PGE STANDARD DETAILS AND SPECIFICATIONS.

S6. REFER TO LANDSCAPE ARCHITECT'S DRAWINGS FOR EXACT LOCATION OF STREET LIGHTING FIXTURES, LIGHT BOLLARDS, BENCH LIGHTS, STEP LIGHTS, WELL LIGHTS, TREE UP-LIGHTS, IRRIGATION CONTROLLERS, PULLBOXES, ETC.

S7. CONDUIT SHALL NOT BE RUN THROUGH FOUNTAIN POOL SLABS, EQUIPMENT ROOMS CEILINGS, WALLS OR FLOORS OR THROUGH ANY WATERPROOF MEMBRANE UNLESS SPECIFICALLY INDICATED ON PLANS. INSTALL WATERTIGHT CONDUCT ENTRANCE SEALS ON ALL CONDUIT RUNS PENETRATING EQUIPMENT ROOM WALLS, FLOORS OR CEILINGS.

S8. PRIOR TO COMMENCING TRENCHING OPERATIONS, CONTACT THE UTILITIES UNDERGROUND SERVICE ALERT BUREAU AND DETERMINE THE EXACT LOCATION OF ANY EXISTING UTILITY LINES WHICH MIGHT BE DAMAGED DURING THE INSTALLATION OF THIS WORK. HAND TRENCH, BACKFILL AND COMPACT IN AREAS OF EXISTING UTILITY LINES TO AVOID DAMAGE TO SAME.

S9. SIZE PULLBOXES TO MINIMUM CODE REQUIREMENTS. OBTAIN THE LANDSCAPE ARCHITECTS APPROVAL OF ANY PULLBOX(ES) ADDED TO FACILITATE THE INSTALLATION OF CONDUITS SHOWN ON THE PLANS.

S10. ALL WORK SHALL BE LOCATED IN PUBLIC UTILITY EASEMENT. EQUIPMENT AND DUCT BANKS IN GENERAL ARE SHOWN LOCATED IN EASEMENTS. CONTRACTOR SHALL REFER TO EASEMENT DRAWINGS DURING CONSTRUCTION TO MAINTAIN ALL EQUIPMENT AND DUCTS WITHIN EASEMENTS.

S11. COORDINATE LOCATIONS OF ALL SITE PULLBOXES, TRANSFORMER PADS AND TRENCHING WITH LANDSCAPE ARCHITECT PRIOR TO INSTALLATION. UTILITY LINES SHALL BE A MINIMUM OF 10'-0" AWAY FROM TREE LOCATIONS.

EQUIPMENT NOTES

E1. VERIFY THE EXACT LOCATION OF ALL MECHANICAL PUMP AND FAN MOTORS, SPRINKLER VALVE MONITORS AND FLOW SWITCHES, DUCT SMOKE DETECTORS, CONTROLS DEVICES, ETC. PRIOR TO DETERMINING CONDUIT TERMINATION POINTS.

COPPER FEEDER SCHEDULE

FEEDER TAG	FEEDER DESCRIPTION	CONDUIT	CONDUCTORS PHASE/NEUTRAL	CONDUCTORS GROUND	REMARKS
16004	1600 AMP,3 PHASE,4 WIRE	5–3.00"	5 SETS OF 4 #400 KCMIL	1 #4/0 PER SET	–
16003	1600 AMP,3 PHASE,3 WIRE	5–3.00"	5 SETS OF 3 #400 KCMIL	1 #4/0 PER SET	–
14004	1400 AMP,3 PHASE,4 WIRE	4–3.50"	4 SETS OF 4 #500 KCMIL	1 #4/0 PER SET	–
14003	1400 AMP,3 PHASE,3 WIRE	4–3.50"	4 SETS OF 3 #500 KCMIL	1 #4/0 PER SET	–
12004K	1200 AMP,3 PHASE,4 WIRE	4–3.00"	4 SETS OF 3 #400 KCMIL, 2 #400 KCMIL NEU.	1 #3/0 PER SET	1
12004	1200 AMP,3 PHASE,4 WIRE	4–3.00"	4 SETS OF 4 #350 KCMIL	1 #3/0 PER SET	–
12003	1200 AMP,3 PHASE,3 WIRE	4–2.50"	4 SETS OF 3 #350 KCMIL	1 #3/0 PER SET	–
10004	1000 AMP,3 PHASE,4 WIRE	3–3.00"	3 SETS OF 4 #400 KCMIL	1 #2/0 PER SET	–
10003	1000 AMP,3 PHASE,3 WIRE	3–3.00"	3 SETS OF 3 #400 KCMIL	1 #2/0 PER SET	–
9004K	900 AMP,3 PHASE,4 WIRE	3–3.00"	3 SETS OF 3 #400 KCMIL, 2 #400 KCMIL NEU.	1 #2/0 PER SET	1
8004K	800 AMP,3 PHASE,4 WIRE	3–3.00"	3 SETS OF 3 #350 KCMIL, 2 #350 KCMIL NEU.	1 #1/0 PER SET	1
8004	800 AMP,3 PHASE,4 WIRE	3–3.00"	3 SETS OF 4 #300 KCMIL	1 #1/0 PER SET	–
8003	800 AMP,3 PHASE,3 WIRE	3–2.50"	3 SETS OF 3 #300 KCMIL	1 #1/0 PER SET	–
7004	700 AMP,3 PHASE,4 WIRE	2–3.50"	2 SETS OF 4 #500 KCMIL	1 #1/0 PER SET	–
7003	700 AMP,3 PHASE,3 WIRE	2–3.00"	2 SETS OF 3 #400 KCMIL	1 #1/0 PER SET	–
6004K	600 AMP,3 PHASE,4 WIRE	2–3.00"	2 SETS OF 3 #400 KCMIL, 2 #400 KCMIL NEU.	1 #1 PER SET	1
6004	600 AMP,3 PHASE,4 WIRE	2–3.00"	2 SETS OF 4 #350 KCMIL	1 #1 PER SET	–
6003	600 AMP,3 PHASE,3 WIRE	2–2.50"	2 SETS OF 3 #350 KCMIL	1 #1 PER SET	–
5004K	500 AMP,3 PHASE,4 WIRE	2–3.00"	2 SETS OF 3 #300 KCMIL, 2 #300 NEU.	1 #2 PER SET	1
5004	500 AMP,3 PHASE,4 WIRE	2–2.50"	2 SETS OF 4 #250 KCMIL	1 #2 PER SET	–
5003	500 AMP,3 PHASE,3 WIRE	2–2.00"	2 SETS OF 3 #250 KCMIL	1 #2 PER SET	–
4504K	450 AMP,3 PHASE,4 WIRE	2–2.50"	2 SETS OF 3 #250 KCMIL, 2 #250 NEU.	1 #2 PER SET	1
4504	450 AMP,3 PHASE,4 WIRE	2–2.50"	2 SETS OF 4 #4/0	1 #2 PER SET	–
4503	450 AMP,3 PHASE,3 WIRE	2–2.00"	2 SETS OF 3 #4/0	1 #2 PER SET	–
4004K	400 AMP,3 PHASE,4 WIRE	2–2.50"	2 SETS OF 3 #4/0 KCMIL, 2 #4/0 KCMIL NEU.	1 #2 PER SET	1
4004	400 AMP,3 PHASE,4 WIRE	1–3.50"	4 #500 KCMIL	1 #2	–
4003	400 AMP,3 PHASE,3 WIRE	1–3.00"	3 #500 KCMIL	1 #2	–
3504K	350 AMP,3 PHASE,4 WIRE	2–2.50"	2 SETS OF 3 #3/0 1 #500 KCMIL NEU.	1 #2 PER SET	1
3504	350 AMP,3 PHASE,4 WIRE	1–3.00"	4 #400 KCMIL	1 #2	–
3503	350 AMP,3 PHASE,3 WIRE	1–2.50"	3 #400 KCMIL	1 #2	–
3004K	350 AMP,3 PHASE,4 WIRE	1–3.00"	3 #400 KCMIL, 2 #400 KCMIL NEU.	1 #4	1
3004	300 AMP,3 PHASE,4 WIRE	1–3.00"	4 #350 KCMIL	1 #4	–
3003	300 AMP,3 PHASE,3 WIRE	1–2.50"	3 #350 KCMIL	1 #4	–
2754	275 AMP,3 PHASE,4 WIRE	1–3.00"	4 #300 KCMIL	1 #4	–
2753	275 AMP,3 PHASE,3 WIRE	1–2.50"	3 #300 KCMIL	1 #4	–
2504K	250 AMP,3 PHASE,4 WIRE	1–3.00"	3 #300 KCMIL, 2 #300 NEU.	1 #4	1
2504	250 AMP,3 PHASE,4 WIRE	1–2.50"	4 #250 KCMIL	1 #4	–
2503	250 AMP,3 PHASE,3 WIRE	1–2.00"	3 #250 KCMIL	1 #4	–
2254K	225 AMP,3 PHASE,4 WIRE	1–2.50"	3 #250 KCMIL, 2 #250 NEU.	1 #4	1
2254	225 AMP,3 PHASE,4 WIRE	1–2.50"	4 #4/0	1 #4	–
2253	225 AMP,3 PHASE,3 WIRE	1–2.00"	3 #4/0	1 #4	–
2004K	200 AMP,3 PHASE,4 WIRE	1–2.50"	3 #4/0 KCMIL 2 #4/0 KCMIL NEU.	1 #6	1
2004	200 AMP,3 PHASE,4 WIRE	1–2.00"	4 #3/0	1 #6	–
2003	200 AMP,3 PHASE,3 WIRE	1–2.00"	3 #3/0	1 #6	–
1754K	175 AMP,3 PHASE,4 WIRE	1–3.00"	3 #3/0, 1 #500 KCMIL NEU.	1 #6	1
1754	175 AMP,3 PHASE,4 WIRE	1–2.00"	4 #2/0	1 #6	–
1753	175 AMP,3 PHASE,3 WIRE	1–1.50"	3 #2/0	1 #6	–
1504K	150 AMP,3 PHASE,4 WIRE	1–2.50"	3 #2/0 AWG, 1 #400 KCMIL NEU.	1 #6	1
1504	150 AMP,3 PHASE,4 WIRE	1–1.50"	4 #1/0	1 #6	–
1503	150 AMP,3 PHASE,3 WIRE	1–1.50"	3 #1/0	1 #6	–
1254	125 AMP,3 PHASE,4 WIRE	1–1.50"	4 #1	1 #6	–
1253	125 AMP,3 PHASE,3 WIRE	1–1.25"	3 #1	1 #6	–
1004K	100 AMP,3 PHASE,4 WIRE	1–2.00"	3 #2 AWG, 1 #4/0 AWG NEU.	1 #8	1
1004	100 AMP,3 PHASE,4 WIRE	1–1.25"	4 #2	1 #8	–
1003	100 AMP,3 PHASE,3 WIRE	1–1.25"	3 #2	1 #8	–
904	90 AMP,3 PHASE,4 WIRE	1–1.25"	4 #2	1 #8	–
903	90 AMP,3 PHASE,3 WIRE	1–1.25"	3 #2	1 #8	–
804	80 AMP,3 PHASE,4 WIRE	1–1.25"	4 #4	1 #8	–
803	80 AMP,3 PHASE,3 WIRE	1–1.00"	3 #4	1 #8	–
704	70 AMP,3 PHASE,4 WIRE	1–1.25"	4 #4	1 #8	–
703	70 AMP,3 PHASE,3 WIRE	1–1.00"	3 #4	1 #8	–
604K	60 AMP,3 PHASE,4 WIRE	1–1.50"	3 #4 AWG 1 #1 AWG NEU.	1 #10	1
604	60 AMP,3 PHASE,4 WIRE	1–1.25"	4 #6	1 #10	–
603	60 AMP,3 PHASE,3 WIRE	1–1.00"	3 #6	1 #10	–
504K	50 AMP,3 PHASE,4 WIRE	1–1.25"	3 #6 AWG, 1 #2 AWG NEU.	1 #10	1
504	50 AMP,3 PHASE,4 WIRE	1–1.00"	4 #8	1 #10	–
503	50 AMP,3 PHASE,3 WIRE	1–0.75"	3 #8	1 #10	–
404K	40 AMP,3 PHASE,4 WIRE	1–1.00"	3 #8 AWG 1 #3 AWG NEU.	1 #10	1
404	40 AMP,3 PHASE,4 WIRE	1–0.75"	4 #8	1 #10	–
403	40 AMP,3 PHASE,3 WIRE	1–0.75"	3 #8	1 #10	–
304K	30 AMP,3 PHASE,4 WIRE	1–0.75"	3 #10 AWG 1 #6 AWG NEU.	1 #10	1
304	30 AMP,3 PHASE,4 WIRE	1–0.75"	4 #10	1 #10	–
303	30 AMP,3 PHASE,3 WIRE	1–0.75"	3 #10	1 #10	–
204	20 AMP,3 PHASE,4 WIRE	1–0.50"	4 #12	1 #12	–
203	20 AMP,3 PHASE,3 WIRE	1–0.50"	3 #12	1 #12	–
154	15 AMP,3 PHASE,4 WIRE	1–0.50"	4 #12	1 #12	–
153	15 AMP,3 PHASE,3 WIRE	1–0.50"	3 #12	1 #12	–

FEEDER SCHEDULE GENERAL NOTES:

1. CONDUCTORS AND CONDUITS SHOWN IN THIS SCHEDULE ARE BASED ON COPPER CONDUCTORS WITH DUAL RATED THHN/THWN–2 INSULATION AT 90° C, AND AMBIENT TEMPERATURE OF 30° C (86° F).
2. FEEDERS CONSISTING OF MULTIPLE SETS OF CONDUCTORS AND CONDUITS ARE TO BE PROVIDED WITH THE INDICATED SIZE GROUND CONDUCTOR IN EACH CONDUIT. NEUTRALS NOTED SHALL BE PER SET.

FEEDER SCHEDULE REMARK:

(1) 200% OVERSIZED NEUTRAL FOR SERVICE FROM K–13 RATED TRANSFORMERS.

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% CDs / Permit	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : NONE

SHEET TITLE

NOTES AND SCHEDULES

SHEET No

E0.02

PROJECT: **JACOB HALL**

LOCATION: **ELEC RM**

PANEL - HBAL

LOAD SERVED	Load(KVA) Ltg	Rec	Oth Tot	C. B. Amp	Pole		A	B	C		C. B. Amp	Pole	Load(KVA) Ltg	Rec	Oth Tot	LOAD SERVED
LTG BASEMENTCAD LAB	2.1			20	1	1	*			2	20	1	3.5			1ST FL STUDIO
LTG BASEMENT SUPPORT SPACS	0.6			20	1	3		*		4	20	1				SPARE
SPARE				20	1	5			*	6	20	1	1.6			1ST FL SUPPORT
SPARE				20	1	7	*			8	20	1	1.6			3RD FL SUPPORT
2ND FL STUDIO	3.5			20	1	9		*		10	20	1	3.5			3RD FL STUDIO
2ND FL SUPPORT	1.6			20	1	11			*	12	20	1	1.0			3RD FL STUDIO SOFFIT LIGHT
SPARE				20	1	13	*			14	20	1				SPARE
SPARE				20	1	15		*		16	20	1				SPARE
EXTERIOR	0.2			20	1	17			*	18	20	1				SPARE
SPARE				20	1	19	*			20	20	1				SPARE
SPARE				20	1	21		*		22	20	1				SPARE
INVERTER FOR EGRESS LTG	4.0			30	1	23			*	24	20	1				SPARE
SPARE				20	1	25	*			26	20	1				SPARE
SPARE				20	1	27		*		28	20	1				SPARE
SPARE				20	1	29			*	30	20	1				SPARE
SPARE				20	1	31	*			32	20	1				SPARE
SPARE				20	1	33		*		34	20	1				SPARE
SPARE				20	1	35			*	36	20	1				SPARE
SPARE				20	1	37	*			38	20	1				SPARE
SPARE				20	1	39		*		40	20	1				SPARE
SPARE				20	1	41			*	42	20	1				SPARE
TOTALS ---------->	12.0												11.2			<-------- TOTALS

VOLTAGE:	**277/480V, 3Ø, 4W**				
S.C.A.:	**14K AIC RMS SYM.**				
MOUNTING:	**SURFACE**				
BUS SIZE:	**100A BUSING**				
MAINS:	**100A MAIN BKR.**				

Connected Load (KVA): 23.2 — Demand Factor: 100% OF LOAD; CEC 220-14(I); CEC 220-56; CEC 620-14; CEC 517.73(A); 1.0 + 25% Largest; 1.0 — Demand Load: 23.2 — Load Description: <------ Lighting; <------ Receptacles; <------ Kitchen; <------ Elevator; <------ X-Ray; <------ Mech; <------ Other

23.2 KVA — 23.2 KVA, +25% Spare — 27.9 Amps, 34.9 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	7	8	8
%	31%	33%	36%
AMP	26	27	30

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **ELECT RM**

PANEL - HBAM

LOAD SERVED	Load(KVA) Ltg	Rec	Oth Tot	C. B. Amp	Pole		A	B	C		C. B. Amp	Pole	Load(KVA) Ltg	Rec	Oth Tot	LOAD SERVED
IWH-1 1ST FL MENS RM			4.0	20	1	1	*			2		---			6.7	--
IWH-1 1ST FL WOMENS RM			4.0	20	1	3		*		4	30	3			6.7	IWH-2 1ST FL LOUNGE
IWH-1 2ND FL MENS RM			4.0	20	1	5			*	6		---			6.7	---
IWH-1 2ND FL WOMENS RM			4.0	20	1	7	*			8		---			6.7	---
IWH-1 3RD FL MENS RM			4.0	20	1	9		*		10	30	3			6.7	IWH-2 2ND FLOOR LOUNGE
IWH-1 3RD FL WOMENS RM			4.0	20	1	11			*	12		---			6.7	--
IWH-4 STUDIO SINK 1W			9.0	50	1	13	*			14		---			6.7	--
IWH-4 STUDIO SINK 2W			9.0	50	1	15		*		16	30	3			6.7	IWH-2 3RD FL LOUNGE
IWH-4 STUDIO SINK 3W			9.0	50	1	17			*	18		---			6.7	--
IWH-4 STUDIO SINK 1E			9.0	50	1	19	*			20		---			8.0	---
IWH-4 STUDIO SINK 2E			9.0	50	1	21		*		22	40	3			8.0	IWH-3 2ND FL MOP SINK
IWH-4 STUDIO SINK 3E			9.0	50	1	23			*	24		---			8.0	---
SPARE				20	1	25	*			26		---			8.0	---
SPARE				20	1	27		*		28	40	3			8.0	IWH-3 3RD MOP SINK
SPARE				20	1	29			*	30		---			8.0	---
SPARE				20	1	31	*			32	20	1				SPARE
SPARE				20	1	33		*		34	20	1				SPARE
SPARE				20	1	35			*	36	20	1				SPARE
---			3.0		---	37	*			38	20	1				SPARE
AHU-1 -CONFIRM VOLTAGE			3.0	25	3	39		*		40	20	1				SPARE
			3.0		---	41			*	42	20	1				SPARE
TOTALS ---------->			87.0												108.3	<-------- TOTALS

VOLTAGE:	**277/480V, 3Ø, 4W**				
S.C.A.:	**14K AIC RMS SYM.**				
MOUNTING:	**SURFACE**				
BUS SIZE:	**400A BUSING**				
MAINS:	**MAIN LUGS ONLY**				

Connected Load (KVA): 195.3 — Demand Factor: 100% OF LOAD; CEC 220-14(I); CEC 220-56; CEC 620-14; CEC 517.73(A); 1.0 + 25% Largest; 1.0 — Demand Load: ### — Load Description: <------ Lighting; <------ Receptacles; <------ Kitchen; <------ Elevator; <------ X-Ray; <------ Mech; <------ Other

195.3 KVA — ### KVA, +25% Spare — 242.2 Amps, 302.8 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	65	65	65
%	33%	33%	33%
AMP	235	235	235

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **ELECT RM**

PANEL - HBAM

LOAD SERVED	Load(KVA) Ltg	Rec	Oth Tot	C. B. Amp	Pole		A	B	C		C. B. Amp	Pole	Load(KVA) Ltg	Rec	Oth Tot	LOAD SERVED
IWH-1 1ST FL MENS RM			4.0	20	1	1	*			2		---			6.7	--
IWH-1 1ST FL WOMENS RM			4.0	20	1	3		*		4	30	3			6.7	IWH-2 1ST FL LOUNGE
IWH-1 2ND FL MENS RM			4.0	20	1	5			*	6		---			6.7	---
IWH-1 2ND FL WOMENS RM			4.0	20	1	7	*			8		---			6.7	---
IWH-1 3RD FL MENS RM			4.0	20	1	9		*		10	30	3			6.7	IWH-2 2ND FLOOR LOUNGE
IWH-1 3RD FL WOMENS RM			4.0	20	1	11			*	12		---			6.7	--
IWH-4 STUDIO SINK 1W			9.0	50	1	13	*			14		---			6.7	--
IWH-4 STUDIO SINK 2W			9.0	50	1	15		*		16	30	3			6.7	IWH-2 3RD FL LOUNGE
IWH-4 STUDIO SINK 3W			9.0	50	1	17			*	18		---			6.7	--
IWH-4 STUDIO SINK 1E			9.0	50	1	19	*			20		---			8.0	---
IWH-4 STUDIO SINK 2E			9.0	50	1	21		*		22	40	3			8.0	IWH-3 2ND FL MOP SINK
IWH-4 STUDIO SINK 3E			9.0	50	1	23			*	24		---			8.0	---
SPARE				20	1	25	*			26		---			8.0	---
SPARE				20	1	27		*		28	40	3			8.0	IWH-3 3RD MOP SINK
SPARE				20	1	29			*	30		---			8.0	---
SPARE				20	1	31	*			32	20	1				SPARE
SPARE				20	1	33		*		34	20	1				SPARE
SPARE				20	1	35			*	36	20	1				SPARE
---			3.0		---	37	*			38	20	1				SPARE
AHU-1 -CONFIRM VOLTAGE			3.0	25	3	39		*		40	20	1				SPARE
			3.0		---	41			*	42	20	1				SPARE
TOTALS ---------->			87.0												108.3	<-------- TOTALS

VOLTAGE:	**277/480V, 3Ø, 4W**				
S.C.A.:	**14K AIC RMS SYM.**				
MOUNTING:	**SURFACE**				
BUS SIZE:	**400A BUSING**				
MAINS:	**MAIN LUGS ONLY**				

Connected Load (KVA): 195.3 — Demand Factor: 100% OF LOAD; CEC 220-14(I); CEC 220-56; CEC 620-14; CEC 517.73(A); 1.0 + 25% Largest; 1.0 — Demand Load: ### — Load Description: <------ Lighting; <------ Receptacles; <------ Kitchen; <------ Elevator; <------ X-Ray; <------ Mech; <------ Other

195.3 KVA — ### KVA, +25% Spare — 242.2 Amps, 302.8 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	65	65	65
%	33%	33%	33%
AMP	235	235	235

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **ELEC RM**

PANEL - LBAM

LOAD SERVED	Load(KVA) Ltg	Rec	Oth Tot	C. B. Amp	Pole		A	B	C		C. B. Amp	Pole	Load(KVA) Ltg	Rec	Oth Tot	LOAD SERVED
ROOF EF-2			1.8	30	1	1	*			2	20	1			1.2	3RD FL MEETING RM EF-4
ROOF REC		0.4		20	1	3		*		4	20	1			1.2	3RD FL MEETING RM EF-8
ROOF EF-5			1.0	20	1	5			*	6	20	1				SPARE
SPARE				20	1	7	*			8	20	1			0.6	1ST FL MENS RM EF-1
SPARE				20	1	9		*		10	20	1				SPARE
SPARE				20	1	11			*	12	20	1				SPARE
ROOF EF-7			1.0	20	1	13	*			14	20	1			0.5	1ST FSD
SPARE				20	1	15		*		16	20	1			0.5	2nd FSD
SPARE				20	1	17			*	18	20	1			0.3	3rd FSD
					---		*			20	20	1				SPARE
SPARE				20	3	21		*		22	20	1				SPARE
					---				*	24	20	1				SPARE
					---		*			26	20	1				SPARE
SPARE				20	3	27		*		28	20	1				SPARE
					---				*	30	20	1				SPARE
			2.7		---		*			32	15	2				BSMT TELCOM RM FC-1
ROOF EF-6			2.7	60	3	33		*				---			0.2	---
			2.7		---				*	36	20	1			0.8	BSMT ELEC RM EF-3
--			3.7		---		*			38	20	1				
ROOF EF-9			3.7	70	3	39		*		40	20	2			1.4	ROOF CU-1
---			3.7		---				*			---			1.4	---
TOTALS ---------->		0.4	23.0												8.1	<-------- TOTALS

VOLTAGE:	**120/208V, 3Ø, 4W**				
S.C.A.:	**10K AIC RMS SYM.**				
MOUNTING:	**SURFACE**				
BUS SIZE:	**225A BUSING**				
MAINS:	**225A MAIN BKR.**				

Connected Load (KVA): 0.4 — Demand Factor: 100% OF LOAD; CEC 220-14(I); CEC 220-56; CEC 620-14; CEC 517.73(A); 1.0 + 25% Largest; 1.0 — Demand Load: 0.4 — Load Description: <------ Lighting; <------ Receptacles; <------ Kitchen; <------ Elevator; <------ X-Ray; <------ Mech; <------ Other

31.7 KVA — 34.4 KVA, +25% Spare — 95.7 Amps, 119.6 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	12	10	10
%	37%	32%	31%
AMP	98	84	83

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **ELECT RM**

PANEL - LBBE

LOAD SERVED	Load(KVA) Ltg	Rec	Oth Tot	C. B. Amp	Pole		A	B		C. B. Amp	Pole	Load(KVA) Ltg	Rec	Oth Tot	LOAD SERVED
SPARE				20	2	1	*		2	20	2				SPARE
--					---						---				SPARE IN EQMT 110C
SPARE				20	2	5		*	6	20	2				SPARE IN EQMT 110C
--					---		*				---				SPARE IN EQMT 110C
SPARE				20	2	9			10	20	2				SPARE IN EQMT 110C
--					---			*			---				SPARE IN EQMT 120C
SPARE				20	2	13	*		14	20	2				SPARE IN EQMT 120C
--					---			*			---				SPARE IN EQMT 120C
SPARE IN EQMT 210C				20	2	17	*		18	20	1				SPARE IN EQMT 120C
SPARE IN EQMT 210C					---			*	20	20	2			0.8	EQMT RM 332 3D PRINTER
SPARE IN EQMT 210C				20	2	21	*				---			0.8	---
SPARE IN EQMT 210C					---			*	24	20	2			1.8	EQMT RM 332 LASER
SPARE IN EQMT 220C				20	2	25	*		26		---			1.8	---
SPARE IN EQMT 220C					---	27		*	28	20					SPARE IN EQMT 332
SPARE IN EQMT 220C				20	2	29	*		30						SPARE IN EQMT 332
SPARE IN EQMT 220C					---	31		*	32	20					SPARE IN EQMT 332
SPARE				20	2	33	*		34						SPARE IN EQMT 332
---					---	35		*	36	20					SPARE IN EQMT 332
SPARE				20	1	37	*		38						SPARE IN EQMT 332
PANEL L3CE IN BSMT EQ 010B				80	2	39		*	40	20					SPARE IN EQMT 332
---					---	41			42						SPARE IN EQMT 332
TOTALS ---------->														5.1	<-------- TOTALS

VOLTAGE:	**120/240V, 1Ø, 3W**				
S.C.A.:	**10K AIC RMS SYM.**				
MOUNTING:	**SURFACE**				
BUS SIZE:	**225A BUSING**				
MAINS:	**125A MAIN BKR.**				

Connected Load (KVA): 5.1 — Demand Factor: 100% OF LOAD; CEC 220-14(I); CEC 220-56; CEC 620-14; CEC 517.73(A); 1.0 + 25% Largest; 1.0 — Demand Load: 5.1 — Demand Load CP: 5.1 — Load Description: <------ Lighting; <------ Receptacles; <------ Kitchen; <------ Elevator; <------ X-Ray; <------ Mech; <------ Other

5.1 KVA — 5.1 KVA, +25% Spare — 21.3 Amps, 26.6 Amps

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **EQUIPMENT RM 010B**

PANEL - LBCE

LOAD SERVED	Load(KVA) Ltg	Rec	Oth Tot	C. B. Amp	Pole		A	B		C. B. Amp	Pole	Load(KVA) Ltg	Rec	Oth Tot	LOAD SERVED
SPARE				20	2	1	*		2	20	1				SPARE
--					---						1				SPARE
SPARE				20	2	5		*	6	20	1				SPARE
--					---		*				1				SPARE
SPARE				20	2	9			10	20	1				SPARE
--					---			*			1				SPARE
SPARE				20	2	13	*		14	20	1				SPARE
--					---			*			1				SPARE
SPARE				20	2	17			18	20	1				SPARE
					---		*			20	1				SPARE
SPARE				20	2	21		*	22	20	1				SPARE
					---				24	20	1				SPARE
TOTALS ---------->															<-------- TOTALS

VOLTAGE:	**120/240V, 1Ø, 3W**				
S.C.A.:	**10K AIC RMS SYM.**				
MOUNTING:	**SURFACE**				
BUS SIZE:	**100A BUSING**				
MAINS:	**100A MAIN BKR.**				

Connected Load (KVA): — Demand Factor: 100% OF LOAD; CEC 220-14(I); CEC 220-56; CEC 620-14; CEC 517.73(A); 1.0 + 25% Largest; 1.0 — Demand Load: — Demand Load CP: — Load Description: <------ Lighting; <------ Receptacles; <------ Kitchen; <------ Elevator; <------ X-Ray; <------ Mech; <------ Other

KVA — KVA, +25% Spare — Amps, Amps

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **TELECOM RM**

PANEL - LBAT

LOAD SERVED	Load(KVA) Ltg	Rec	Oth Tot	C. B. Amp	Pole		A	B	C		C. B. Amp	Pole	Load(KVA) Ltg	Rec	Oth Tot	LOAD SERVED
TRAY OUTLET		1.1		20	1	1	*			2	20	1				SPARE
TRAY OUTLET		1.1		20	1	3		*		4	20	1				SPARE
SPARE				20	1	5			*	6	20	1				SPARE
WALL REC		1.1		20	1	7	*			8	20	1				SPARE
WALL REC		1.1		20	1	9		*		10	20	1				SPARE
SPARE				20	1	11			*	12	20	1				SPARE
SPARE				20	1	13	*			14	20	1				SPARE
SPARE				20	1	15		*		16	20	1				SPARE
SPARE				20	1	17			*	18	20	1				SPARE
SPARE				20	1	19	*			20	20	1				SPARE
SPARE				20	1	21		*		22	20	1				SPARE
SPARE				20	1	23			*	24	20	1				SPARE
SPARE				20	1	25	*			26	20	1				SPARE
SPARE				20	1	27		*		28	20	1				SPARE
SPARE				20	1	29			*	30	20	1				SPARE
						XXX	*			XXX						
						XXX		*		XXX						
						XXX			*	XXX						
						XXX	*			XXX						
						XXX		*		XXX						
						XXX			*	XXX						
TOTALS ---------->		4.3														<-------- TOTALS

VOLTAGE:	**120/208V, 3Ø, 4W**				
S.C.A.:	**10K AIC RMS SYM.**				
MOUNTING:	**SURFACE**				
BUS SIZE:	**100A BUSING**				
MAINS:	**100A MAIN BKR.**				

Connected Load (KVA): 4.3 — Demand Factor: 100% OF LOAD; CEC 220-14(I); CEC 220-56; CEC 620-14; CEC 517.73(A); 1.0 + 25% Largest; 1.0 — Demand Load: 4.3 — Load Description: <------ Lighting; <------ Receptacles; <------ Kitchen; <------ Elevator; <------ X-Ray; <------ Mech; <------ Other

4.3 KVA — 4.3 KVA, +25% Spare — 12.0 Amps, 15.0 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	2	2	
%	50%	50%	
AMP	18	18	

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

NOTE: AIC RATINGS TO BE CONFIRMED BY A SHORT CIRCUIT STUDY.

HBAL	HBAM	HBBM
LBAM	LBBE	LBCE
LBAT		

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PROJECT

JACOBS HALL

UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% CDs / Permit	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : NONE

SHEET TITLE

SCHEDULES - PANEL

SHEET No

E0.03

PROJECT: **JACOB HALL**

LOCATION: **BASEMENT CLOSET**

PANEL - LBAP

SECTION 1

	Load(KVA)			C. B.							C. B.		Load(KVA)			
LOAD SERVED	Ltg	Rec	Oth Tot	Amp	Pole		A	B	C		Amp	Pole	Ltg	Rec	Oth Tot	LOAD SERVED
ELEC RM MAINT. REC		0.4		20	1	1	*			2	20	1			0.5	BSMT DOOR HARDWARE
ELEC RM REC		0.4		20	1	3		*		4	20	1			0.5	BSMT FL DOOR HARDWARE
SPARE				20	1	5			*	6	20	1			1.2	BSMT FL SMOKE GUARD
ELEC RM OBVIUS SYS			0.5	20	1	7	*			8	20	1				SPARE
ELEC RM FIRE ALARM			0.5	20	1	9		*		10	20	1		0.4		HALL EAST REC
ELEC RM BMS			0.5	20	1	11			*	12	20	1		0.2		STORAGE 032A
SPARE				20	1	13	*			14	20	1		0.7		CAD LAB AV
SPARE				20	1	15		*		16	20	1		0.4		CAD LAB END WALLS
SPARE				20	1	17			*	18	20	1		0.7		CAD LAB DESKS
STORAGE 001		0.5		20	1	19	*			20	20	1		0.7		CAD LAB DESKS
WEST HALL/JAN CLOSET				20	1	21		*		22	20	1		0.7		CAD LAB DESKS
STORAGE 001				20	1	23			*	24	20	1		0.7		CAD LAB DESKS
MECH. RM 010A		0.4		20	1	25	*			26	20	1		0.7		CAD LAB DESKS
EQMT RM 010B		0.2		20	1	27		*		28	20	1		0.7		CAD LAB DESKS
EQMT RM 010B		0.2		20	1	29			*	30	20	1		0.7		CAD LAB DESKS
EQMT RM 010B		0.2		20	1	31	*			32	20	1		0.7		CAD LAB DESKS
EQMT RM 010B		0.2		20	1	33		*		34	20	1		0.7		CAD LAB DESKS
EQMT RM 010B		0.2		20	1	35			*	36	20	1		0.7		CAD LAB DESKS
EQMT RM 010B		0.2		20	1	37	*			38	20	1		0.7		CAD LAB DESKS
SPARE				20	1	39		*		40	20	1		0.7		CAD LAB DESKS
SPARE				20	1	41			*	42	20	1		0.7		CAD LAB DESKS
TOTALS ---------->		2.7	1.5											11.0	2.2	<-------- TOTALS

VOLTAGE: **120/208V, 3Ø, 4W**
S.C.A.: **10K AIC RMS SYM.**
MOUNTING: **SURFACE**
BUS SIZE: **225A BUSING**
MAINS: **200A MAIN BKR.**

Connected Load (KVA)	Demand Factor	Demand Load	Load Description
0.8	100% OF LOAD	0.8	<----- Lighting
16.6	CEC 220-14(I)	13.3	<----- Receptacles
	CEC 220-56		<----- Kitchen
	CEC 620-14		<----- Elevator
	CEC 517.73(A)		<----- X-Ray
0.4	1.0 + 25% Largest	0.5	<----- Mech
3.7	1.0	3.7	<----- Other

21.5 KVA 18.3 KVA 50.8 Amps
+25% Spare 63.5 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	6	5	6
%	36%	31%	34%
AMP	52	44	49

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **BASEMENT CLOSET**

PANEL - LBAP

SECTION 2

	Load(KVA)			C. B.							C. B.		Load(KVA)			
LOAD SERVED	Ltg	Rec	Oth Tot	Amp	Pole		A	B	C		Amp	Pole	Ltg	Rec	Oth Tot	LOAD SERVED
ELEVATOR PIT REC		0.2		20	1	43	*			44	20	1		0.4		CAD LAB DESKS
ELEVATOR PIT LTG	0.4			20	1	45		*		46	20	1		0.4		CAD LAB DESKS
ELEVATOR CAR LTG	0.4			20	1	47			*	48	20	1		0.4		CAD LAB DESKS
ELEV ROOM REC		0.2		20	1	49	*			50	20	1		0.4		CAD LAB DESKS
SPARE				20	1	51		*		52	20	1		0.4		CAD LAB DESKS
ELEVATOR SHUNT IF REQUIRED				20	1	53			*	54	20	1		0.4		CAD LAB DESKS
CAD LAB FANS			0.4	20	1	55	*			56	20	1		0.4		CAD LAB DESKS
SPARE				20	1	57		*		58	20	1				SPARE
SPARE				20	1	59			*	60	20	1				SPARE
SPARE				20	1	61	*			62	20	1				SPARE
SPARE				20	1	63		*		64	20	1				SPARE
SPARE				20	1	65			*	66	20	1				SPARE
SPARE				20	1	67	*			68	20	1				SPARE
SPARE				20	1	69		*		70	20	1				SPARE
SPARE				20	1	71			*	72	20	1				SPARE
SPARE				20	1	73	*			74	20	1				SPARE
SPARE				20	1	75		*		76	20	1				SPARE
SPARE				20	1	77			*	78	20	1				SPARE
SPARE				20	1	79	*			80	20	1				SPARE
SPARE				20	1	81		*		82	20	1				SPARE
SPARE				20	1	83			*	84	20	1				SPARE
TOTALS ---------->	0.8	0.4	0.4											2.5		<-------- TOTALS

VOLTAGE: **120/208V, 3Ø, 4W**
S.C.A.: **10,000 AIC RMS SYM.**
MOUNTING: **SURFACE**
BUS SIZE: **225 AMP BUSING**
MAINS: **MAIN LUGS ONLY**

Connected Load (KVA)	Load Description
0.8	<----- Lighting
2.9	<----- Receptacles
	<----- Kitchen
	<----- Elevator
	<----- X-Ray
0.4	<----- Mech
	<----- Other

4.1 KVA SECTION TOTAL

PHASE BALANCE (SECT 2)

	A	B	C
KVA	2	1	1
%	45%	27%	27%
AMP	15	9	9

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **1ST FL CLOSET**

PANEL - L1AP

SECTION 1

	Load(KVA)			C. B.							C. B.		Load(KVA)			
LOAD SERVED	Ltg	Rec	Oth Tot	Amp	Pole		A	B	C		Amp	Pole	Ltg	Rec	Oth Tot	LOAD SERVED
OFFICE 120A & 120B		1.6		20	1	1	*			2	20	1		1.3		STUDIO 120 WALL REC
EQMT RM 120C			1.2	20	1	3		*		4	20	1		1.3		STUDIO 110 WALL REC
EQMT RM 120C		0.2		20	1	5			*	6	20	1		0.4		STUDIO VIDEO PROJ.
EQMT RM 120C		0.2		20	1	7	*			8	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 120C		0.2		20	1	9		*		10	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 120C		0.2		20	1	11			*	12	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 120C		0.2		20	1	13	*			14	20	1		0.4		STUDIO 120 CLG REEL
SPARE				20	1	15		*		16	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 110C		0.2		20	1	17			*	18	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 110C		0.2		20	1	19	*			20	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 110C		0.4		20	1	21		*		22	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 110C			1.2	20	1	23			*	24	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 110C			1.0	20	1	25	*			26	20	1		0.4		STUDIO 120 CLG REEL
EQMT RM 110C		0.2		20	1	27		*		28	20	1		0.4		STUDIO 110 CLG REEL
OFFICE 110A & 110B		1.6		20	1	29			*	30	20	1		0.4		STUDIO 110 CLG REEL
FUTURE EQMT RM 120C		0.2		20	1	31	*			32	20	1		0.4		STUDIO 110 CLG REEL
FUTURE EQMT RM 120C		0.2		20	1	33		*		34	20	1		0.4		STUDIO 110 CLG REEL
FUTURE EQMT RM 120C		0.2		20	1	35			*	36	20	1		0.4		STUDIO 110 CLG REEL
FUTURE EQMT RM 110C		0.2		20	1	37	*			38	20	1		0.4		STUDIO 110 CLG REEL
FUTURE EQMT RM 110C		0.2		20	1	39		*		40	20	1		0.4		STUDIO 110 CLG REEL
FUTURE EQMT RM 110C		0.2		20	1	41			*	42	20	1		0.4		STUDIO 110 CLG REEL
TOTALS ---------->		6.1	3.4											9.4		<-------- TOTALS

VOLTAGE: **120/208V, 3Ø, 4W**
S.C.A.: **10K AIC RMS SYM.**
MOUNTING: **SURFACE**
BUS SIZE: **225A BUSING**
MAINS: **150A MAIN BKR.**

Connected Load (KVA)	Demand Factor	Demand Load	Load Description
	100% OF LOAD		<----- Lighting
19.6	CEC 220-14(I)	14.8	<----- Receptacles
	CEC 220-56		<----- Kitchen
	CEC 620-14		<----- Elevator
	CEC 517.73(A)		<----- X-Ray
0.6	1.0 + 25% Largest	0.7	<----- Mech
9.5	1.0	9.5	<----- Other

29.7 KVA 25.0 KVA 69.3 Amps
+25% Spare 86.7 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	7	6	7
%	35%	28%	37%
AMP	58	48	62

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **1ST FL CLOSET**

PANEL - L1AP

SECTION 2

	Load(KVA)			C. B.							C. B.		Load(KVA)			
LOAD SERVED	Ltg	Rec	Oth Tot	Amp	Pole		A	B	C		Amp	Pole	Ltg	Rec	Oth Tot	LOAD SERVED
LOUNGE WALL REC		0.4		20	1	43	*			44	20	1			0.2	1ST DOOR HARDWARE
LOUNGE VENDING MACHINE			1.0	20	1	45		*		46	20	1			1.0	1ST LOUNGE DOOR
LOUNGE WATER STATION			0.5	20	1	47			*	48	20	1			0.2	LOBBY ENTRY DOOR
LOUNGE UC REFRIDGE			1.0	20	1	49	*			50	20	1		0.5		LOBBY REC
LOUNGE COUNTER REC		0.4		20	1	51		*		52	20	1		0.5		LOBBY REC
LOUNGE MICROWAVE			1.5	20	1	53			*	54	20	1			0.2	LOBBY FANS
SPARE				20	1	55	*			56	20	1		0.4		WOMENS ROOM
SPARE				20	1	57		*		58	20	1		0.4		MENS ROOM
SPARE				20	1	59			*	60	20	1		0.4		EAST HALL
STUDIO 120 CLG FAN			0.2	20	1	61	*			62	20	1		0.2		EXT COURTYARD
STUDIO 110 CLG FAN			0.2	20	1	63		*		64	20	1		0.4		EXT COURTYARD
SPARE				20	1	65			*	66	20	1			0.1	IRRIGATION CONTROLLER
SPARE				20	1	67	*			68	20	1			0.5	ELEV SMOKE GUARD
SPARE				20	1	69		*		70	20	1			0.1	FIRE ALARM BELL
SPARE				20	1	71			*	72	20	1		0.4		STUDIO 110 CLG REEL
SPARE				20	1	73	*			74	20	1		0.4		STUDIO 110 CLG REEL
SPARE				20	1	75		*		76	20	1				SPARE
SPARE				20	1	77			*	78	20	1				SPARE
SPARE				20	1	79	*			80	20	1				SPARE
SPARE				20	1	81		*		82	20	1				SPARE
SPARE				20	1	83			*	84	20	1				SPARE
TOTALS ---------->		0.7	4.4											3.4	2.3	<-------- TOTALS

VOLTAGE: **120/208V, 3Ø, 4W**
S.C.A.: **10,000 AIC RMS SYM.**
MOUNTING: **SURFACE**
BUS SIZE: **225 AMP BUSING**
MAINS: **MAIN LUGS ONLY**

Connected Load (KVA)	Load Description
	<----- Lighting
4.1	<----- Receptacles
	<----- Kitchen
	<----- Elevator
	<----- X-Ray
0.6	<----- Mech
6.1	<----- Other

10.8 KVA SECTION TOTAL

PHASE BALANCE (SECT 2)

	A	B	C
KVA	4	4	3
%	34%	36%	30%
AMP	31	33	27

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **2ND FL CLOSET**

PANEL - L2AP

SECTION 1

	Load(KVA)			C. B.							C. B.		Load(KVA)			
LOAD SERVED	Ltg	Rec	Oth Tot	Amp	Pole		A	B	C		Amp	Pole	Ltg	Rec	Oth Tot	LOAD SERVED
OFFICE 220A & 220B		1.6		20	1	1	*			2	20	1		1.3		STUDIO 220 WALL REC
EQMT RM 220C		0.2		20	1	3		*		4	20	1		1.3		STUDIO 210 WALL REC
EQMT RM 220C			1.2	20	1	5			*	6	20	1		0.7		STUDIO VIDEO PROJ.
EQMT RM 220C		0.2		20	1	7	*			8	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 220C		0.2		20	1	9		*		10	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 220C		0.2		20	1	11			*	12	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 220C			1.0	20	1	13	*			14	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 210C		0.4		20	1	15		*		16	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 210C		0.2		20	1	17			*	18	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 210C		0.2		20	1	19	*			20	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 210C			1.5	20	1	21		*		22	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 210C			1.5	20	1	23			*	24	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 210C			1.0	20	1	25	*			26	20	1		0.4		STUDIO 220 CLG REEL
EQMT RM 210C			1.0	20	1	27		*		28	20	1		0.4		STUDIO 210 CLG REEL
OFFICE 210A & 210B		1.6		20	1	29			*	30	20	1		0.4		STUDIO 210 CLG REEL
FUTURE EQMT 220C		0.2		20	1	31	*			32	20	1		0.4		STUDIO 210 CLG REEL
FUTURE EQMT 220C		0.2		20	1	33		*		34	20	1		0.4		STUDIO 210 CLG REEL
FUTURE EQMT 220C		0.2		20	1	35			*	36	20	1		0.4		STUDIO 210 CLG REEL
FUTURE EQMT 210C		0.2		20	1	37	*			38	20	1		0.4		STUDIO 210 CLG REEL
FUTURE EQMT 210C		0.2		20	1	39		*		40	20	1		0.4		STUDIO 210 CLG REEL
FUTURE EQMT 210C		0.2		20	1	41			*	42	20	1		0.4		STUDIO 210 CLG REEL
TOTALS ---------->		5.8	7.2											9.7		<-------- TOTALS

VOLTAGE: **120/208V, 3Ø, 4W**
S.C.A.: **10K AIC RMS SYM.**
MOUNTING: **SURFACE**
BUS SIZE: **225A BUSING**
MAINS: **150A MAIN BKR.**

Connected Load (KVA)	Demand Factor	Demand Load	Load Description
	100% OF LOAD		<----- Lighting
19.6	CEC 220-14(I)	14.8	<----- Receptacles
	CEC 220-56		<----- Kitchen
	CEC 620-14		<----- Elevator
	CEC 517.73(A)		<----- X-Ray
0.4	1.0 + 25% Largest	0.5	<----- Mech
14.7	1.0	14.7	<----- Other

34.7 KVA 30.0 KVA 83.2 Amps
+25% Spare 104.0 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	8	9	9
%	30%	33%	37%
AMP	65	71	79

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **2ND FL CLOSET**

PANEL - L2AP

SECTION 2

	Load(KVA)			C. B.							C. B.		Load(KVA)			
LOAD SERVED	Ltg	Rec	Oth Tot	Amp	Pole		A	B	C		Amp	Pole	Ltg	Rec	Oth Tot	LOAD SERVED
LOUNGE WALL REC		0.4		20	1	43	*			44	20	1			1.0	2ND DOOR HARDWARE
LOUNGE VENDING MACHINE			1.0	20	1	45		*		46	20	1			1.0	2ND BRIDGE DOOR
LOUNGE WATER STATION			0.5	20	1	47			*	48	20	1			1.0	LOBBY ENTRY DOOR
LOUNGE UC REFRIDGE			1.0	20	1	49	*			50	20	1			0.2	LOBBY CLG FANS
LOUNGE COUNTER REC		0.4		20	1	51		*		52	20	1				SPARE
LOUNGE MICROWAVE			1.5	20	1	53			*	54	20	1				SPARE
SPARE				20	1	55	*			56	20	1		0.5		EXHIBIT SPACE
SPARE				20	1	57		*		58	20	1		0.2		LOBBY WALL/ELEV VEST
SPARE				20	1	59			*	60	20	1		0.5		EXHIBIT SPACE
WOMENS ROOM		0.4		20	1	61	*			62	20	1		0.4		EXHIBIT SPACE
JAN CLOSET & HALL		0.4		20	1	63		*		64	20	1				SPARE
MENS ROOM		0.4		20	1	65			*	66	20	1			0.5	ELEV SMOKE GUARD
STUDIO 220 CLG FANS			0.1	20	1	67	*			68	20	1				SPARE
STUDIO 210 CLG FANS			0.1	20	1	69		*		70	20	1				SPARE
SPARE				20	1	71			*	72	20	1				SPARE
SPARE				20	1	73	*			74	20	1		0.4		STUDIO 210 CLG REEL
SPARE				20	1	75		*		76	20	1		0.4		STUDIO 210 CLG REEL
SPARE				20	1	77			*	78	20	1				SPARE
SPARE				20	1	79	*			80	20	1				SPARE
SPARE				20	1	81		*		82	20	1				SPARE
SPARE				20	1	83			*	84	20	1				SPARE
TOTALS ---------->		1.8	4.2											2.3	3.7	<-------- TOTALS

VOLTAGE: **120/208V, 3Ø, 4W**
S.C.A.: **10,000 AIC RMS SYM.**
MOUNTING: **SURFACE**
BUS SIZE: **225 AMP BUSING**
MAINS: **MAIN LUGS ONLY**

Connected Load (KVA)	Load Description
	<----- Lighting
4.1	<----- Receptacles
	<----- Kitchen
	<----- Elevator
	<----- X-Ray
0.4	<----- Mech
7.5	<----- Other

12.0 KVA SECTION TOTAL

PHASE BALANCE (SECT 2)

	A	B	C
KVA	4	3	4
%	36%	28%	37%
AMP	36	28	37

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **3RD FL CLOSET**

PANEL - L3AP

SECTION 1

	Load(KVA)			C. B.							C. B.		Load(KVA)			
LOAD SERVED	Ltg	Rec	Oth Tot	Amp	Pole		A	B	C		Amp	Pole	Ltg	Rec	Oth Tot	LOAD SERVED
MEETING ROOM 310B		0.9		20	1	1	*			2	20	1		1.1		STUDIO 310 WALL REC
MEETING ROOM 310B		0.7		20	1	3		*		4	20	1		0.9		STUDIO 310 WALL REC
MEETING ROOM 310A		0.9		20	1	5			*	6	20	1		0.7		STUDIO VIDEO PROJ.
MEETING ROOM 310A		0.9		20	1	7	*			8	20	1		0.7		STUDIO VIDEO RACK
SPARE				20	1	9		*		10	20	1				SPARE
SPARE				20	1	11			*	12	20	1		0.4		STUDIO 310 CLG REEL
WOMENS RESTROOM		0.4		20	1	13	*			14	20	1		0.4		STUDIO 310 CLG REEL
JAN CLOSET & HALL		0.4		20	1	15		*		16	20	1		0.4		STUDIO 310 CLG REEL
MENS REST ROOM		0.4		20	1	17			*	18	20	1		0.4		STUDIO 310 CLG REEL
SPARE				20	1	19	*			20	20	1		0.4		STUDIO 310 CLG REEL
SPARE				20	1	21		*		22	20	1		0.4		STUDIO 310 CLG REEL
SPARE				20	1	23			*	24	20	1		0.4		STUDIO 310 CLG REEL
LOUNGE WALL REC		0.4		20	1	25	*			26	20	1		0.4		STUDIO 310 CLG REEL
LOUNGE VENDING MACHINE			1.0	20	1	27		*		28	20	1		0.4		STUDIO 310 CLG REEL
LOUNGE WATER STATION			0.5	20	1	29			*	30	20	1		0.4		STUDIO 310 CLG REEL
LOUNGE UC REFRIDGE			1.0	20	1	31	*			32	20	1		0.4		STUDIO 310 CLG REEL
LOUNGE COUNTER REC		0.4		20	1	33		*		34	20	1		0.4		STUDIO 310 CLG REEL
LOUNGE MICROWAVE			1.5	20	1	35			*	36	20	1		0.4		STUDIO 310 CLG REEL
SPARE				20	1	37	*			38	20	1		0.4		STUDIO 310 CLG REEL
SPARE				20	1	39		*		40	20	1		0.4		STUDIO 310 CLG REEL
SPARE				20	1	41			*	42	20	1		0.4		STUDIO 310 CLG REEL
TOTALS ---------->		5.2	4.0											9.2		<-------- TOTALS

VOLTAGE: **120/208V, 3Ø, 4W**
S.C.A.: **10K AIC RMS SYM.**
MOUNTING: **SURFACE**
BUS SIZE: **225A BUSING**
MAINS: **150A MAIN BKR.**

Connected Load (KVA)	Demand Factor	Demand Load	Load Description
	100% OF LOAD		<----- Lighting
18.4	CEC 220-14(I)	14.2	<----- Receptacles
	CEC 220-56		<----- Kitchen
	CEC 620-14		<----- Elevator
	CEC 517.73(A)		<----- X-Ray
0.2	1.0 + 25% Largest	0.2	<----- Mech
11.1	1.0	11.1	<----- Other

29.7 KVA 25.5 KVA 70.8 Amps
+25% Spare 88.6 Amps

PHASE BALANCE (SECT 1)

	A	B	C
KVA	7	5	6
%	39%	28%	33%
AMP	59	43	51

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

PROJECT: **JACOB HALL**

LOCATION: **3RD FL CLOSET**

PANEL - L3AP

SECTION 2

	Load(KVA)			C. B.							C. B.		Load(KVA)			
LOAD SERVED	Ltg	Rec	Oth Tot	Amp	Pole		A	B	C		Amp	Pole	Ltg	Rec	Oth Tot	LOAD SERVED
CLERSTORY WINDOWS			0.2	20	1	43	*			44	20	1		0.7		CORD REEL
CLERSTORY WINDOWS			0.2	20	1	45		*		46	20	1			0.1	CLG FANS
CLERSTORY WINDOWS			0.2	20	1	47			*	48	20	1			0.1	CLG FANS
CLERSTORY WINDOWS			0.2	20	1	49	*			50	20	1			1.0	EQMT 332 -PRINTER
SPARE				20	1	51		*		52	20	1			1.0	EQMT 332 -PRINTER
SPARE				20	1	53			*	54	20	1			1.0	EQMT 332 -PRINTER
SPARE				20	1	55	*			56	20	1			1.0	EQMT 332 -PRINTER BATH
SPARE				20	1	57		*		58	20	1			1.0	EQMT 332 -PRINTER BATH
SPARE				20	1	59			*	60	20	1		0.4		EQMT 332 -COMPUTER STATIONS
SPARE				20	1	61	*			62	20	1			0.1	EQMT 332 -SCANNER
SPARE				20	1	63		*		64	20	1		0.7		EQMT 332 -WORK BENCH
SPARE				20	1	65			*	66	20	1		0.4		EQMT 332 -COMPUTER STATIONS
SPARE				20	1	67	*			68	20	1			0.1	EQMT 332 -SMALL LASER
SPARE				20	1	69		*		70	20	1			0.1	EQMT 332 -SMALL LASER
SPARE				20	1	71			*	72	20	1		0.2		EQMT 332
SPARE				20	1	73	*			74	20	1			0.5	EQMT 332 -SPRAYBOOTH
SPARE				20	1	75		*		76	20	1		1.4		DOOR HARDWARE
SPARE				20	1	77			*	78	20	1		0.2		HALL
SPARE				20	1	79	*			80	20	1			0.5	ELEVATOR SMOKE GUARD
SPARE				20	1	81		*		82	20	1				SPARE
SPARE				20	1	83			*	84	20	1				SPARE
TOTALS ---------->			0.8											4.0	6.5	<-------- TOTALS

VOLTAGE: **120/208V, 3Ø, 4W**
S.C.A.: **10,000 AIC RMS SYM.**
MOUNTING: **SURFACE**
BUS SIZE: **225 AMP BUSING**
MAINS: **MAIN LUGS ONLY**

Connected Load (KVA)	Load Description
	<----- Lighting
4.0	<----- Receptacles
	<----- Kitchen
	<----- Elevator
	<----- X-Ray
0.2	<----- Mech
7.1	<----- Other

11.3 KVA SECTION TOTAL

PHASE BALANCE (SECT 2)

	A	B	C
KVA	4	5	2
%	38%	40%	21%
AMP	36	38	20

ADDITIONAL FEATURES:

DATE PRINTED: 08/15/14

NOTE: AIC RATINGS TO BE CONFIRMED BY A SHORT CIRCUIT STUDY.

LBAP (SEC 1)	LBAP (SEC 2)	L1AP (SEC 1)
L1AP (SEC 2)	L2AP (SEC 1)	L2AP (SEC 2)
L3AP (SEC 1)	L3AP (SEC 2)	

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PROJECT

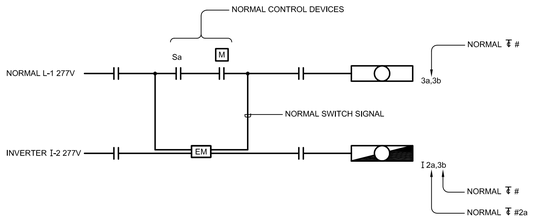
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% CDs / Permit	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : NONE

SHEET TITLE
SCHEDULES - PANEL

SHEET No
E0.04



NOTE: INTENT INFORMATION ONLY. REFERENCE MANUFACTURER'S INSTALLATION REQUIREMENTS FOR ACTUAL WIRING DIAGRAM.

A E0.05 EGRESS LIGHTING CONTROL DETAIL

NTS

INVERTER SCHEDULE				
			INPUT:	277V
			OUTPUT:	277V
TAG	CIRCUIT	AREA	WATTAGE	LOAD
"I"	1	EXTERIOR	1010	1010
"I"	2	BASEMENT	555	555
"I"	3	FIRST	600	600
"I"	4	STAIRWELLS	750	750
"I"	5	SECOND	670	670
"I"	6	THIRD	320	320
"I"	7	SPARE		0
"I"	8	SPARE		
TOTAL				3905
DUAL LITE #D-277-48S-277-277-20-8 OR EQUAL				

LIGHTING CONTROL RELAY SCHEDULE				
TAG	RELAY	AREA	CIRCUIT	CONTROL TYPE
LCP	1	EXT.	HBAL-17	PC/TC
LCP	2	3RD SOFFIT	HBAL-12	PC/TC
LCP	3	EXT.EGRESS	INVERTER -1	PC/TC
LCP	4-8	SPARE		

LIGHTING CONTROL INTENT:	
1	EACH OFFICE, STUDIO, UTILITY ROOM SHALL BE CONTROLLED BY A LOCAL VACANCY SENSOR WITH MULTI-LEVEL CONTROL SWITCHES AT EACH ENTRANCE.
2	ROOMS UNDER 100 SQFT MAY HAVE SINGLE LEVEL CONTROL BY VACANCY SENSOR.
3	EACH HALLWAY, VESTIBULE, LOBBY, STAIRWELL FIXTURE SHALL BE PROVIDED WITH AN AUTOMATIC "ON" MOTION SENSOR.
4	STAIR WELL FIXTURES SHALL BE TIED TOGETHER VERTICALLY FOR CONTROL. MOTION AT ANY ENTRANCE WILL TURN ON ALL FIXTURES FULL. WHEN MOTION IS NOT SENSED, F5 WILL GO TO HALF LEVEL BY TURNING OFF ONE OF ITS TWO DRIVERS. DURING THE DAY PHOTOCELL SHALL ALSO OVERRIDE CONTROL OF THE "z" FIXTURES ON THE FLOORS THAT HAVE ADEQUATE DAY LIGHTING.
5	ROOMS THAT INCLUDE INVERTER BACKED FIXTURES (SHADED AND NOTED WITH "I" CIRCUIT NUMBER) SHALL BE CONTROLLED BY A VACANCY SENSOR, HOWEVER ADDITIONAL POWER PACKS MAY BE REQUIRED IN ORDER TO CONTROL BOTH NORMAL AND INVERTER CIRCUITS.
6	OPEN STUDIOS AND CAD AREAS SHALL BE CONTROLLED BY VACANCY SENSORS AND MULTILEVEL, 3-WAY SWITCHES. THESE AREAS ALSO INCLUDE EGRESS LIGHTING (SHADED). EGRESS FIXTURES SHALL BE CONTROLLED BY UL924 LISTED ALCR (AUTOMATIC LOAD CONTROL RELAY) SUCH THAT FIXTURE TURNS ON IN THE EVENT OF A POWER OUTAGE REGARDLESS OF THE STATE WHICH IT IS IN AT THE TIME.
7	EXTERIOR FIXTURES SHALL BE CONTROLLED BY RELAYS IN A LIGHTING CONTROL PANEL, LCP. INPUT SHALL BE PROVIDED BY EXTERIOR PHOTOCELL AND TIME CLOCK FOR PROGRAMMING BY THE USER.
8	ELECTRICAL ROOMS, ELECTRICAL CLOSETS AND ELEVATOR CLOSET SHALL NOT BE PROVIDED WITH AUTOMATIC CONTROL, PER CODE.

INTERIOR LIGHTING FIXTURE SCHEDULE

7/22/14

TYPE		MFR / CAT. NO.	LAMP QTY / TYPE	WATTS	VOLTS	QTY / BALLAST	DESCRIPTION
F1		(FLUORESCENT, 50 FT-C, 0-10V) CORELITE - JAYLUM SERIES #J2-S-3-M-T8-1C-VOLTS-AC48-ST-ROWS-**1.10**BF FINLITE SERIES 16	(3) F32T8/841	90	277	ELECTRONIC HPF BI-LEVEL SWITCHING **HIGH BALLAST FACTOR 1.10**	CABLE SUSPENDED UP-DOWNLIGHT WITH AT LEAST 75% UPLIGHT COMPONENT, OPEN TOP, DIFFUSER IN BOTTOM. SINGLE CIRCUIT, DIMMABLE. LOCATED IN STUDIOS. BOTTOM OF LIGHT ALIGNED WITH BOTTOM OF BEAMS, APPROX. 21" BELOW CEILING. PROVIDE INTEGRAL OR REMOTE OCCUPANCY SENSORS AND DAYLIGHT SENSORS AS REQUIRED.
F2		FINELITE S16WM-DCO-X-2T8-DC-91W-OPEN-277V-FE-	(2) F32T8/841	58	277	ELECTRONIC HPF DUAL LEVEL BALLAST FOR BI-LEVEL SWITCHING	WALL MOUNTED LINEAR FIXTURE. 1.5-2.25" TALL, SIMILAR APPEARANCE TO F1.
F3		METALUX #VT2 SERIES	(2) F32T8/841	58	UNV	ELECTRONIC	SURFACE MOUNTED, ENCLOSED, GASKETTED LATCHING WRAPAROUND FOR ELEVATOR PIT SHAFT.
F4		GAMMA LUX #GB93BW-MOD-432T8-VOLTS-DIM 0/10V-4 FT-C48" ADJUSTABLE OP-WHITE PBB-WSG	(4) F32T8/841	116	277	ELECTRONIC HPF DUAL LEVEL BALLAST FOR BI-LEVEL SWITCHING	CABLE SUSPENDED UP-DOWNLIGHT, OPEN TOP,WHITE BAFFLE DOWNLIGHT, SINGLE CIRCUIT DIMMABLE, 4-T8-CROSS SECTION,4 FT. LOCATED IN WORKSHOPS AND OFFICES VERIFY MOUNTING HEIGHT. PROVIDE INTEGRAL OR REMOTE OCCUPANCY SENSORS AND DAYLIGHT SENSORS AS REQUIRED.
F5		DELRAY #6824-FINISH-W30-VOLTS-BDIM-W	LED 3000K	158	277	ELECTRONIC	4 FT DIAMETER PENDANT. LOCATED IN FEATURE STAIR MID-LANDINGS PROVIDED WITH 2 DRIVERS. MOTION SENSOR SHALL CONTROL ONE, THE OTHER SHALL BE CONTROLLED BY PHOTOCELL CONTROLLED CIRCUIT. POWER SUPPLY IN CEILING CANOPY. VERIFY MOUNTING HEIGHT
F6		ARCHITECTURAL LIGHTING WORKS #CML-16-HP14-3000K-20 - LED-UNV-AL ARCHITECTURAL LIGHTING WORKS #CML-20-HP14-3000K-24-LED-TIE-BACK-UNV-AL	LED 3000k	10/FT	277	ELEC HPF INTEGRAL	ARM MOUNTED LED DISPLAY LIGHT, LENGTHS AS SHOWN USING 4 FT MODULES. MOUNT BALLAST REMOTELY, SURFACE MTD TO UNDERSIDE OF DECK. LOCATED IN TYPICAL DISPLAYS PROVIDE 2 SPARE 4 FT LED MODULES
F7		WAC # WS-6736-30	LED 1520/ 35K LUMENS MIN.	29	277	ELEC HPF INTEGRAL	36" WALL MOUNTED LIGHT CENTERED ABOVE MIRROR AT SINK. LOCATED IN TOILETS SEE ELEVATION FOR MOUNTING HEIGHT.
F8		CORELITE #JW-S-M-T8-1C-SUWA-LENGTH (modified 10 FT, 4 + 4 +2) BALLAST AS NOTED FINELITE S18WM	(1) F17T8/841 (1) F32T8/841	80	277	ELEC HPF INTEGRAL	WALL MOUNTED LINEAR LIGHT, LOCATED IN TOILETS ON WALL ABOVE PARTITIONS (30" MIN. FROM TOP OF LIGHT TO CEILING) BALLAST: GENERIC 10% THD, QTP-ISN PER 265000
F9-EXIT		SURE LITES ES SERIES OR EQUAL	GREEN LED	3	277	INTEGRAL DRIVER	EDGELIT CLEAR ACRYLIC, LED,WHITE FINISH. PROVIDE SURFACE BOX FOR MOUNTING TO STRUCTURAL CEILING, RECESSED BOX,ON SUSPENDED CEILING OR WALL. CEILING OR WALL, MOUNTED EXIT SIGN, FACES AND ARROWS AS NOTED ON THE DRAWINGS. COLOR AS REQUIRED BY UCB STANDARDS.
F10		EDISON PRICE # MM-XSM2-OBM-O-LH-DMV-L21S-30K-X-SI-	LED 3000K	26W	277	0-10V DIMMING DRIVER-CONFIRM AVAILABILITY	MONOPOINT LED TRACK HEAD WITH REMOTE DRIVER PER AREA
F11		HALO #HU1024D-830P #HU107P #HU106P	LED 3000K/80CRI	18	120 ONLY	INTEGRAL DRIVER	UNDER-SHELF LED TASK LIGHT 30" LENGTH. TYPICAL LOCATIONS: PROVIDE UP ON FRONT OF SHELF OR CABINET WITH 1-1/2" CLEAR INSIDE HEIGHT.
F12		CORELITE CT-S-N-2T8-1D-(0-10V) VOLTS-ROWS-ROWS-USING 2/4/8 FT SEGMENTS 16WLF	(2) F32T8/840	16 WLF	277	ELECTRONIC HPF BI-LEVEL SWITCHING	COVE LIGHT CONCEALED ON TOP OF LEDGE BELOW CLERESTORY, LENGTHS AS REQUIRED TO FILL WITHIN 12" OF EACH END OF AVAILABLE SPACES. LOCATED ON TOP FLOOR.
F13		SOLID STATE LUMINAIRES #(9) BLAC-4-X-3K-60-D w/2' CONNECTOR (1) 10' LEADER CABLE WITH FROSTED DIFFUSING LENS	LED 3000K	8WLF	277	0-10V DIMMING DRIVER-CONFIRM AVAILABILITY	LINEAR LED WITH BAFFLE, INSTALLED ON UNDERSIDE OF ENTRY SOFFIT IN REVEAL BETWEEN SOFFIT AND PERIMETER BEAM. LOCATED AT ENTRIES ALLOW CLEAR CONTINUOUS SPACE 2 1/2" WIDE X 2" HIGH. SUBMIT COMPLETE ROW DWGS. PROVIDE 2 SPARE MODULES. SEE ARCH. DWGS.
F14		io LIGHTING - LUXRAIL SERIES #06-SSS-1-WM-NR-55-3KHO-LENGTH-MOD WHITE LENS	LED 3000K	3WLF	277	REMOTE DRIVER	HANDRAIL ASSEMBLY WITH INTEGRAL LED LIGHTING. MODIFIED WITH WHITE LENS. HANDRAIL ATTACHED TO GUARD RAIL SUPPORTS PROVIDED BY STAIR RAIL CONTRACTOR. LOCATION: EXTERIOR STAIR. REMOTE DRIVERS CONCEALED BELOW STAIR.
F15		SAME AS F17	40W LED 3K	40	277	INTEGRAL DRIVER	WALL MOUNTED LIGHT TO REPLACE LIGHT ABOVE DOORS AT SODA HALL. LOCATED IN PLAZA.
F16		LUMERE #203-10LED3041-12-X-OSL WITH REMOTE WET LISTED 277:12V XFMR: LUMERE# TC300	10W LED FLOOD	10	277:12V	TRANSFORMER	SURFACE MOUNTED WET LISTED ADJUSTABLE ACCENT LIGHT FIXTURE WITH REMOTE SURFACE MOUNTED TRANSFORMER. MOUNT HIDDEN UNDER STAIR FOR FLOOD LIGHTING OF BACK WALL
F17		BEGA #6854	40W LED 3K	40	277	INTEGRAL DRIVER	WALL MOUNTED LIGHT TO MATCH TYPE F15.
F18		METALUX CR-232-A-VOLTS-BALLAST-AS NOTED	(2) F32T8/841	58	277	ELECTRONIC HPF BI-LEVEL SWITCHING	2-LAMP 4 FT WRAPAROUND LOCATED IN SERVICE SPACES.
F19		METALUX #SSF-132-UNV-X-WG/SSF-4'	1 F32T8/841	32	277V	UNIV	STRIP LIGHT WITH WIREGUARD
F20		GOTHAM EVO-CYL-30-22-6PR-277-PM-DNA-CRS	LED 2200 LUMENS MIN. 3000K	32	277V	DRIVER	SURFACE/PENDANT MOUNTED 8" DIA. WITH 6" APERTUREX 16" TALL LED DRUM.
F21		FINELITE HPR-F-1X4-DCO-2T8-277-SD	(2) F32T8/841	64	277V	ELECTRONIC HPF BI-LEVEL SWITCHING	RECESSED 1X4
F22		GOTHAM EVO-30-14-6PR-	LED 1400 LUMENS MIN. 3000K	25	277V	DRIVER	RECESSED LED DOWNLIGHT, 6" APERTURE.

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PROJECT

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UNIVERSITY OF CALIFORNIA, BERKELEY

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DATE : 15 August 2014
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SCALE : NONE

SHEET TITLE

SCHEDULES - LIGHTING

SHEET No

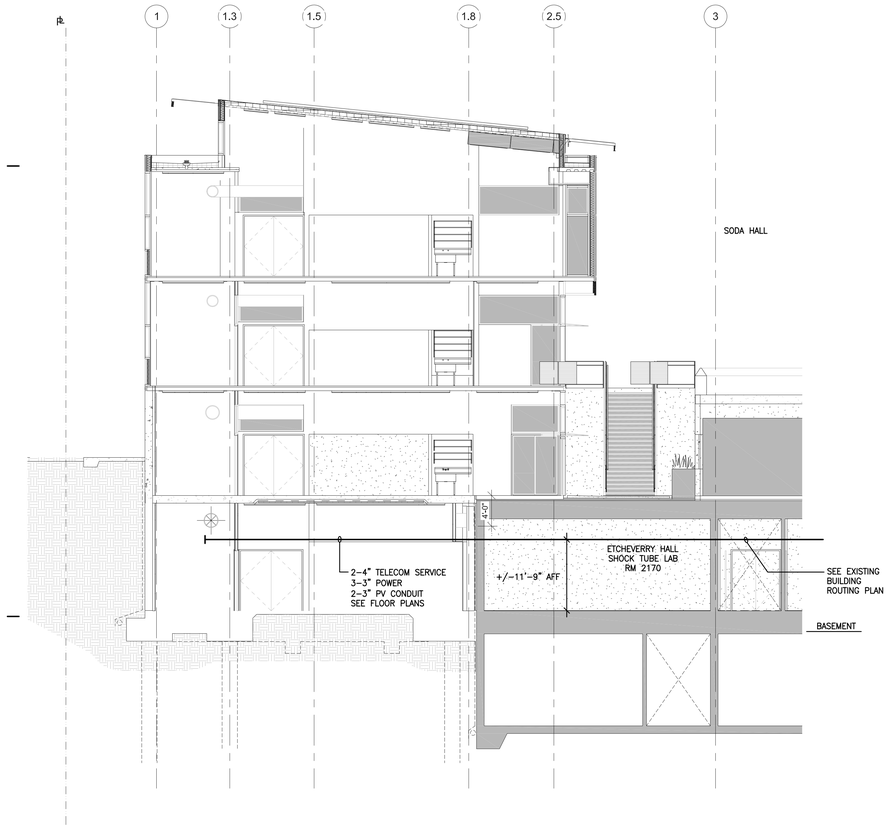
E0.05

NUMBERED SHEET NOTES

1. EXTEND 120V POWER FROM EXISTING CONTROLLER TO NEW IRRIGATION CONTROLLER IN 1" CONDUIT. COORDINATE EXISTING LOCATION WITH UCB.
2. PROVIDE POWER TO FIXTURE TYPE F14: ILLUMINATED STAIR RAIL. COORDINATE INSTALLATION WITH GENERAL CONTRACTOR AND ARCHITECT.
3. PROVIDE ETHERNET CONNECTION TO IRRIGATION CONTROLLER.

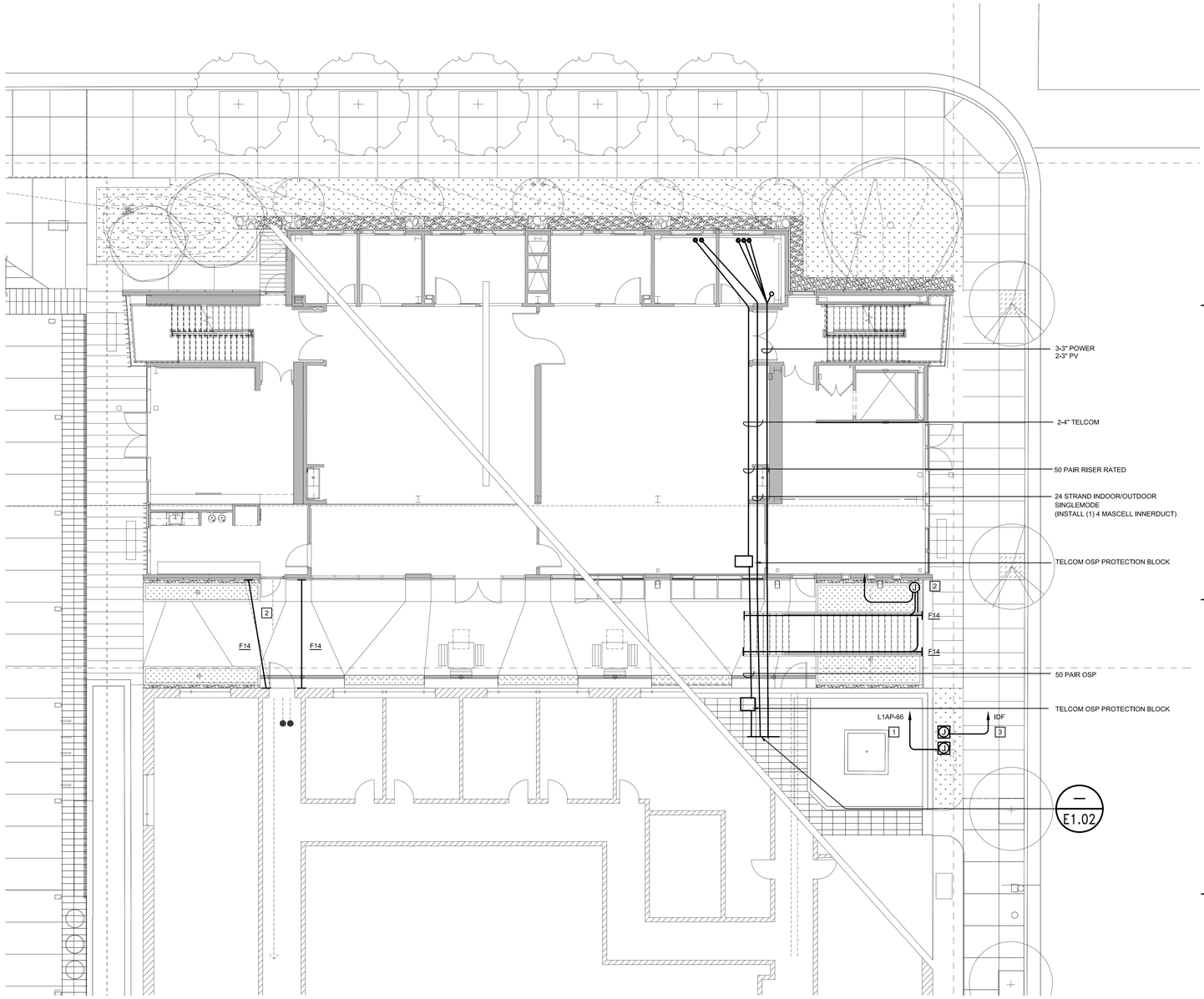
GENERAL SHEET NOTES

1. PROVIDE ONE 24 STRANDED SINGLE MODE INDOOR/OUTDOOR FIBER IN ONE CONTINUOUS RUN FROM EXISTING MDF ROOM 288 ON THE 2ND FLOOR OF SODA HALL UP TO THE 3RD FLOOR OF SODA HALL. ROUTE THROUGH ETCHEVERRY LAB ALONG WITH POWER INTO JACOBS HALL. KEEP A MINIMUM OF 12" SEPARATEION BETWEEN POWER AND DATA CONDUITS. TERMINATE IN THE NEW JACOBS HALL TELECOM ROOM 010D..
2. PROVIDE ONE 50 PAIR COPPER CABLE FROM ETCHEVERRY 1102 TO NEW JACOBS BDF THROUGH SODA HALL ROOM 288.



B E1.01 CONDUIT ROUTING

NTS



A E1.01 SITE PLAN - ELECTRICAL

SCALE: 1/8" = 1'-0"

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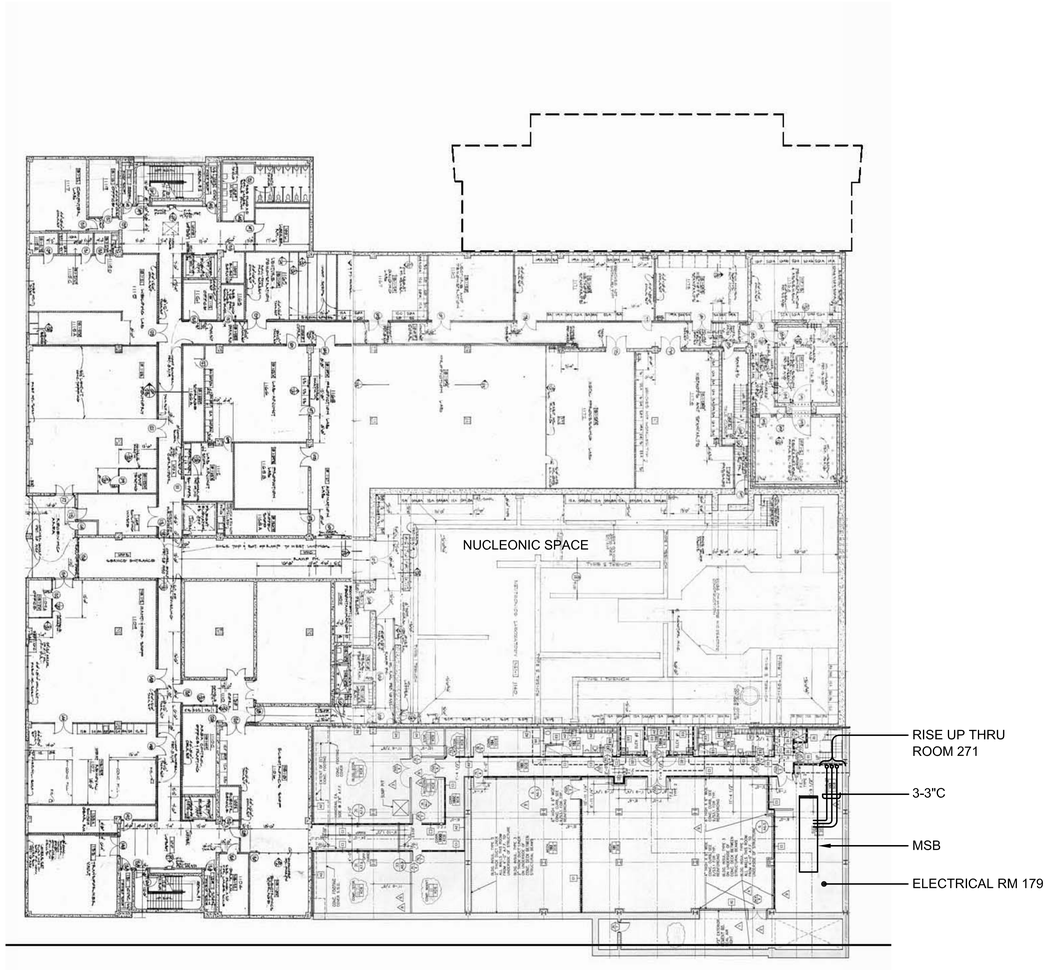
SHEET TITLE

SITE PLAN - ELECTRICAL

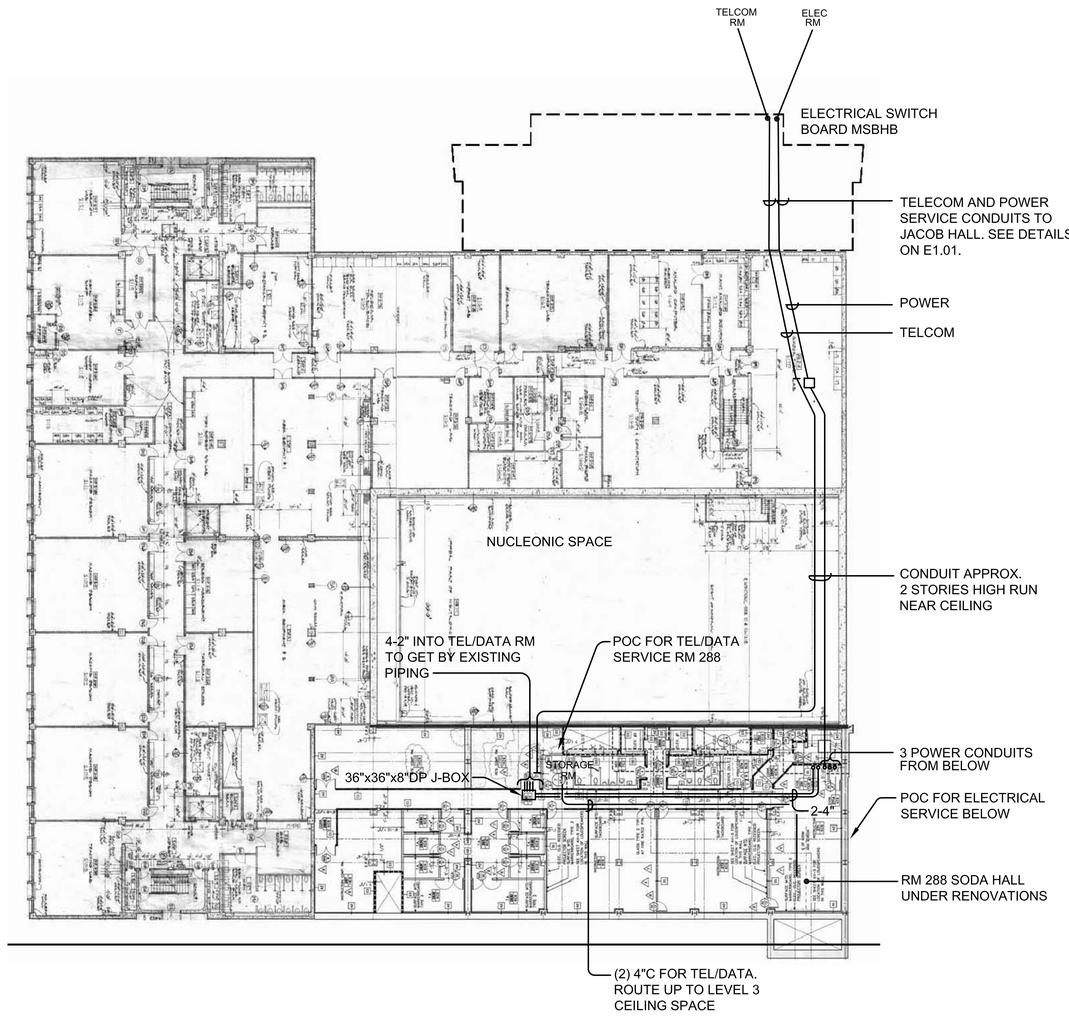
SHEET No

E1.01



A E1.02 1ST FLOOR PLAN - EXISTING SODA HALL

SCALE: NONE



B E1.02 2ND FLOOR - EXISTING SODA & ETCHEVERRY HALL

SCALE: NONE

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SHEET TITLE

EXISTING BUILDING ROUTING PLAN

SHEET No

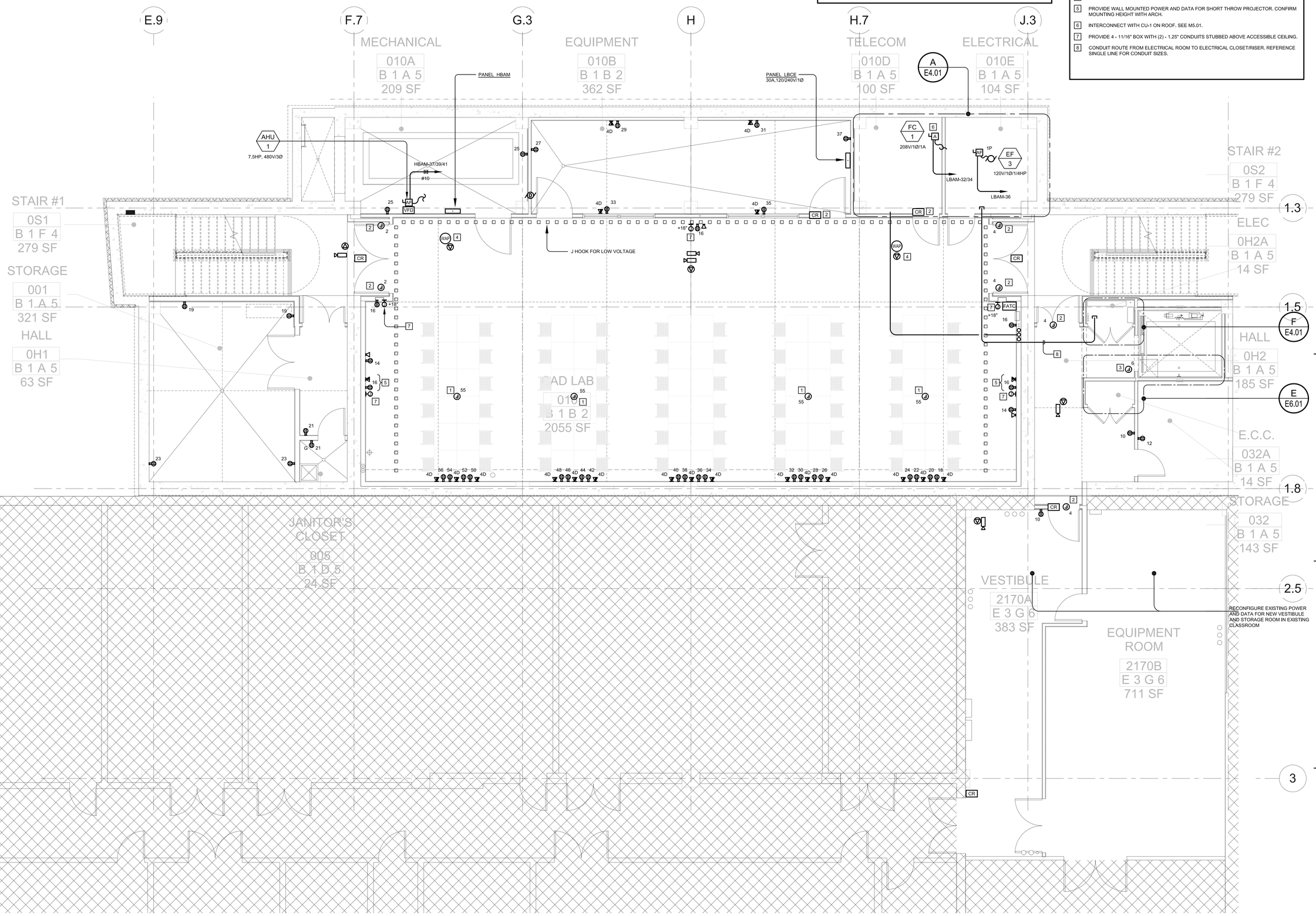
E1.02

GENERAL SHEET NOTES

1. ALL CIRCUITS ARE FED FROM PANEL LBAP UNLESS OTHERWISE NOTED.
2. ALL DEVICES AND FIXTURES TO BE LOCATED AS SHOWN ON ARCH DRAWINGS.
3. ALL EXPOSED CABLING AND CONDUIT TO BE NEATLY BUNDLED AND RUN ORTHOGONAL TO STRUCTURE FOR CLEAN APPEARANCE.

NUMBERED SHEET NOTES

1. PROVIDE CEILING MOUNTED FAN. COORDINATE CONTROL LOCATION WITH LIGHT SWITCHES.
2. COORDINATE PATHWAY AND POWER REQUIREMENTS FOR ELECTRIC DOOR HARDWARE AND SECURITY.
3. PROVIDE POWER TO SMOKE CURTAIN AT ELEVATOR.
4. WIRELESS ACCESS POINT.
5. PROVIDE WALL MOUNTED POWER AND DATA FOR SHORT THROW PROJECTOR. CONFIRM MOUNTING HEIGHT WITH ARCH.
6. INTERCONNECT WITH CU-1 ON ROOF. SEE M5.01.
7. PROVIDE 4 - 11/16" BOX WITH (2) - 1.25" CONDUITS STUBBED ABOVE ACCESSIBLE CEILING.
8. CONDUIT ROUTE FROM ELECTRICAL ROOM TO ELECTRICAL CLOSET/RISER. REFERENCE SINGLE LINE FOR CONDUIT SIZES.



A E2.00 BASEMENT PLAN - POWER

SCALE: 1/4" = 1'-0"

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SCALE : 1/4" = 1'-0"

SHEET TITLE
BASEMENT PLAN - POWER

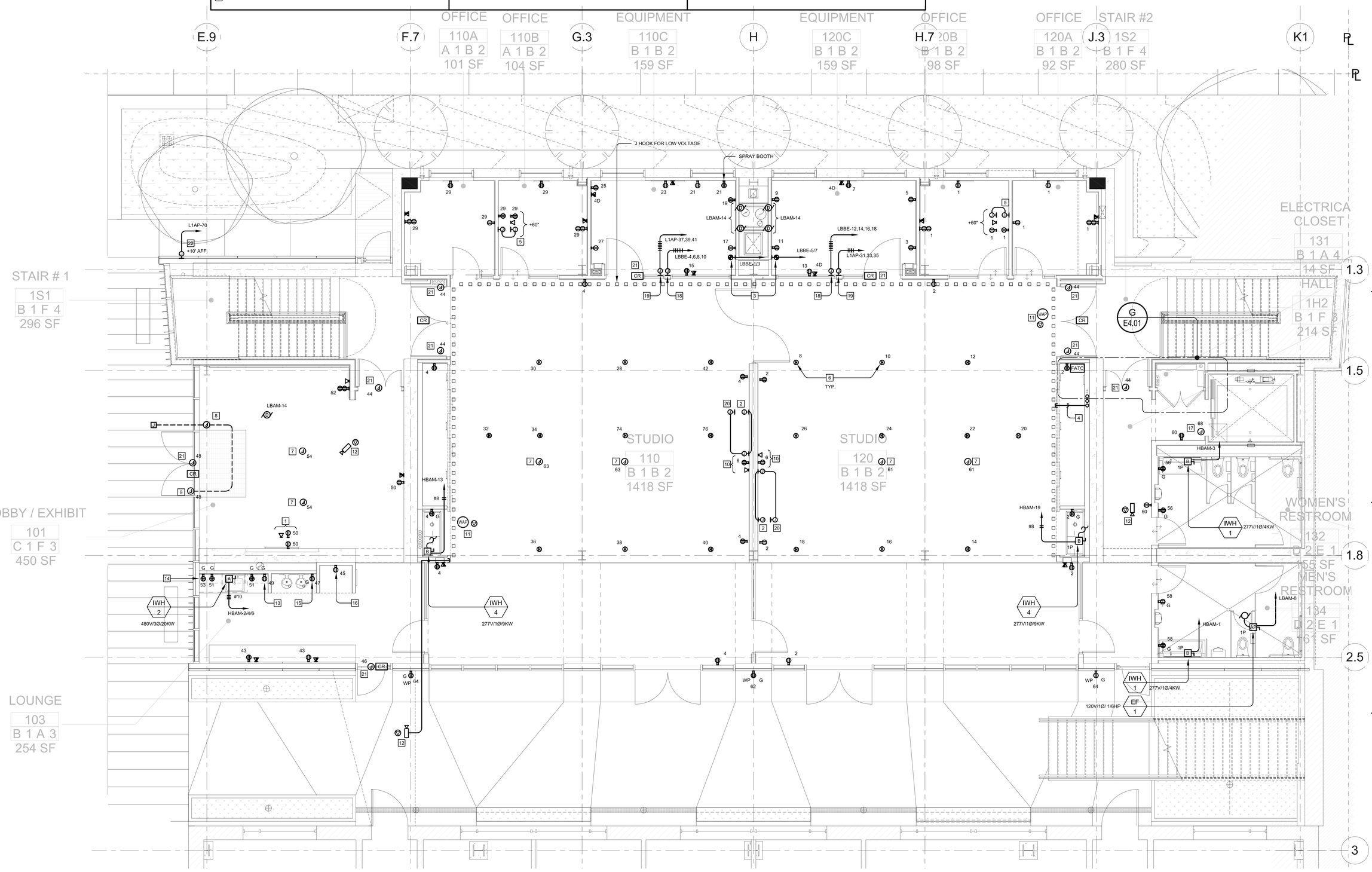
SHEET No
E2.00

NUMBERED SHEET NOTES

1. PROVIDE POWER AND DATA IN ALCOVE FOR FLAT SCREEN TV. COORDINATE EXACT HEIGHT WITH ARCH AND VENDOR DRAWINGS. PROVIDE SECOND OUTLET BELOW AT +18".
2. PROVIDE 4" x 4" AV BOX AT 18" AFF. PROVIDE A 1.25 C TO CONTROL BOX AS SHOWN ON G/E6.01. PROVIDE COMBINATION VGA, HDM1, AUDIO DEVICE. COORDINATE WITH AV VENDOR.
3. PROVIDE ELECTRICAL DISCONNECT FOR LARGE LASER CUTTER. 240V/16A MAX.
4. TELCOM CONDUIT PATH TO J-HOOKS.
5. PROVIDE 4" x 4" AV BOX AT 18" AFF. PROVIDE 1.25"C TO CONTROL BOX ABOVE. REFERENCE F/E6.01.
6. PROVIDE CEILING RECEPTACLE FOR OWNER FURNISHED CORD REEL.
7. PROVIDE CEILING MOUNTED FAN. COORDINATE CONTROL LOCATION WITH LIGHT SWITCH LOCATION. MOUNT UNDER SAME FACEPLATE.
8. PROVIDE ELECTRICAL CONNECTION FOR ASSISTED DOOR STATION.
9. PROVIDE ELECTRICAL DISCONNECT TO MOTORIZED DOOR OPENER.
10. PROVIDE POWER AND DATA FOR CEILING PROJECTOR. PROVIDE 4 - 11/16" BOX AND CONDUIT TO LOW VOLTAGE CONTROL LOCATION. COORDINATE WITH AV VENDOR. REFERENCE G/E6.01.
11. WIRELESS ACCESS POINT.
12. PROVIDE DATA CONNECTION TO SECURITY CAMERA.
13. PROVIDE RECEPTACLE FOR UNDER COUNTER REFRIGERATOR.
14. PROVIDE DEDICATED RECEPTACLE FOR MICROWAVE. COORDINATE EXACT HEIGHT WITH ARCHITECT.
15. PROVIDE POWER TO BOTTLE FILLING STATION.
16. PROVIDE DEDICATED CIRCUIT FOR VENDING MACHINE.
17. PROVIDE POWER TO SMOKE CURTAIN AT ELEVATOR.
18. MOUNT A 4 x 4 DEEP J-BOX IN ACCESSIBLE LOCATION AT CEILING. PROVIDE 3 SPARE CIRCUITS FROM PANEL LBBE.
19. MOUNT A 4 x 4 DEEP J-BOX IN ACCESSIBLE LOCATION AT CEILING. PROVIDE 3 SPARE CIRCUITS FROM PANEL L1AP.
20. PROVIDE A SINGLE GANG AV PATHWAY BOX AT 60", 3/4" C TO BOX AS SHOWN ON G/E6.01. PROVIDE COMBINATION VGA, HDM1, AUDIO JACK DEVICE. COORDINATE WITH AV VENDOR.
21. COORDINATE PATHWAY AND POWER REQUIREMENTS FOR ELECTRIC DOOR HARDWARE AND SECURITY.
22. PROVIDE 120V CIRCUIT TO FIRE ALARM BELL. REFERENCE FA DRAWINGS.

GENERAL SHEET NOTES

1. ALL CIRCUITS ARE FED FROM PANEL L1AP UNLESS OTHERWISE NOTED.
2. ALL DEVICES AND FIXTURES TO BE LOCATED AS SHOWN ON ARCH DRAWINGS.
3. ALL EXPOSED CABLING AND CONDUIT TO BE NEATLY BUNDLED AND RUN ORTHOGONAL TO STRUCTURE FOR CLEAN APPEARANCE.



A E2.01 1ST FLOOR PLAN - POWER

SCALE: 1/4" = 1'-0"

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SHEET TITLE
1ST FLOOR PLAN - POWER

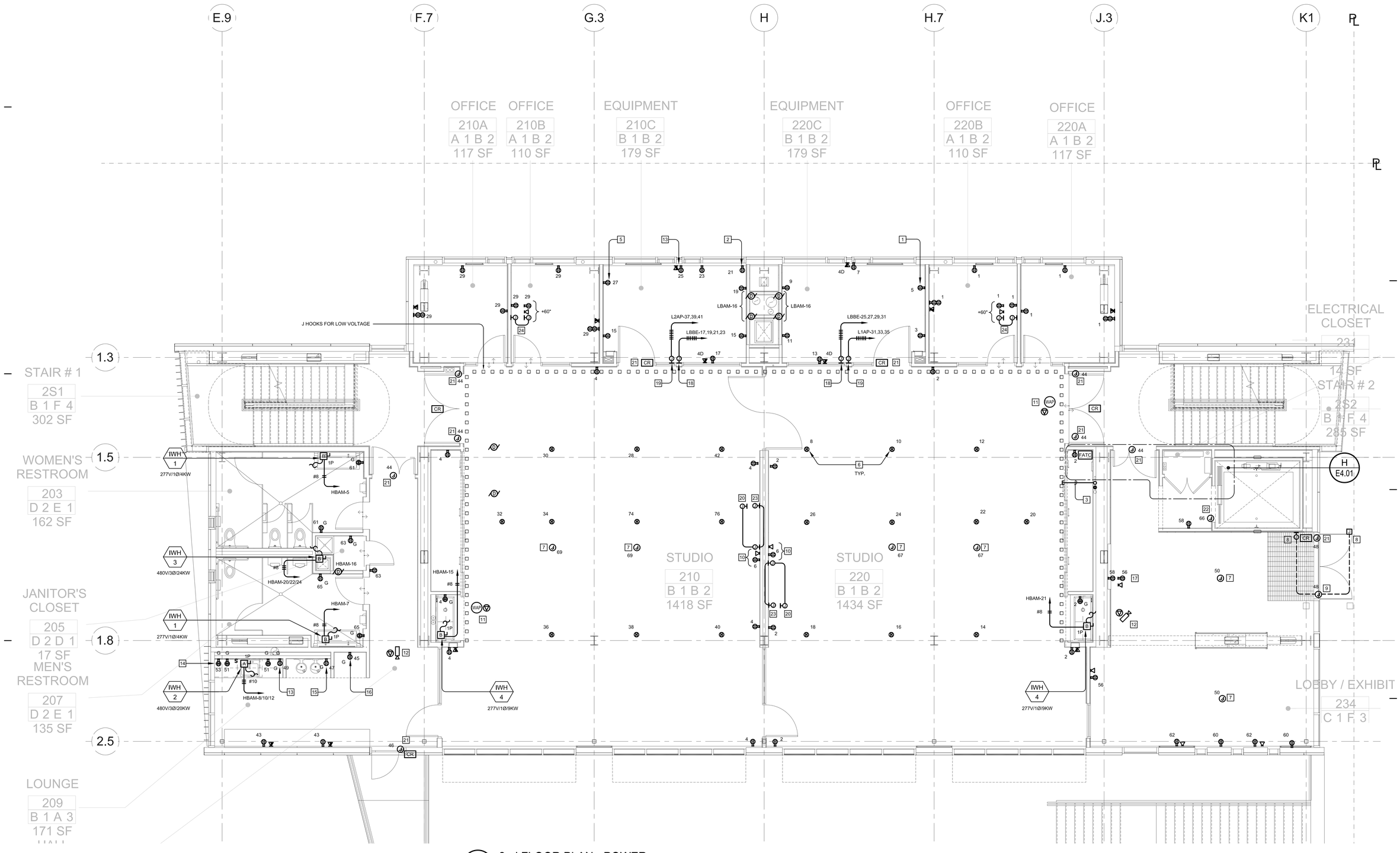
SHEET No
E2.01

NUMBERED SHEET NOTES

1. PROVIDE DEDICATED 20A/120V CIRCUIT FOR 3D PRINTER.
2. PROVIDE DEDICATED 20A/120V CIRCUIT FOR SOLDERING STATION.
3. TELCOM CONDUIT PATH TO J-HOOKS.
4. NOT USED.
5. PROVIDE DEDICATED CIRCUIT FOR CIRCUIT BOARD PLOTTER.
6. PROVIDE CEILING MOUNTED RECEPTACLE FOR OWNER FURNISHED CORD REEL.
7. PROVIDE CEILING MOUNTED FAN. COORDINATE CONTROL LOCATION WITH LIGHT SWITCH LOCATION. MOUNT UNDER SAME FACEPLATE.
8. PROVIDE ELECTRICAL CONNECTION FOR ASSISTED DOOR STATION.
9. PROVIDE ELECTRICAL DISCONNECT TO MOTORIZED DOOR OPENER.
10. PROVIDE RECEPTACLE FOR WALL MOUNTED PROJECTOR. PROVIDE CONDUIT TO LOW VOLTAGE CONTROL LOCATION. COORDINATE WITH AV VENDOR REFERENCE G /E.601.
11. WIRELESS ACCESS POINT.
12. PROVIDE DATA CONNECTION TO SECURITY CAMERA.
13. PROVIDE RECEPTACLE FOR UNDER COUNTER REFRIGERATOR.
14. PROVIDE DEDICATED RECEPTACLE FOR MICROWAVE. COORDINATE EXACT HEIGHT WITH ARCHITECT.
15. PROVIDE POWER TO BOTTLE FILLING STATION.
16. PROVIDE DEDICATED CIRCUIT FOR VENDING MACHINE.
17. PROVIDE POWER AND DATA IN ALCOVE FOR FLAT SCREEN TV. COORDINATE EXACT HEIGHT WITH ARCH AND VENDOR DRAWINGS. PROVIDE SECOND OUTLET BELOW AT +18".
18. MOUNT A 4 x 4 DEEP J-BOX IN ACCESSIBLE LOCATION AT CEILING. PROVIDE 3 SPARE CIRCUITS FROM PANEL LBBE.
19. MOUNT A 4 x 4 DEEP J-BOX IN ACCESSIBLE LOCATION AT CEILING, PROVIDE 3 SPARE CIRCUITS FROM PANEL L2AP.
20. PROVIDE A SINGLE GANG AV PATHWAY BOX AT 60" WITH 3/4" TO BOX AS SHOW ON 2/E6.02. PROVIDE COMBINATION VGA, HDM1, AUDIO JACK DEVICE, COORDINATE WITH AV VENDOR.
21. COORDINATE PATHWAY AND POWER REQUIREMENTS FOR ELECTRIC DOOR HARDWARE AND SECURITY.
22. PROVIDE POWER TO SMOKE CURTAIN AT ELEVATOR.
23. PROVIDE 4" x 4" AV BOX AT 18" AFF. PROVIDE 1.25" C TO CONTROL BOX AS SHOWN ON G/E6.01.
24. PROVIDE 4" x 4" AV BOX AT 18" AFF. PROVIDE A 1.25" C TO CONTROL BOX ABOVE. PROVIDE COMBINATION VGA, HDM1, AUDIO DEVICE. COORDINATE WITH AV VENDOR. REFERENCE F/E6.01.

GENERAL SHEET NOTES

1. ALL CIRCUITS ARE FED FROM PANEL L2AP UNLESS OTHERWISE NOTED.
2. ALL DEVICES AND FIXTURES TO BE LOCATED AS SHOWN ON ARCH DRAWINGS.
3. ALL EXPOSED CABLING AND CONDUIT TO BE NEATLY BUNDLED AND RUN ORTHOGONAL TO STRUCTURE FOR CLEAN APPEARANCE.



A E2.02 2nd FLOOR PLAN - POWER

SCALE: 1/4" = 1'-0"

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SHEET TITLE

2nd FLOOR PLAN - POWER

SHEET No

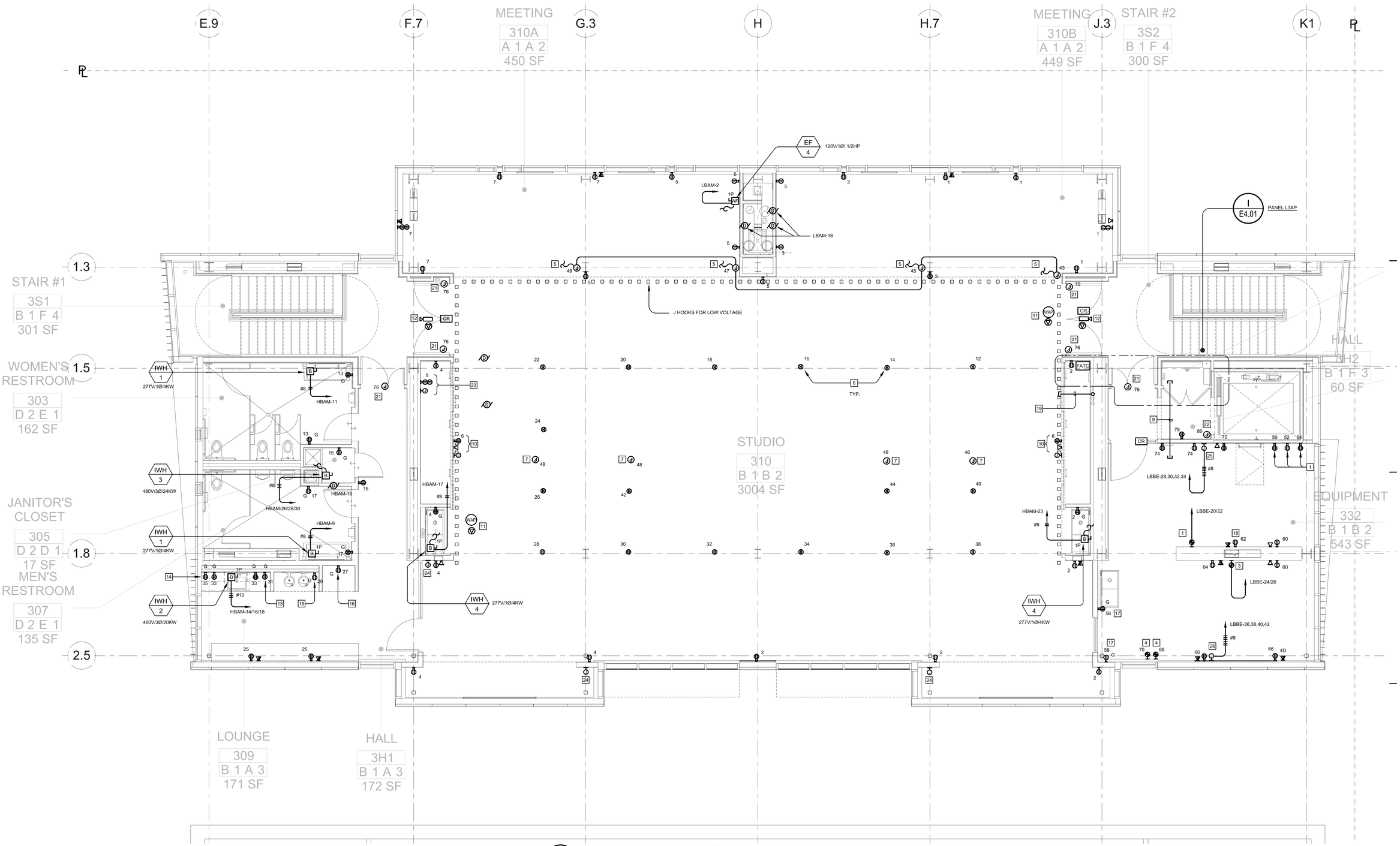
E2.02

NUMBERED SHEET NOTES

1. PROVIDE DEDICATED CIRCUIT FOR 3D PRINTER. CONFIRM NEMA CONFIGURATION.
2. NOT USED.
3. PROVIDE ELECTRICAL DISCONNECT OR OUTLET FOR LARGE LASER CUTTER. 240V/16A MAX. CONFIRM NEMA CONFIGURATION WITH EQUIPMENT.
4. PROVIDE ELECTRICAL OUTLET FOR SMALL LASER CUTTER.
5. PROVIDE POWER AND CONTROL PATH TO MOTORIZED WINDOWS ABOVE. COORDINATE CONTROL QUANTITY AND LOCATIONS. PROVIDE ADJACENT LIGHTING AND FAN SWITCHES, UNDER SAME FACEPLATE WHERE POSSIBLE.
6. PROVIDE CEILING MOUNTED RECEPTACLE FOR OWNER FURNISHED CORD REEL.
7. PROVIDE CEILING MOUNTED FAN. COORDINATE CONTROL LOCATION WITH LIGHT SWITCH LOCATION. MOUNT UNDER SAME FACEPLATE.
8. NOT USED.
9. PROVIDE EMPTY 1" CONDUIT FOR FUTURE CIRCUIT ROUTING.
10. PROVIDE RECEPTACLE FOR LCD WALL DISPLAY. PROVIDE CONDUIT TO LOW VOLTAGE CONTROL LOCATION. COORDINATE WITH AV VENDOR REFERENCE G/E.601.
11. WIRELESS ACCESS POINT.
12. PROVIDE DATA CONNECTION TO SECURITY CAMERA.
13. PROVIDE RECEPTACLE FOR UNDER COUNTER REFRIGERATOR.
14. PROVIDE DEDICATED RECEPTACLE FOR MICROWAVE. COORDINATE EXACT HEIGHT WITH ARCHITECT.
15. PROVIDE POWER TO BOTTLE FILLING STATION.
16. PROVIDE DEDICATED CIRCUIT FOR VENDING MACHINE.
17. PROVIDE ELECTRICAL CONNECTION FOR 3D PRINTER BATH (NIC),120V.
18. PROVIDE ELECTRICAL CONNECTION FOR 3D SCANNER (NIC).
19. TELCOM CONDUIT PATH TO J-HOOKS.
20. NOT USED.
21. COORDINATE PATHWAY AND POWER REQUIREMENTS FOR ELECTRIC DOOR HARDWARE AND SECURITY.
22. PROVIDE POWER TO SMOKE CURTAIN AT ELEVATOR. PROVIDE INTERFACE WITH FIRE ALARM.
23. POWER TO AV RACK. COORDINATE EXACT REQUIREMENTS WITH AV VENDOR.
24. PROVIDE 4" x 4" AV BOX AT 18" AFF. PROVIDE A 1.25" C TO STUBBED ABOVE. PROVIDE COMBINATION VGA, HDM1, AUDIO DEVICE. COORDINATE WITH AV VENDOR.
25. MOUNT A 4 x 4 DEEP J-BOX IN ACCESSIBLE LOCATION AT CEILING. PROVIDE 3 SPARE CIRCUITS FROM PANEL LBBE.

GENERAL SHEET NOTES

1. ALL CIRCUITS ARE FED FROM PANEL L3AP, UNLESS OTHERWISE NOTED.
2. ALL DEVICES AND FIXTURES TO BE LOCATED AS SHOWN ON ARCH DRAWINGS.
3. ALL EXPOSED CABLING AND CONDUIT TO BE NEATLY BUNDLED AND RUN ORTHOGONAL TO STRUCTURE FOR CLEAN APPEARANCE.



A E2.03 3rd FLOOR PLAN - POWER

SCALE: 1/4" = 1'-0"

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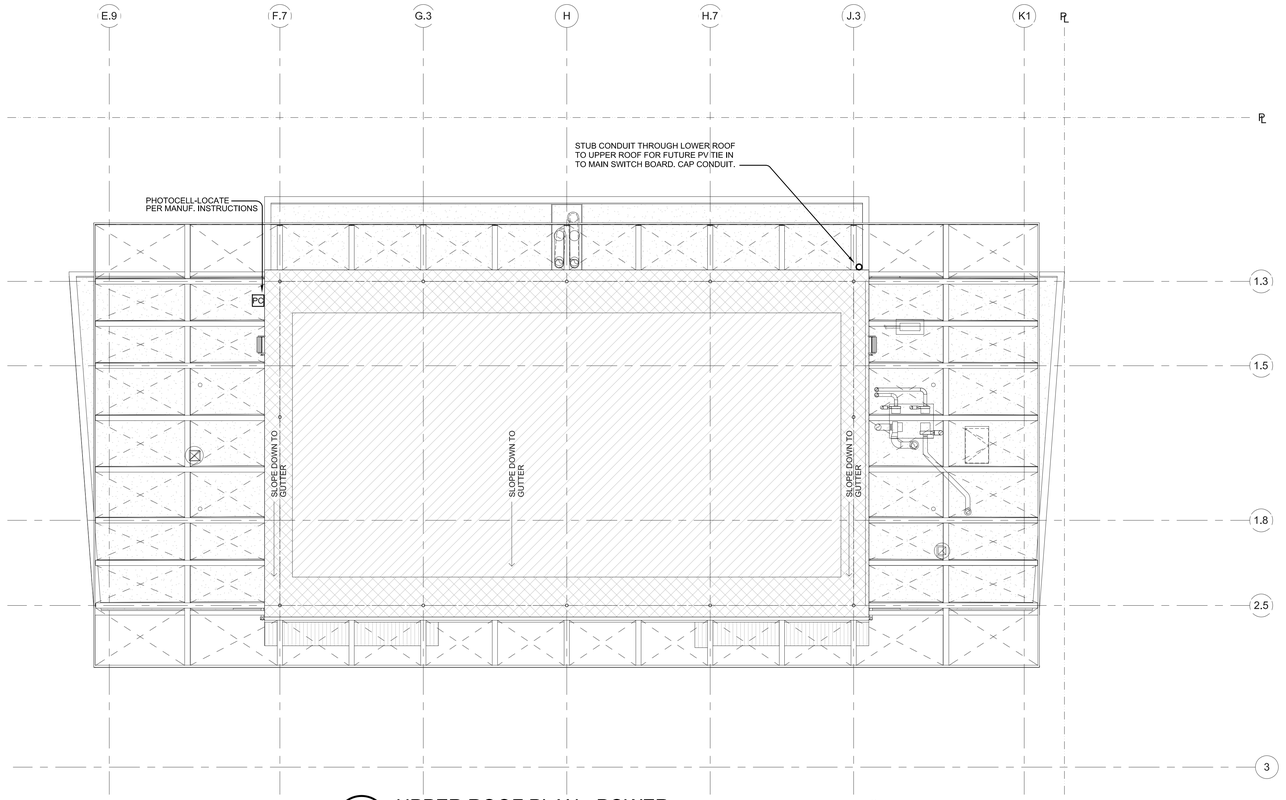
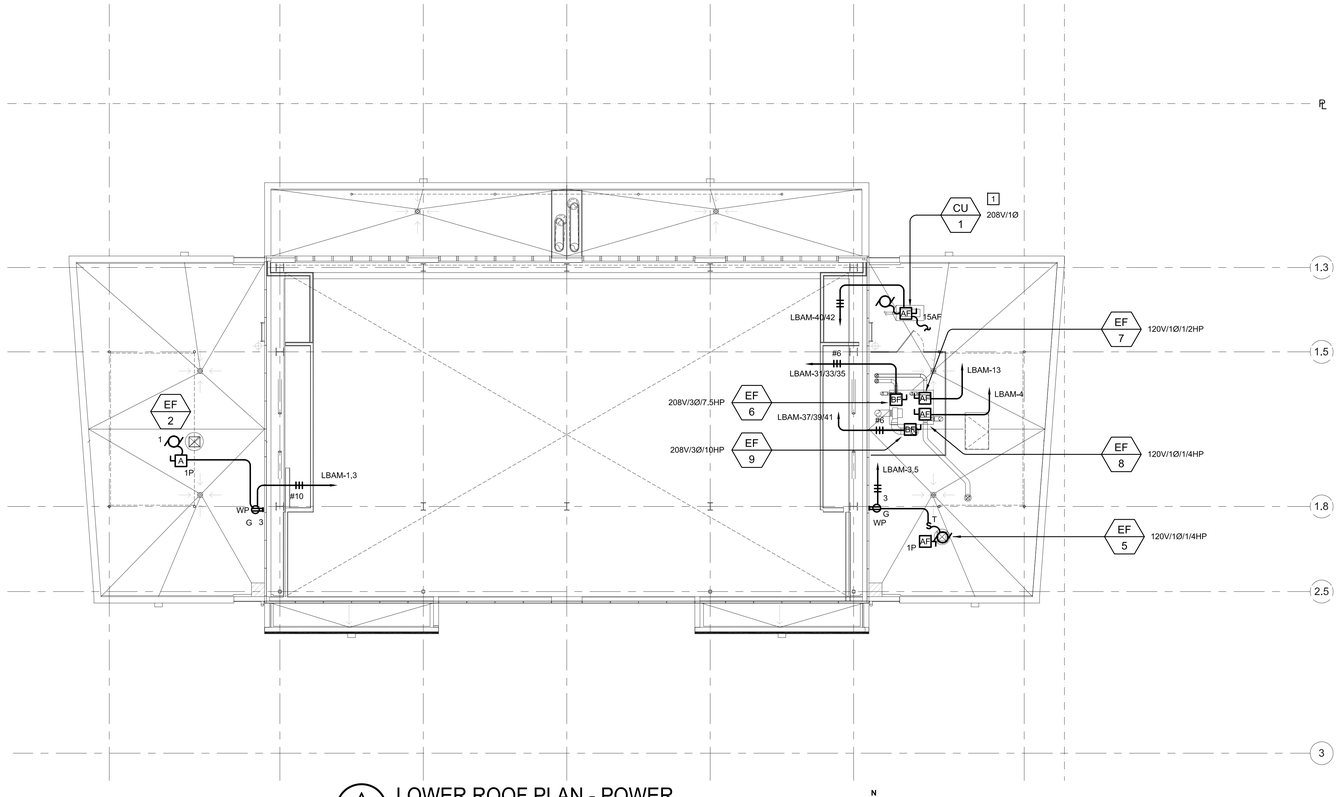
SHEET TITLE
3rd FLOOR PLAN - POWER

SHEET No
E2.03



B E2.04 UPPER ROOF PLAN - POWER

SCALE: 1/8" = 1'-0"



A E2.04 LOWER ROOF PLAN - POWER

SCALE: 1/8" = 1'-0"

GENERAL SHEET NOTES

1. ALL CIRCUITS ARE FED FROM PANEL LBAM UNLESS OTHERWISE NOTED.
2. ALL DEVICES AND FIXTURES TO BE LOCATED AS SHOWN ON ARCH DRAWINGS.
3. ALL EXPOSED CABLING AND CONDUIT TO BE NEATLY BUNDLED AND RUN ORTHOGONAL TO STRUCTURE FOR CLEAN APPEARANCE.

NUMBERED SHEET NOTES

1 INTERCONNECT W/FC-1. SEE M5.01.

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PROJECT

JACOBS HALL

UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% CDs / Permit	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : 1/8" = 1'-0"

SHEET TITLE

LOWER AND UPPER ROOF PLANS - POWER

SHEET No

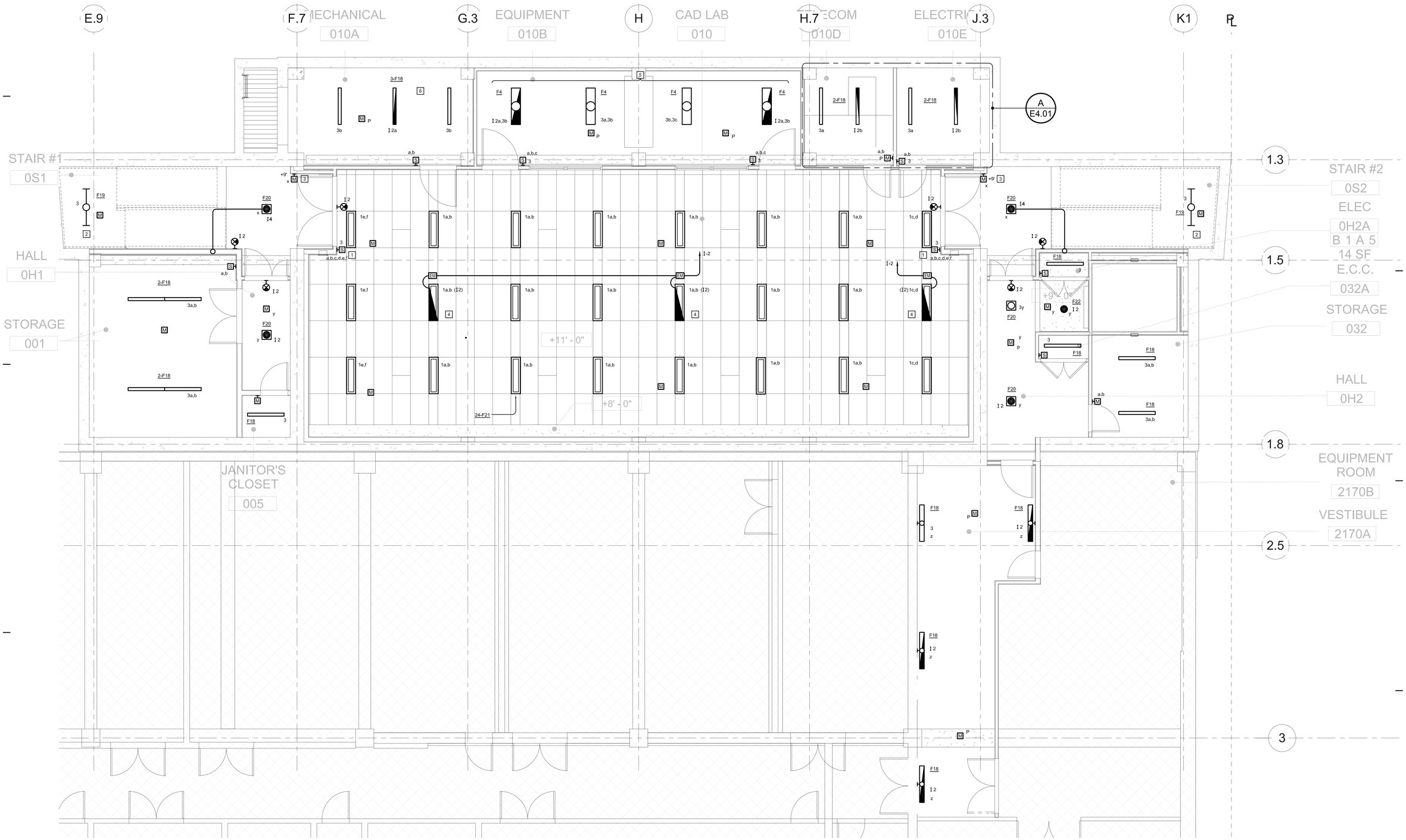
E2.04

NUMBERED SHEET NOTES

1. PROVIDE FAN CONTROL UNDER SAME FACEPLATE AS LIGHT FIXTURES.
2. MOUNT FIXTURE AND SENSOR UNDER THE LOWEST LANDING. PROVIDE LOCAL MOTION SENSOR FOR THIS FIXTURE ONLY.
3. WALL MOUNT ADJUSTABLE SENSOR ABOVE DOOR HEIGHT TO SENSE MOTION ON STAIRS.
4. PROVIDE ONE LAMP CONNECTED THROUGH ALCR (WATTSTOPPER OR EQUAL) BUT CONTROLLED NORMALLY THROUGH SWITCH NOTED.
5. IN EQUIPMENT ROOM: SWITCH LEG "a" CONTROLS TWO LAMP FROM INVERTER. SWITCH LEG "b" CONTROLS TWO LAMPS IN ALL 4 FIXTURES ON NORMAL POWER AND "c" CONTROLS 2 LAMPS ON NORMAL.
6. COORDINATE EXACT PLACEMENT WITH DUCTS AND EQUIPMENT.

GENERAL SHEET NOTES

1. ALL LIGHTING CIRCUITS ARE ROUTED TO PANEL HBAL OR INVERTER (I) UNLESS OTHERWISE NOTED.
2. ALL DEVICES AND FIXTURES TO BE LOCATED AS SHOWN ON ARCH DRAWINGS.
3. ALL EXPOSED CABLING AND CONDUIT TO BE NEATLY BUNDLED AND RUN ORTHOGONAL TO STRUCTURE FOR CLEAN APPEARANCE.



A E3.00 BASEMENT PLAN - LIGHTING

SCALE: 1/4" = 1'-0"

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SCALE : 1/4" = 1'-0"

SHEET TITLE

BASEMENT PLAN - LIGHTING

SHEET No

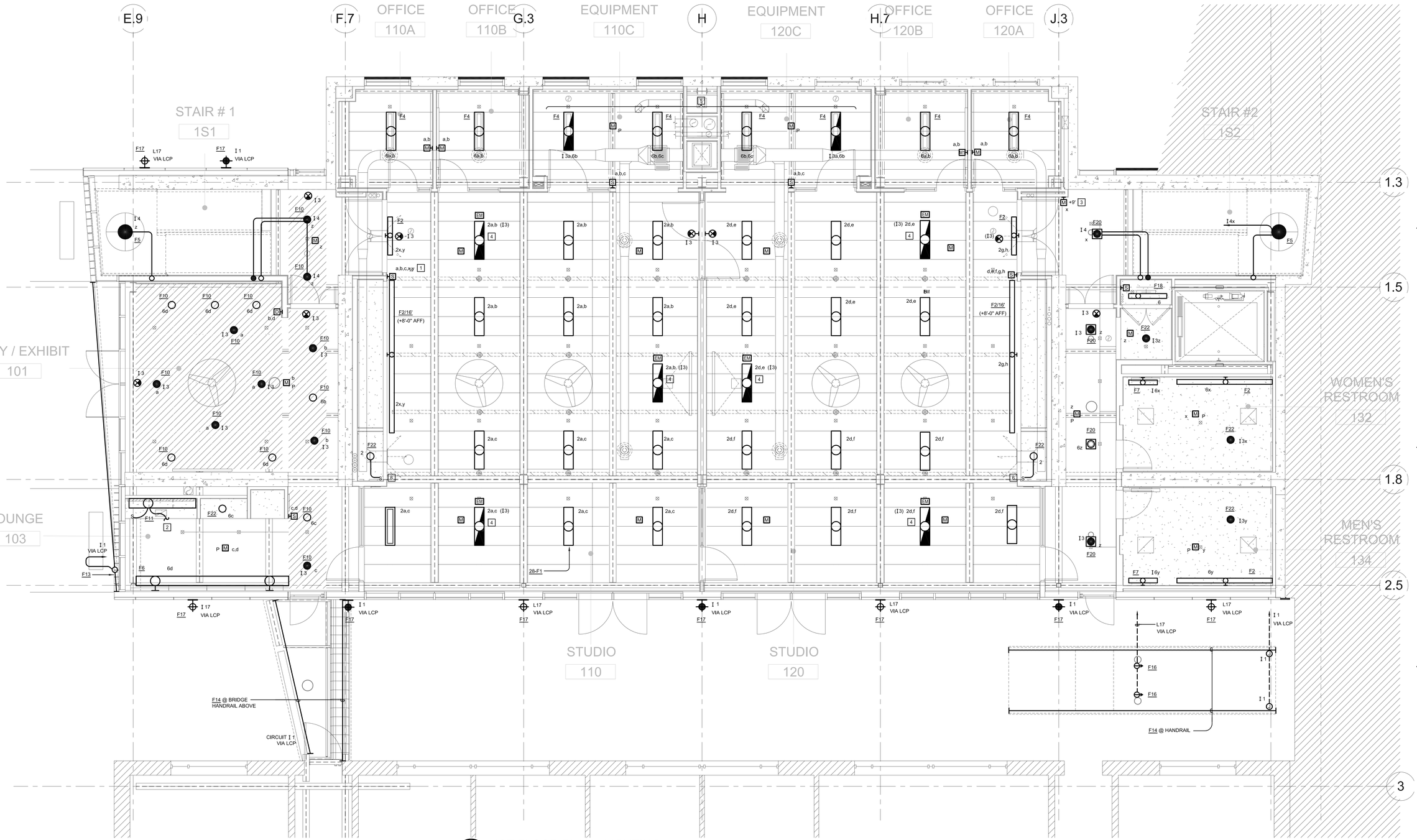
E3.00

NUMBERED SHEET NOTES

1. PROVIDE FAN CONTROL SWITCH UNDER SAME FACEPLATE AS LIGHT SWITCHES.
2. TIE UNDER CABINET FIXTURE TO LOCAL 120V RECEPTACLE BELOW.
3. WALL MOUNT ADJUSTABLE SENSOR AT APPROX. +9' AFF TO SENSE MOTION ON STAIRS. ALL STAIR SENSORS AND FIXTURES SHALL BE TIEFD TOGETHER SUCH THAT SENSOR AT ONE LOCATION WILL CONTROL ALL FIXTURES IN THAT STAIR WELL.
4. PROVIDE ONE LAMP CONNECTED THROUGH ALCR (WATTSTOPPER OR EQUAL) BUT CONTROLLED NORMALLY THROUGH SWITCH NOTED.
5. IN EQUIPMENT ROOM: SWITCH LEG "a" CONTROLS TWO LAMP FROM INVERTER. SWITCH LEG "b" CONTROLS TWO LAMPS IN ALL 4 FIXTURES ON NORMAL POWER AND "c" CONTROLS 2 LAMPS ON NORMAL.
6. PROVIDE NO-HOLD 0-3HR ELECTRONIC TIMER SWITCH.

GENERAL SHEET NOTES

1. ALL LIGHTING CIRCUITS ARE ROUTED TO PANEL HBAL OR INVERTER (I) UNLESS OTHERWISE NOTED.
2. ALL DEVICES AND FIXTURES TO BE LOCATED AS SHOWN ON ARCH DRAWINGS.
3. ALL EXPOSED CABLING AND CONDUIT TO BE NEATLY BUNDLED AND RUN ORTHOGONAL TO STRUCTURE FOR CLEAN APPEARANCE.



A E3.01 1ST FLOOR PLAN - LIGHTING

SCALE: 1/4" = 1'-0"

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PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : 1/4" = 1'-0"

SHEET TITLE
1ST FLOOR PLAN - LIGHTING

SHEET No
E3.01

NUMBERED SHEET NOTES

1. PROVIDE FAN CONTROL SWITCH UNDER SAME FACEPLATE AS LIGHT SWITCHES.
2. TIE UNDER CABINET FIXTURE TO LOCAL 120V RECEPTACLE BELOW.
3. WALL MOUNT ADJUSTABLE SENSOR AT APPROX. +9' AFF TO SENSE MOTION ON STAIRS. ALL STAIR SENSORS AND FIXTURES SHALL BE TIEFD TOGETHER SUCH THAT SENSOR AT ONE LOCATION WILL CONTROL ALL FIXTURES IN THAT STAIR WELL.
4. PROVIDE ONE LAMP CONNECTED THROUGH ALCR (WATTSTOPPER OR EQUAL) BUT CONTROLLED NORMALLY THROUGH SWITCH NOTED.
5. IN EQUIPMENT ROOM: SWITCH LEG "a" CONTROLS TWO LAMP FROM INVERTER. SWITCH LEG "b" CONTROLS TWO LAMPS IN ALL 4 FIXTURES ON NORMAL POWER AND "c" CONTROLS 2 LAMPS ON NORMAL.
6. PROVIDE NO-HOLD 0-3HR ELECTRONIC TIMER SWITCH.

GENERAL SHEET NOTES

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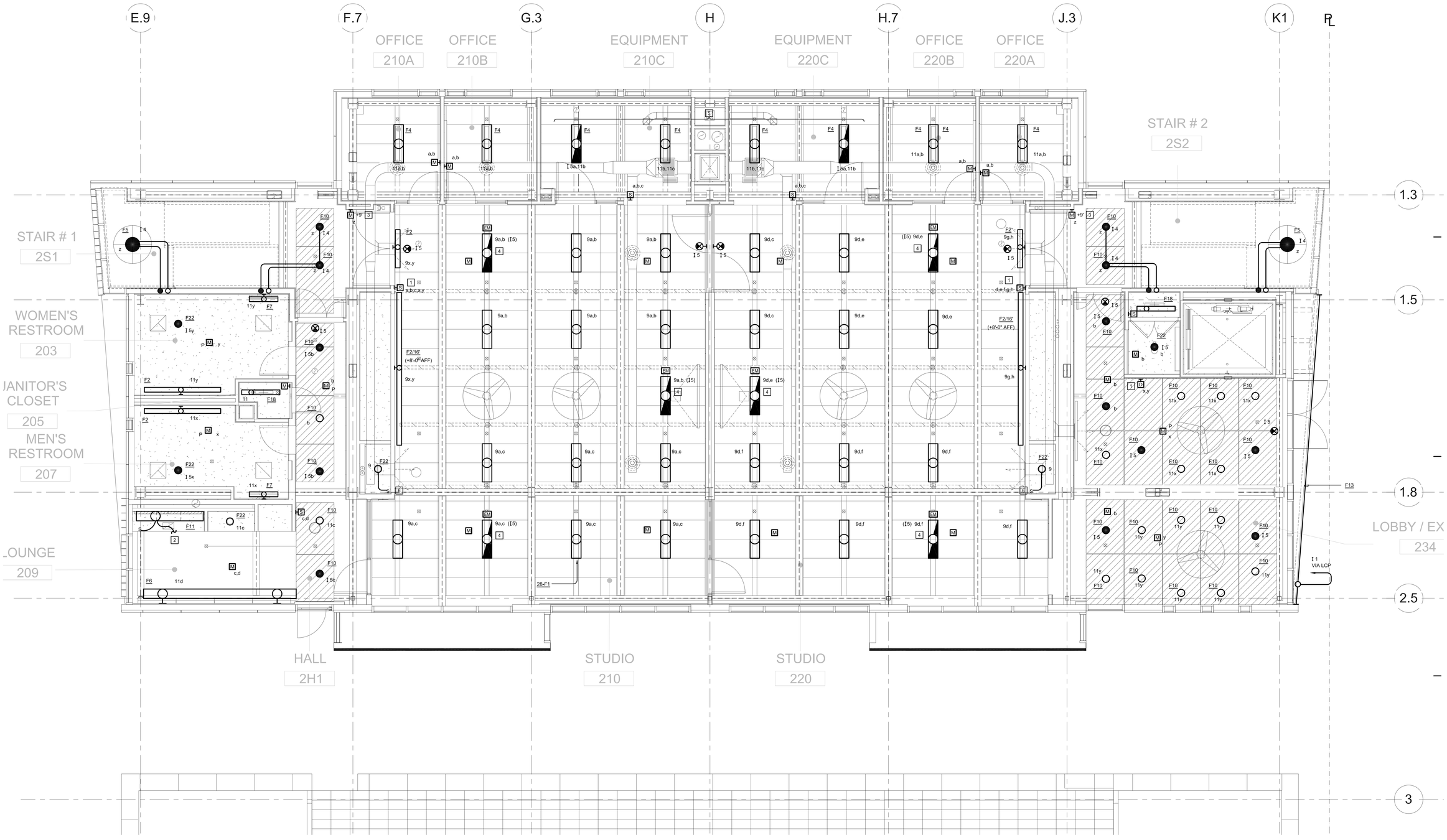

A E3.02 2nd FLOOR PLAN - LIGHTING

SCALE: 1/4" = 1'-0"

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PHASE : CD
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PERMIT No :
SCALE : 1/4" = 1'-0"

SHEET TITLE
2nd FLOOR PLAN - LIGHTING

SHEET No
E3.02

NUMBERED SHEET NOTES

1. PROVIDE FAN CONTROL SWITCH UNDER SAME FACEPLATE AS LIGHT SWITCHES.
2. TIE UNDER CABINET FIXTURE TO LOCAL 120V RECEPTACLE BELOW.
3. WALL MOUNT ADJUSTABLE SENSOR AT APPROX. +9' AFF TO SENSE MOTION ON STAIRS. ALL STAIR SENSORS AND FIXTURES SHALL BE TIEFD TOGETHER SUCH THAT SENSOR AT ONE LOCATION WILL CONTROL ALL FIXTURES IN THAT STAIR WELL.
4. PROVIDE ONE LAMP CONNECTED THROUGH ALCR (WATTSTOPPER OR EQUAL) BUT CONTROLLED NORMALLY THROUGH SWITCH NOTED.
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6. PROVIDE NO-HOLD 0-3HR ELECTRONIC TIMER SWITCH.

GENERAL SHEET NOTES

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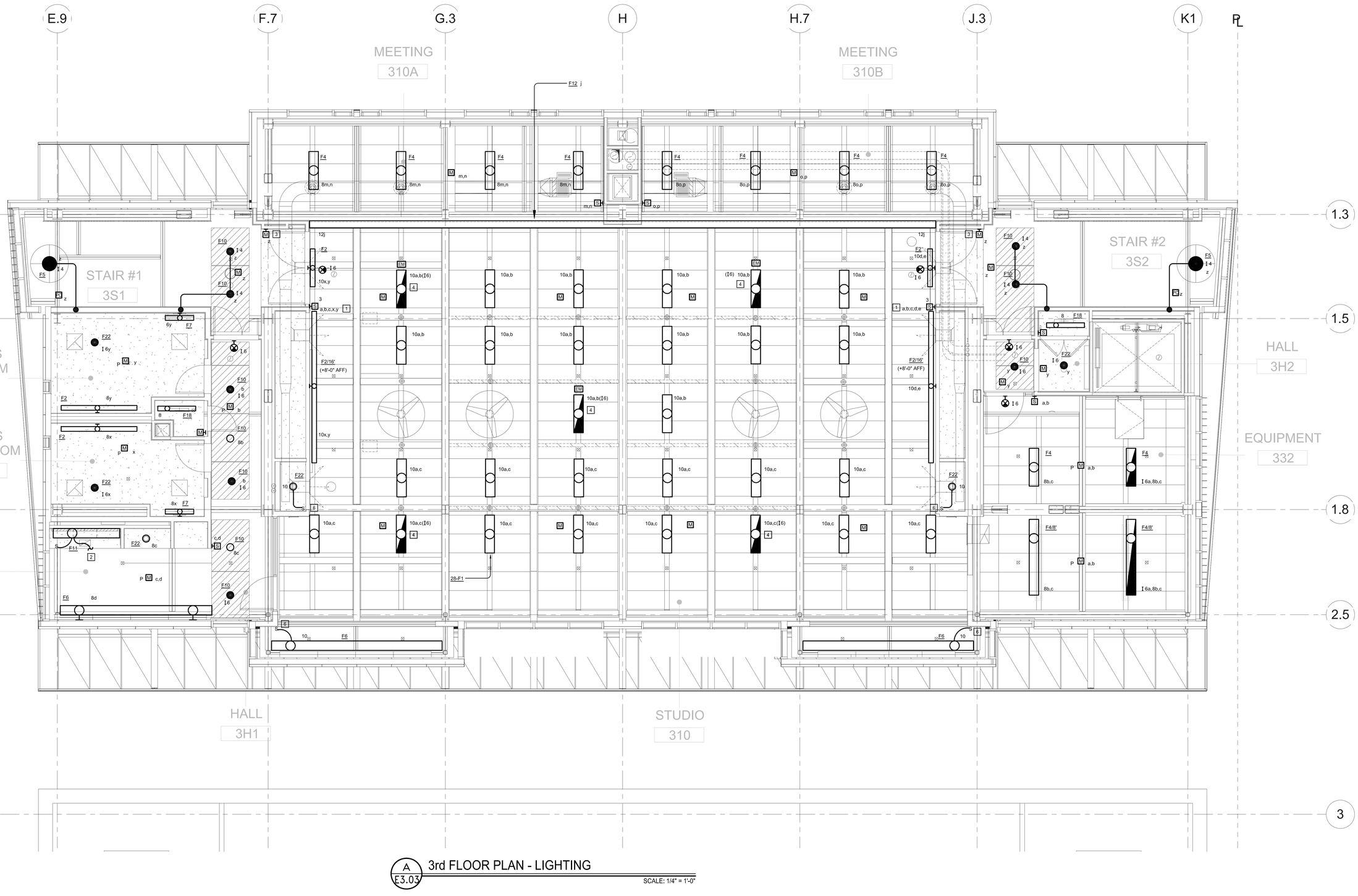

A E3.03 3rd FLOOR PLAN - LIGHTING

SCALE: 1/4" = 1'-0"

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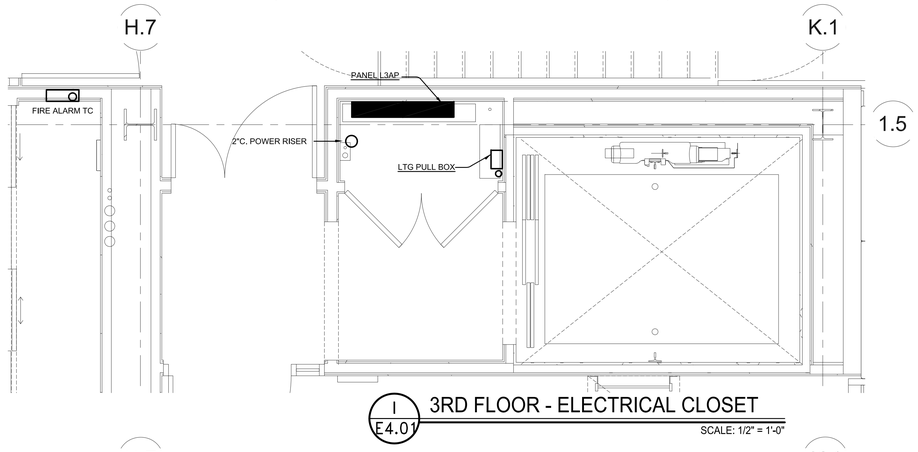
SCALE : 1/4" = 1'-0"

SHEET TITLE

3rd FLOOR PLAN - LIGHTING

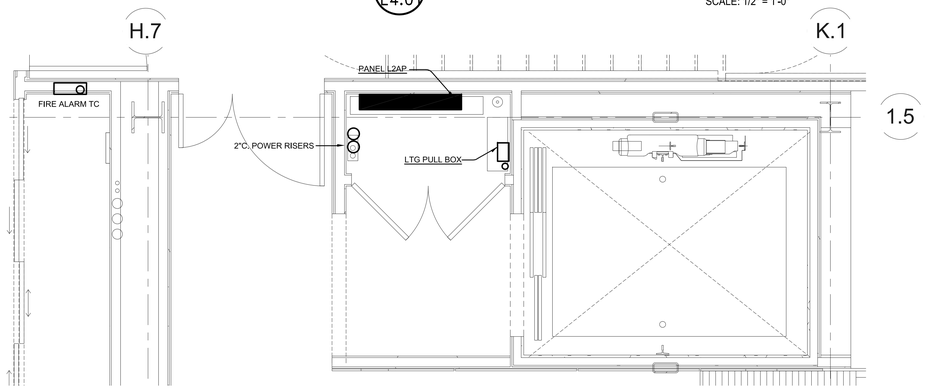
SHEET No

E3.03



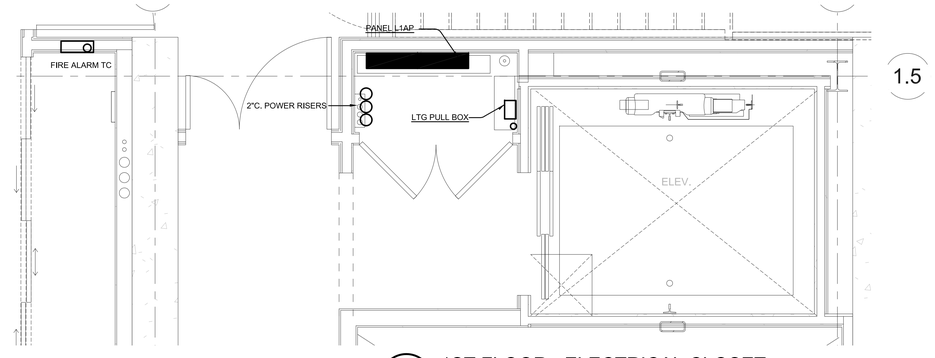
I E4.01 3RD FLOOR - ELECTRICAL CLOSET

SCALE: 1/2" = 1'-0"



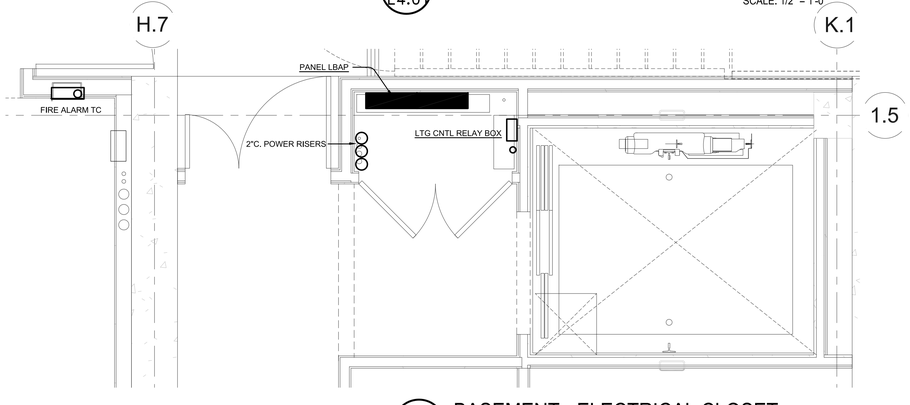
H E4.01 2ND FLOOR - ELECTRICAL CLOSET

SCALE: 1/2" = 1'-0"



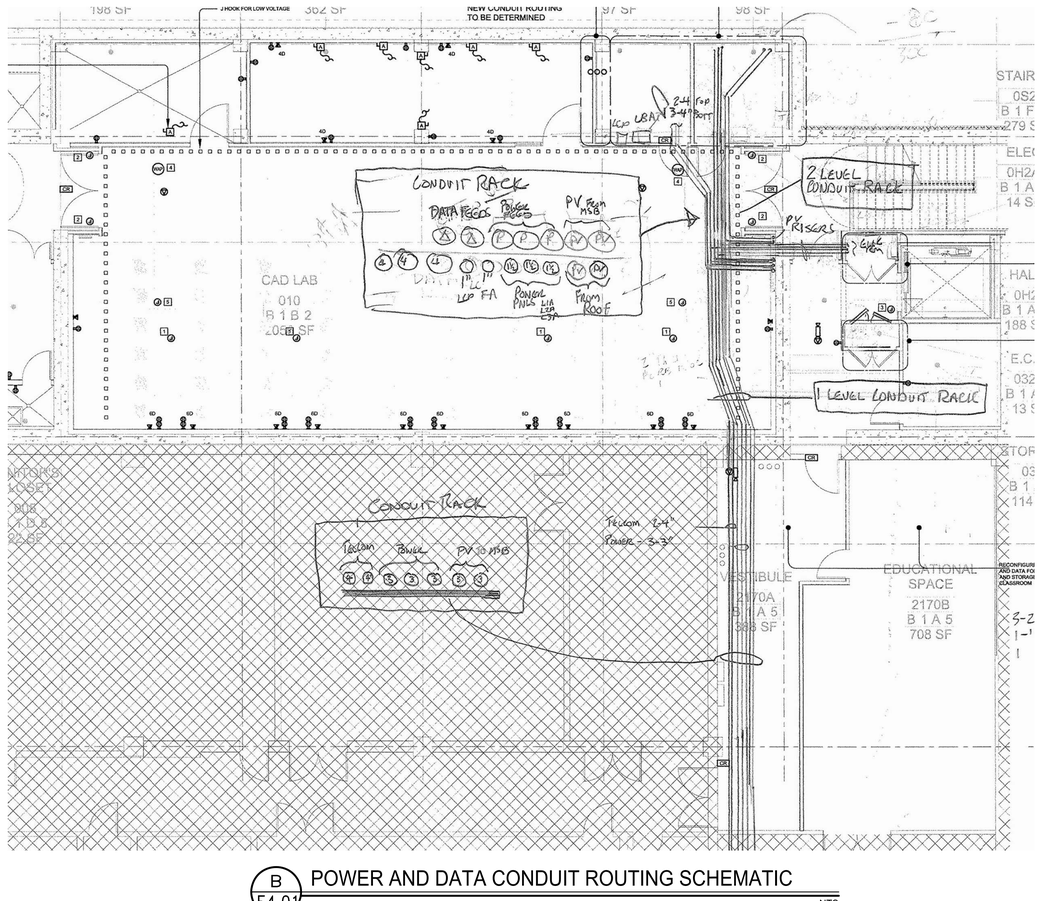
G E4.01 1ST FLOOR - ELECTRICAL CLOSET

SCALE: 1/2" = 1'-0"



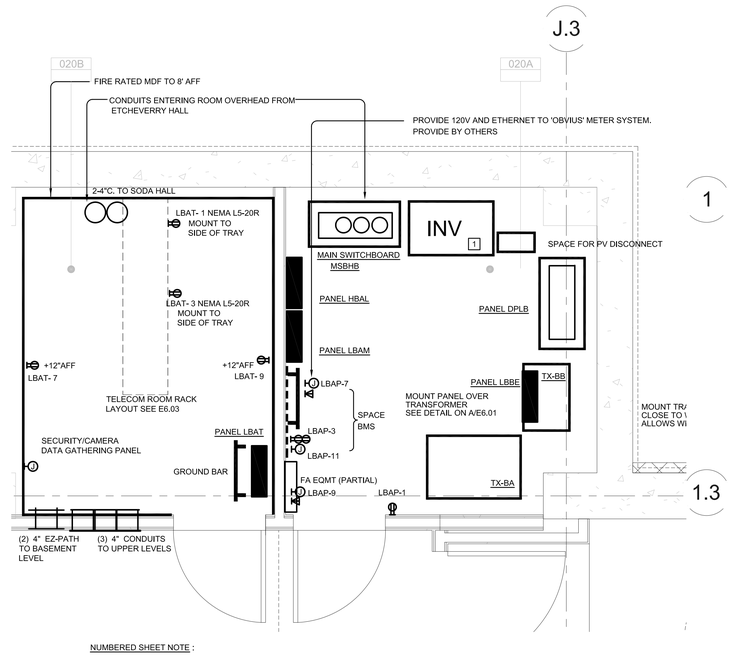
F E4.01 BASEMENT - ELECTRICAL CLOSET

SCALE: 1/2" = 1'-0"



B E4.01 POWER AND DATA CONDUIT ROUTING SCHEMATIC

NTS



NUMBERED SHEET NOTE :

1 INVERTER SHALL BE DUAL LITE #D-277-37-G-277-C-20-3-X3.7S - GOOD FOR 3700 WATTS, OR TYPE #D-277-48-S-277-C-20-4 - GOOD FOR 4800 WATTS. COORDINATE WITH AVAILABLE SPACE.

A E4.01 BASEMENT - ELECTRICAL AND TELCOM ROOM DETAIL

SCALE: 1/2" = 1'-0"

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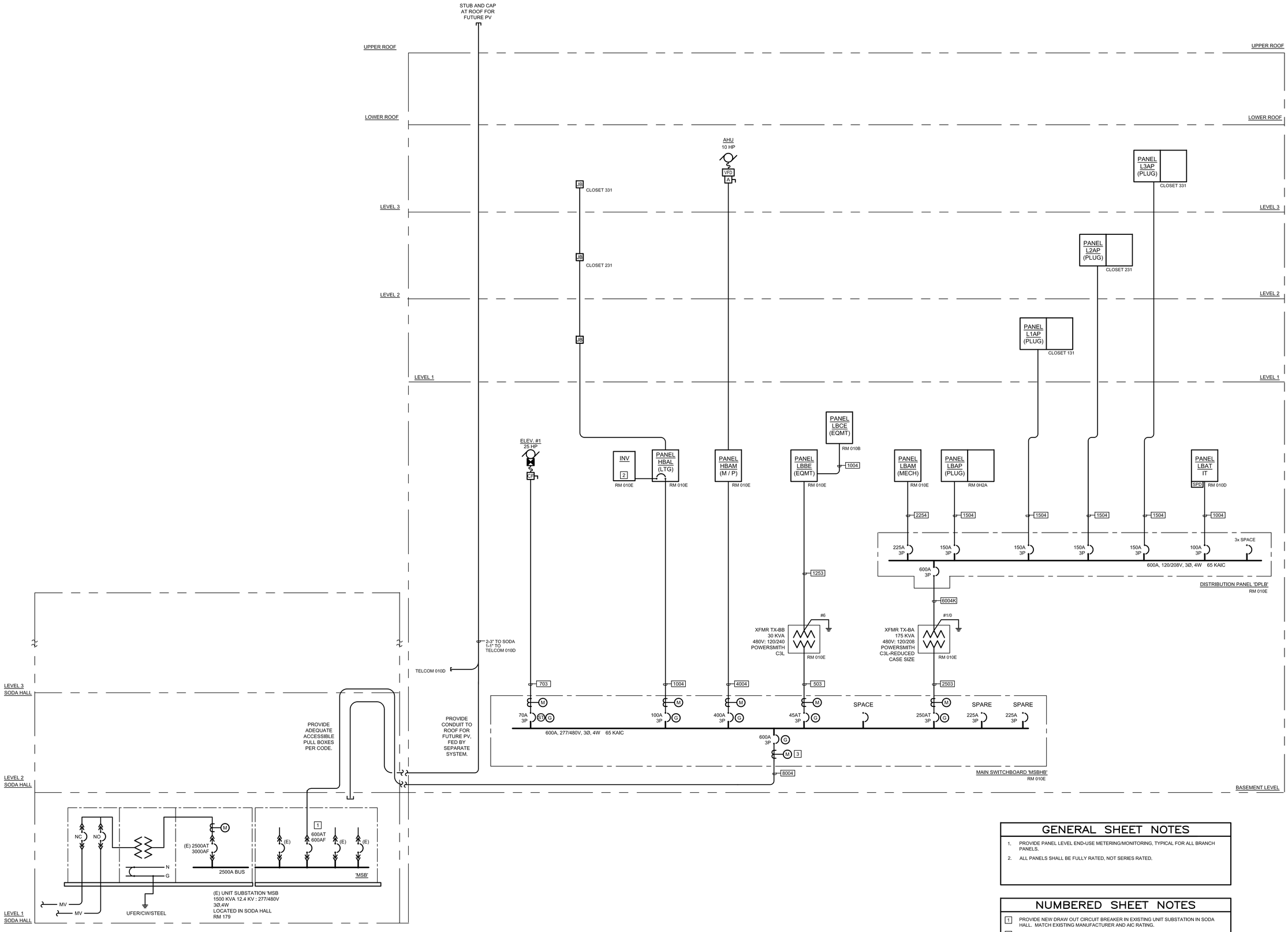
PERMIT No :
SCALE : AS SHOWN

SHEET TITLE

ENLARGED ELECTRICAL AND TELCOM ROOM PLANS

SHEET No

E4.01



GENERAL SHEET NOTES

1. PROVIDE PANEL LEVEL END-USE METERING/MONITORING, TYPICAL FOR ALL BRANCH PANELS.
2. ALL PANELS SHALL BE FULLY RATED, NOT SERIES RATED.

NUMBERED SHEET NOTES

1. PROVIDE NEW DRAW OUT CIRCUIT BREAKER IN EXISTING UNIT SUBSTATION IN SODA HALL. MATCH EXISTING MANUFACTURER AND AIC RATING.
2. PROVIDE 4 KW LIGHTING INVERTER DUAL LITE LSN D SERIES OR APPROVED EQUAL.
3. METER PROVIDED AT THE MAIN SWITCHBOARDS SHALL BE PER UC BERKELEY STANDARDS.

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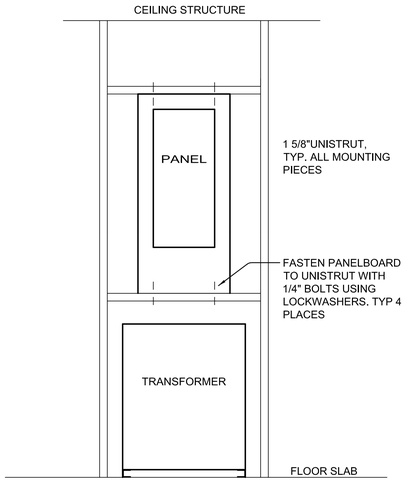
SCALE : NONE

SHEET TITLE

POWER RISER DIAGRAM

SHEET No

E5.01



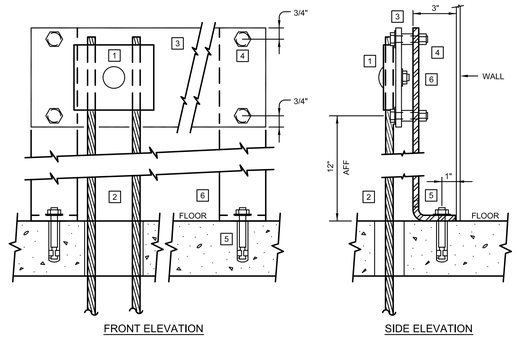
NOTES:

1. MOUNT PANEL MINIMUM 6" ABOVE TRANSFORMER.
2. CIRCUIT BREAKER SHALL BE A MAXIMUM 6'-6" AFF.

A E6.01 PANEL/TRANSFORMER MOUNTING DETAIL (N.T.S.)

NOT USED

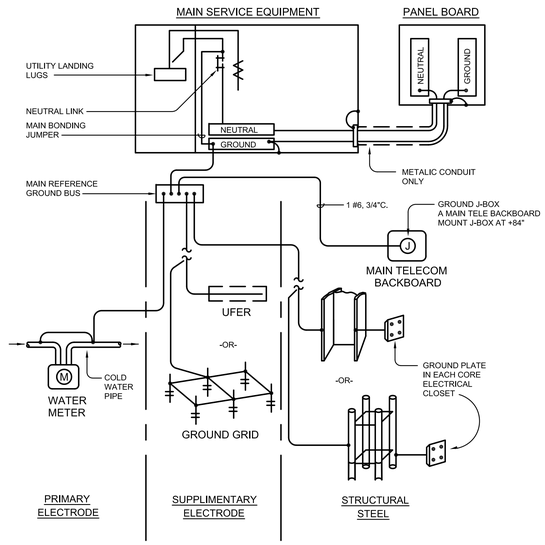
B E6.01 POKE-THROUGH FLUSH FLOOR BOX DETAIL (N.T.S.)



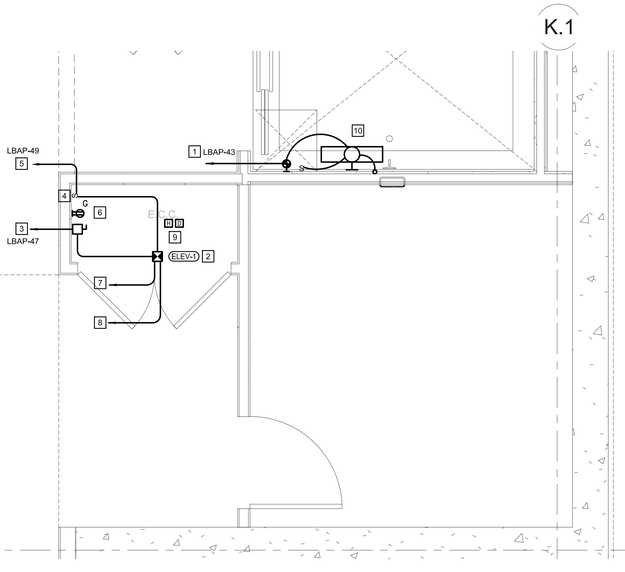
NOTES:

1. GROUND CONDUCTOR CONNECTOR. BURNDY TYPE GB, GC OR GE OR EQUAL FOR 1, 2 OR 3 WIRE CONNECTIONS. DRILL NECESSARY HOLES IN GROUND BUS FOR BOLTED CONNECTIONS.
2. COPPER GROUND CONDUCTORS.
3. 1/4" THICK X 4" HIGH X 24" WIDE COPPER GROUND BUS.
4. 3/8"Ø X 3" LONG BOLT WITH LOCK WASHER AND SPACER FOR ATTACHING COPPER GROUND BUS TO SUPPORTS.
5. SUPPORT ANCHOR BOLT. 3 1/2" MINIMUM EMBEDMENT.
6. 1/4" THICK X 2" WIDE GALVANIZED STEEL PLATE GROUND BUS SUPPORTS. BENT AS SHOWN.

C E6.01 MAIN REFERENCE GROUND BUS DETAIL (N.T.S.)



D E6.01 SINGLE POINT MAIN BUILDING SERVICE AND SAFETY GROUNDING SYSTEM (N.T.S.)



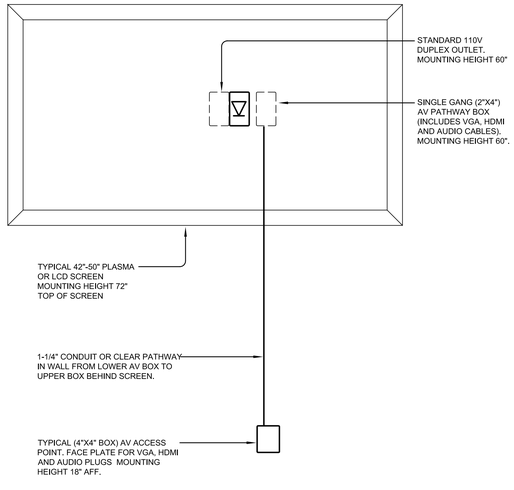
ELEVATOR GENERAL SHEET NOTES

1. COORDINATE INSTALLATION AND EXACT LOCATION OF ALL DEVICES WITH ELEVATOR SHOP DRAWINGS PRIOR TO ROUGH-IN.

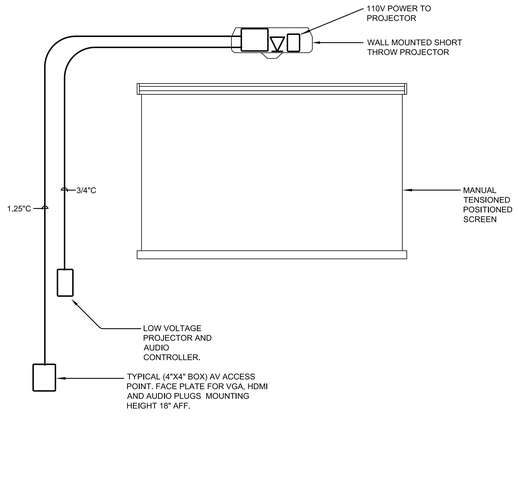
ELEVATOR NUMBERED SHEET NOTES

1. FURNISH AND INSTALL THE FOLLOWING ELEVATOR PIT ASSEMBLY:
   A. GFCI DUPLEX CONVENIENCE RECEPTACLE.
   B. WALL MOUNTED FLUORESCENT STRIP LIGHT, FIXTURE TYPE F3.
   C. SINGLE POLE, SINGLE THROW TOGGLE SWITCH FOR CONTROL OF PIT LIGHT FIXTURE.
   COORDINATE INSTALLATION AND EXACT LOCATION OF ALL DEVICES WITH ELEVATOR SHOP DRAWINGS PRIOR TO ROUGH-IN.
2. ELEVATOR CONTROLLER.
3. ELEVATOR MOTOR DISCONNECT MEANS. REFER TO POWER SINGLE LINE DIAGRAM FOR DISCONNECT AND FEEDER SIZES.
4. CAB LIGHTING, RECEPTACLE(S) AND VENTILATION DISCONNECTION MEANS.
5. DEDICATED 120 VOLT CIRCUIT(S).
6. GFCI PROTECTED RECEPTACLE(S) (AT LEAST ONE REQUIRED).
7. 0.75" C. TO FACP VIA RELAY MODULES FOR RECALL AND ALTERNATE FLOORS.
8. 0.75" C. TO NEAREST TELEPHONE BACKBOARD.
9. CEILING MOUNTED HEAT AND SMOKE DETECTORS FOR ELEVATOR SHUNT TRIP CONTROL. HOISTWAY AND MACHINE ROOM ARE SPRINKLERED. PROVIDE BOTH DEVICES WITHIN 2 FEET OF EACH SPRINKLER HEAD WITHIN THE ROOM. COORDINATE WITH SPRINKLER SHOP DRAWINGS.
10. INSTALL FIXTURE AT EACH LANDING PER ELEVATOR SHOP DRAWINGS.

E E6.01 ELEVATOR CLOSET AND PIT (N.T.S.)



F E6.01 TYPICAL CONFERENCE ROOM AV CONNECTION (N.T.S.)



G E6.01 TYPICAL DESIGN STUDIO AV SYSTEM (N.T.S.)

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REGISTERED PROFESSIONAL ENGINEER KRISTINA MARTIN No. E15303 Ex. 03/31/15 ELECTRICAL STATE OF CALIFORNIA

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PROJECT

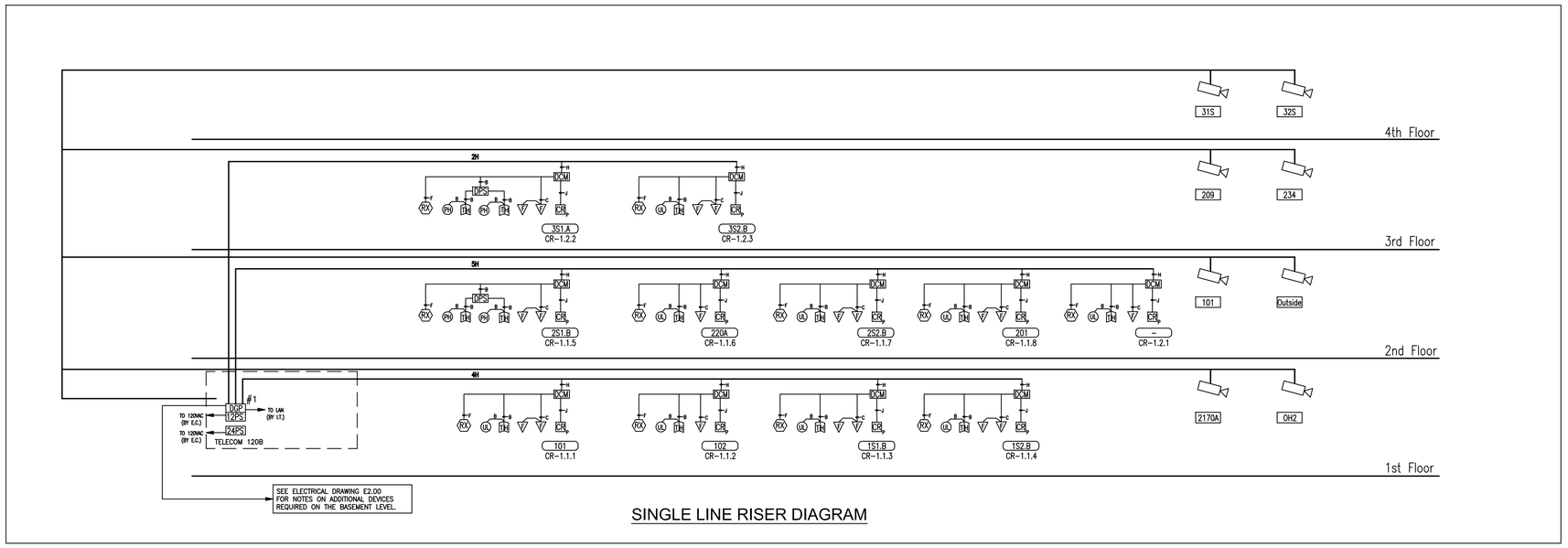
JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% CDs / Permit	08/15/14

DATE : 15 August 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : Permit
PERMIT No :
SCALE : NONE

SHEET TITLE
ELECTRICAL DETAILS

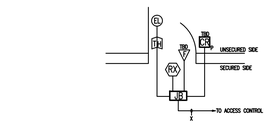
SHEET No
E6.01



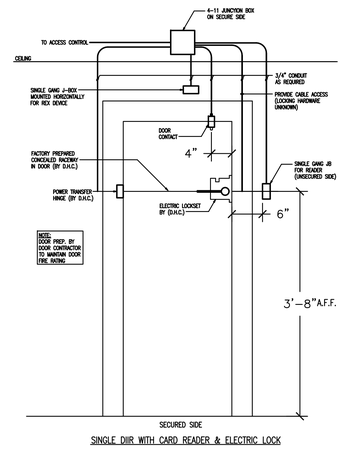
SINGLE LINE RISER DIAGRAM

Provide (1) CAT5E and (1) 14/2 twisted CMP per camera

A E6.02 SECURITY SINGLE LINE RISER DIAGRAM (N.T.S.)



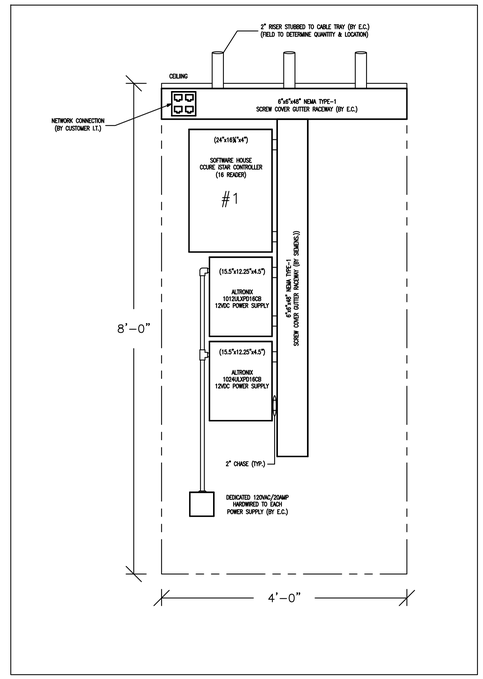
PLAN VIEW



SINGLE DIR WITH CARD READER & ELECTRIC LOCK

NOTES:
BEFORE DRILLING DOOR CONTACT HOLE, CONFIRM THAT NOTHING INTERFERES WITH CONTACT INSTALLATION.

B E6.02 SECURITY DOOR - (N.T.S.)



C E6.02 ELEVATION iSTAR EQUIPMENT LAYOUT TELECOM RM. 120B (N.T.S.)

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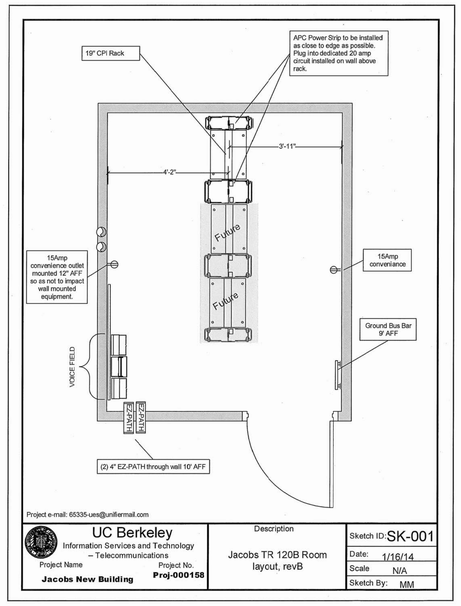
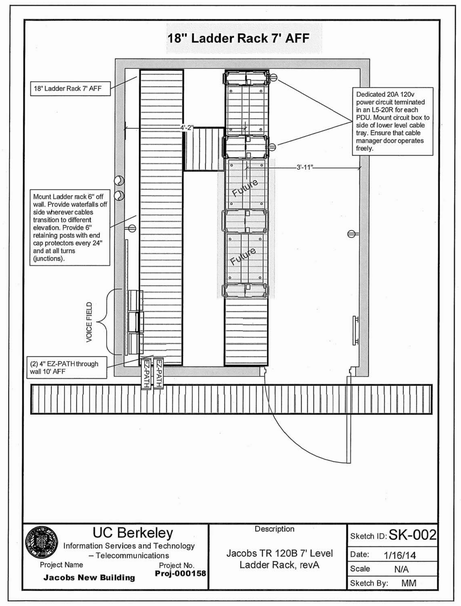
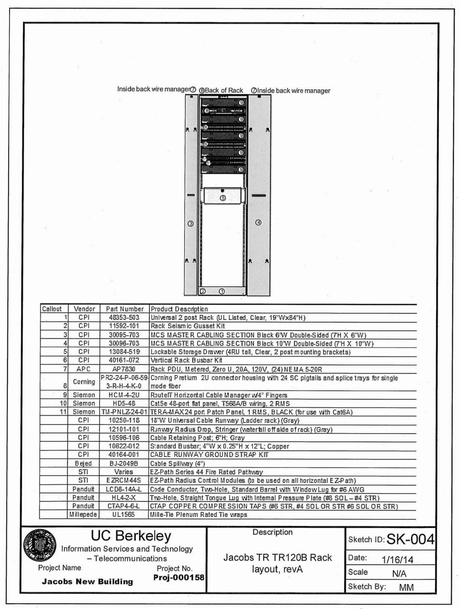
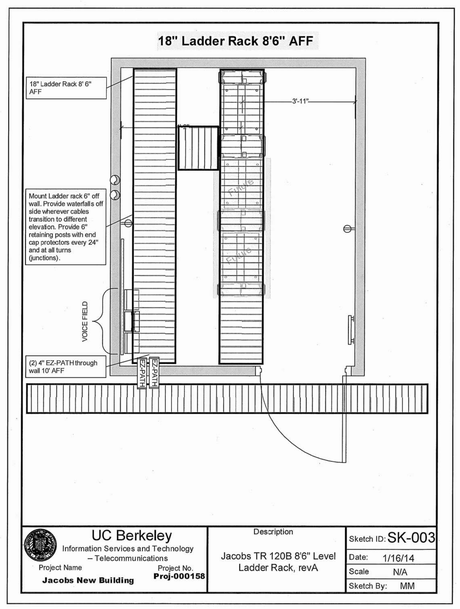
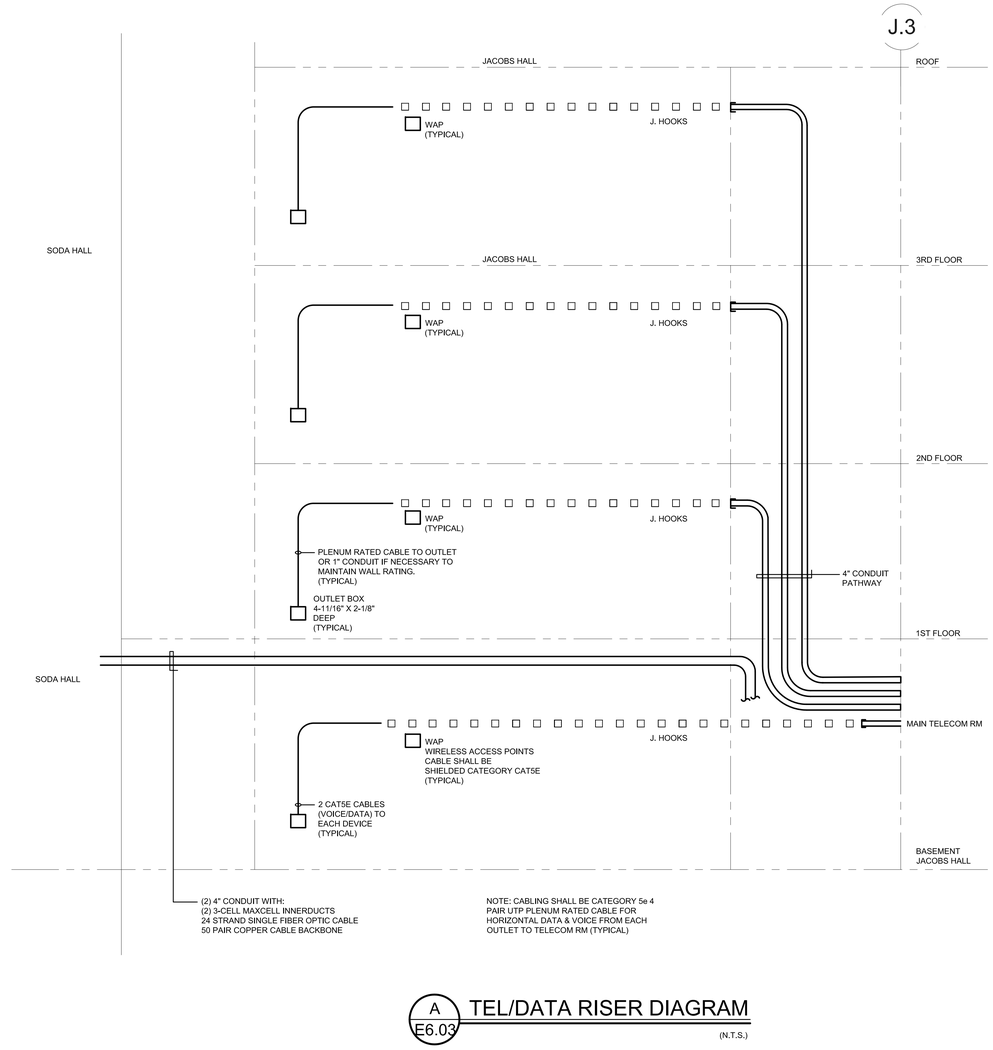






Callout	Vendor	Part Number	Product Description
1	CPI	46853-503	Universal 2 post Rack (UL Listed, Clear, 19"Wx84"H)
2	CPI	11592-701	Rack Seismic Gusset Kit
3	CPI	30095-703	MCS MASTER CABLING SECTION Black 6"W Double-Sided (7'H X 6"W)
4	CPI	30096-703	MCS MASTER CABLING SECTION Black 10"W Double-Sided (7'H X 10"W)
5	CPI	13884-519	Lockable Storage Drawer (4RU tall, Clear, 2 post mounting brackets)
6	CPI	40161-072	Vertical Rack Busbar Kit
7	APC	AP7836	Rack PDU, Metered, Zero U, 20A, 120V, (24) NEMA 5-20R
8	Corning	P-92-24-P--06-59-3-R-H-4-K-0	Corning Pretium 2U connector housing with 24 SC pigtails and splice trays for single mode fiber
9	Siemon	HCM-4-2U	Rostaff Horizontal Cable Manager w/4" Fingers
10	Siemon	HD5-48	Cat5e 48-port flat panel, T568A/B wiring, 2 RMS
11	Siemon	TM-PNL2-24-01	TERA-MAX 24 port Patch Panel, 1 RMS, BLACK (for use with Cat6A)
	CPI	15255-115	18"W Universal Cable Runway (Ladder rack) (Gray)
	CPI	12191-151	Runway Radius Drop, Stringer (waterfall off side of rack) (Gray)
	CPI	10996-106	Cable Retaining Post, 8"H, Gray
	CPI	10622-012	Standard Busbar; 4"W x 0.25"H x 12"L; Copper
	CPI	40164-001	CABLE RUNWAY GROUND STRAP Kit
	Erico	BJ-24949	Cable Spillway (4")
	STI	Varies	EZ-Path Series 44 Fire Rated Pathway
	STI	EZRCM445	EZ-Path Radius Control Modules (to be used on all horizontal EZ Path)
	Panduit	LCD6-14A-L	Code Conductor, Two-Hole, Standard Barrel with Window Lug for #6 AWG
	Panduit	H14-2-X	Two-Hole, Straight Tongue Lug with Internal Pressure Plate (#6 SOL – #4 STR)
	Panduit	CTAP4-4-L	CTAP COPPER COMPRESSION TAP S (#6 STR, #4 SOL OR STR #6 SOL OR STR)
	Millepede	UL1565	Mille-Tie Plenum Rated Tie wraps





A E6.03 TEL/DATA RISER DIAGRAM

(N.T.S.)

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PERMIT No :
SCALE : NONE

SHEET TITLE
TELCOM DETAILS

SHEET No
E6.03

FIRE ALARM SYSTEM
UNIVERSITY OF CALIFORNIA BERKELEY

JACOBS HALL

BERKELEY, CALIFORNIA 94720

PROJECT DATA

PROJECT ADDRESS :	RIDGE ROAD & LEROY AVENUE BERKELEY CA, 94709
PROJECT DESCRIPTION: STUDIOS FOCUSED	DESIGN INSTITUTE HOUSING INTERDISCIPLINARY UNDERGRADUATE ON ENGINEERING DESIGN AND MANUFACTURED INNOVATIONS.
OCCUPANCY CLASSIFICATION:	A-3 ASSEMBLY
CONSTRUCTION TYPE:	TYPE II-B
FIRE PROTECTION:	FULLY SPRINKLERED PER NFPA STANDARD #13D
FLOOR AREA:	19,054 SF
NO. OF STORIES	3

GENERAL SCOPE OF WORK

THE ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT REQUIRED TO PROVIDE A NEW SIEMENS XLS ADDRESSABLE FIRE ALARM SYSTEM FOR CONSTRUCTION PURPOSES.

1. TO PROVIDE NEW XLS FIRE ALARM CONTROL UNIT AND NEW DIGITAL FIRE COMMUNICATOR PANEL LOCATED IN 1ST STORY ELECTRICAL ROOM NO. 120A.

2. TO PROVIDE NEW FIRE ALARM REMOTE ANNUNCIATOR PANEL LOCATED IN IST STORY LOBBY 101.

3. PROVISION OF EQUIPMENT OR DEVICES AS ENUMERATED IN THE FIRE ALARM EQUIPMENT LIST ON SHEET FA0.01.

4. INSTALLATION AND WIRING OF FIRE ALARM EQUIPMENT & DEVICES (BY ELECTRICAL CONTRACTOR).

5. INSPECTION AND TESTING FOR A COMPLETE AND OPERATIONAL FIRE ALARM SYSTEM.

GENERAL NOTES

1. ALL WIRING AND INSTALLATION MUST CONFORM WITH BASIS OF DESIGN DATED 3-31-14 AND APPLICABLE CODE SUMMARIES.

2. SMOKE DETECTORS SHOULD NOT BE LOCATED IN A DIRECT AIRFLOW NOR CLOSER THAN 3 FEET (1 m) FROM AN AIR SUPPLY DIFFUSER OR RETURN AIR OPENING. PER NFPA 72, 2010 EDITION.

3. WHEN INSTALLING INITIATING AND NOTIFICATION DEVICES, POLARITY MUST BE OBSERVED.

4. ALL NOTIFICATION CIRCUIT WIRES MUST BE SUPERVISED. HENCE, NO PARALLEL BRANCHING OF WIRES IS PERMISSIBLE (T-TAPPING). ALL AUDIBLE SIGNALING DEVICES SHALL PRODUCE A DISTINCTIVE THREE-PULSE TEMPORAL TONE, AUDIBLE SIGNALS SHALL HAVE A SOUND LEVEL OF NOT LESS THAN 75dbA AT 10' OR AT LEAST 15dbA ABOVE THE AVERAGE AMBIENT SOUND LEVEL, WHICHEVER IS GREATER, BUT NOT MORE THAN 120dbA AT THE MINIMUM HEARING DISTANCE FROM THE AUDIBLE APPLIANCE (PER NFPA 72, 2010 EDITION) WHEN MORE THAN TWO (2) VISUAL DEVICES ARE IN THE SAME VIEWING PLANE THE VISUAL DEVICES SHALL BE SYNCHRONIZED AS REQUIRED BY NFPA 72, 2010 EDITION.

5. DO NOT INSTALL ADDRESSABLE DEVICES PRIOR TO PROGRAMMING. (SEE NOTE 14)

6. ALL 24 VDC WIRE SHALL BE SEPARATED FROM 120 VAC WIRING, IN ACCORDANCE WITH CURRENT NATIONAL AND STATE ELECTRICAL CODES.

7. DO NOT APPLY 120 VAC POWER TO CONTROL PANEL UNTIL A SIEMENS FIRE SAFETY SPECIALIST HAS INSPECTED ALL SYSTEM WIRING CONNECTIONS AND HAS APPROVED THE SYSTEM TO BE TURNED ON.

8. ALL PLUG-IN TYPE DETECTORS REQUIRE A 4", 1-1/2" OR DEEPER MOUNTING BOX. REFER TO DETAIL DRAWINGS FOR DEVICE WIRING AND MOUNTING CONDITIONS.

9. 120 VAC INPUT CONNECTIONS TO THE FIRE ALARM CONTROL PANEL SHALL BE ON DEDICATED BRANCH CIRCUIT(S). THE CIRCUIT(S) AND CONNECTIONS SHALL BE MECHANICALLY PROTECTED. CIRCUIT DISCONNECTION SHALL HAVE A RED MARKING. SHALL BE ACCESSIBLE ONLY TO AUTHORIZED PERSONNEL AND SHALL BE IDENTIFIED AS FIRE ALARM CIRCUIT CONTROL. THE LOCATION OF THE CIRCUIT DISCONNECTING BREAKER SHALL BE PERMANENTLY IDENTIFIED AT THE FIRE ALARM CONTROL UNIT.

10. INSTALLATION MATERIALS SUCH AS FITTINGS, JUNCTION BOXES, TERMINAL CABINETS, PULL BOXES, HANGERS, ETC. ARE SUPPLIED AND INSTALLED BY THE ELECTRICAL CONTRACTOR.

11. ANY DEVIATION FROM THE DESIGN AND LOCATION OF EQUIPMENT SHOWN MUST FIRST HAVE A WRITTEN APPROVAL FROM SIEMENS FIRE SAFETY. ANY DEVIATION FROM DESIGN MUST ALSO BE INDICATED ON SIEMENS FIRE SAFETY SHOP DRAWINGS (BLUEPRINTS) AND RETURNED TO SIEMENS FIRE SAFETY AT TIME OF JOB COMPLETION.

12. THE DRAWINGS REPRESENT A SIEMENS FIRE SAFETY ENGINEERED FIRE ALARM SYSTEM PER CONTRACTUAL DESIGN DRAWINGS AND BASIS OF DESIGN 3-31-14.

a) CONTRACTOR SHALL NOT DEVIATE BY NOT MORE THAN 5% FROM THE FINAL APPROVED SHOP DRAWINGS.

b) WIRE RUNS HAVE BEEN ENGINEERED TO COMPLY WITH SPECIFIC VOLTAGE DROP REQUIREMENTS. ANY DEVIATION FROM SHOWN WIRE RUNS WHICH RESULTS IN NON-COMPLIANCE WITH VOLTAGE DROP REQUIREMENTS SHALL BE THE SOLE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.

13. ALL SMOKE DETECTORS (NEW OR EXISTING) SHALL BE PROTECTED FROM DUST AND DEBRIS DURING CONSTRUCTION. SMOKE-SENSING DETECTORS SHALL NOT BE INSTALLED UNTIL AFTER THE CONSTRUCTION CLEANUP OF ALL TRADES IS COMPLETE AND FINAL. PER NFPA 72, 2010 EDITION. Exception: WHERE REQUIRED BY THE AUTHORITY HAVING JURISDICTION FOR PROTECTION DURING CONSTRUCTION. DETECTORS THAT HAVE BEEN INSTALLED DURING CONSTRUCTION AND FOUND TO HAVE A SENSITIVITY OUTSIDE THE LISTED AND MARKED SENSITIVITY RANGE SHALL BE CLEANED OR REPLACED AT AN ADDITIONAL COST TO THE CONTRACTOR.

14. ACCEPTANCE TESTING SHALL COMPLY WITH NFPA 72: 10.4.1.2.1.4 AND SHALL INCORPORATE 100% OF ALL DEVICES AFFECTED BY THIS MODIFICATION AS WELL AS 10% OF INITIATING DEVICES NOT DIRECTLY AFFECTED UP TO A MAXIMUM OF 50 DEVICES.

15. ALL DEVICES MUST HAVE THE ADDRESSABLE LABEL; INCLUDING WIRES.

16. ALL DEVICES AND WIRING MUST BE LABELED. ELECTRICAL CONTRACTOR SHOULD PROVIDE MINIMUM OF 5/8 INCH FONT SIZE WHEN LABELING FIRE ALARM DEVICES OUT IN THE FIELD.

APPLICABLE CODES

2010 BUILDING STANDARDS ADMINISTRATIVE CODE, PART 1, C.B.S.C.

2010 CALIFORNIA BUILDING CODE (CBC), PART 2, C.B.SC.

2010 CALIFORNIA ELECTRICAL CODE (CEC), PART 3, C.B.S.C

2010 CALIFORNIA MECHANICAL CODE (CMC), PART 4, C.B.S.C

2010 PLUMBING CODE (CPC), PART 5, C.B.SC.

2010 CALIFORNIA ENERGY CODE, PART 6, C.B.S.C.

2010 CALIFORNIA HISTORICAL BUILDING CODE, PART 8, C.B.S.C.

2010 CALIFORNIA FIRE CODE, PART 9, C.B.S.C.

2010 CALIFORNIA REFERENCED STANDARDS, PART 12, C.B.S.C.

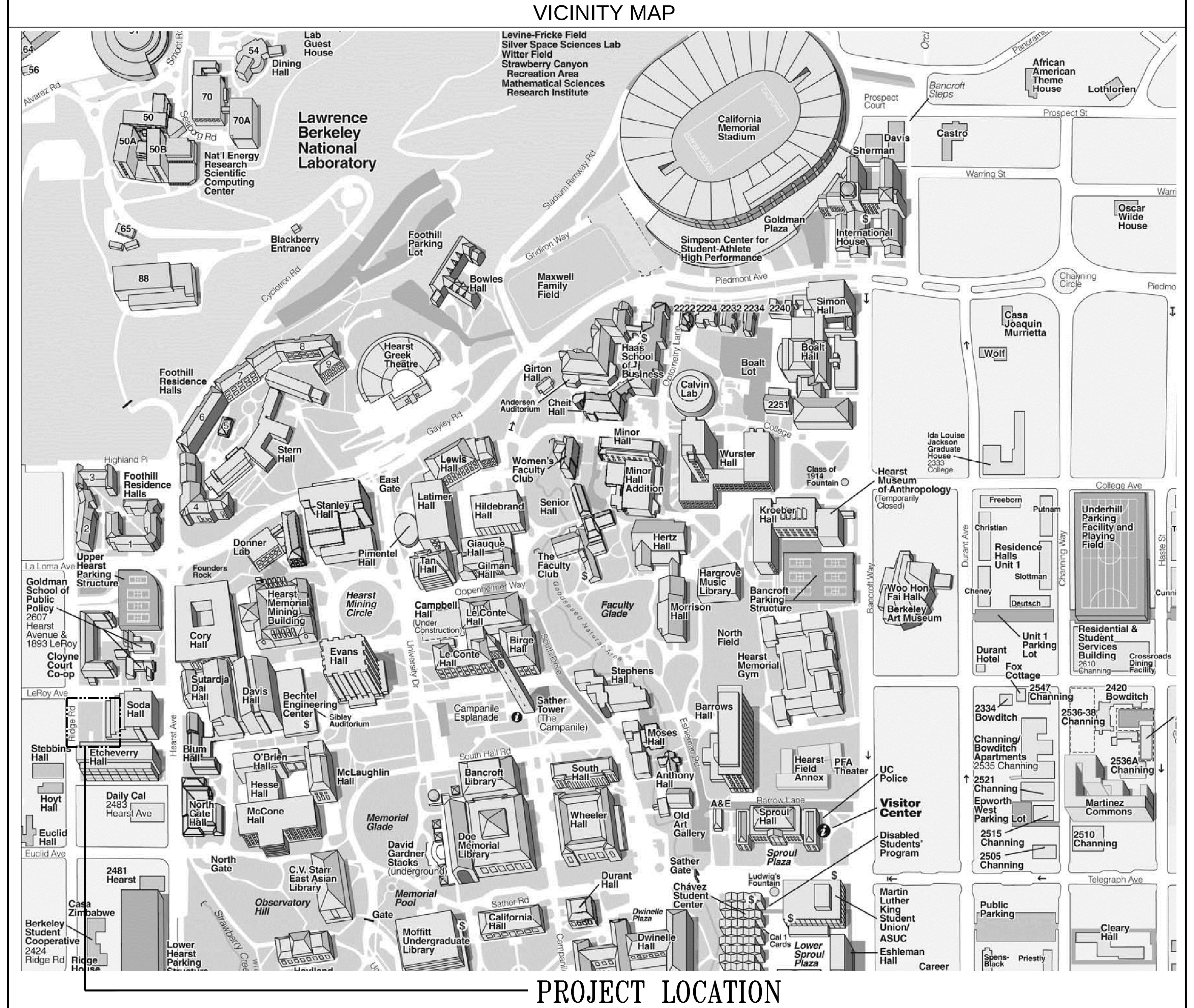
2010 NFPA 72 CODE

AMERICANS WITH DISABILITIES ACT (ADA), TITLE II OR TITLE III

XLS FIRE ALARM SYSTEM WIRING GUIDELINES

1. ALL WIRING MUST COMPLY WITH LOCAL AND CURRENT EDITION OF THE CALIFORNIA ELECTRICAL CODE. ALL WIRING MUST BE DONE AS DESCRIBED IN NOTES 2 & 6 BELOW, TO OBTAIN SAFE AND PROPER SYSTEM OPERATION.
2. EARTH GROUND THE XLS ENCLOSURE PROPERLY; SEE LATEST EDITION OF NATIONAL ELECTRICAL CODES FOR APPROVED METHODS. CONDUIT GROUND IS NOT ADEQUATE.
3. SEPARATE ALL WIRING FOR INITIATING DEVICES (i.e., DETECTORS, MANUAL STATIONS, TRI MODULES, ETC) FROM ALL OTHER WIRING IN THE XLS ENCLOSURE.
4. INSULATE ALL CABLE DRAIN WIRES FROM ANY CONDUIT OR OTHER EARTH GROUNDED ELECTRICAL BOX, INCLUDING THOSE IN THE XLS ENCLOSURE.
5. CONNECT SHIELD CABLE WIRE ONLY AT SPECIFIED LOCATION INSIDE THE XLS ENCLOSURE. (IF APPLICABLE)
6. ALL 110/120 VAC CIRCUITS SHOULD BE INSTALLED IN DEDICATED CONDUIT.
7. ALL INITIATING CIRCUITS ARE RATED POWER LIMITED AND SHOULD BE WIRED IN ACCORDANCE WITH APPLICABLE CODES.
8. UNDERGROUND WIRING IS PERMISSIBLE IF ALL NEC WIRING REQUIREMENTS ARE MET.
9. OVERHEAD OR EXTERIOR WIRING IS NOT RECOMMENDED.

VICINITY MAP



DRAWING INDEX

SHEET NO.	FIRE ALARM SYSTEM SHEET CONTENTS
FA0.00	COVER SHEET & DRAWING INDEX
FA0.01	EQUIPMENT LIST / FIRE STOP PENETRATION DETAIL
FA0.02	MISCELLANEOUS NOTES / SEQUENCE OF OPERATIONS
FA1.00	MAIN XLS FACU DETAILS & CALCULATIONS
FA1.01	MAIN XLS FACU INNER AND OUTER DOORS
FA1.02	REMOTE ANNUNCIATOR AND DIGITAL FIRE COMMUNICATOR DETAILS
FA1.03	FIRE ALARM CONTROL UNIT MOUNTING DETAILS
FA1.04	TYPICAL WIRING DETAILS OF FIELD DEVICES
FA2.00	FIRE ALARM RISER DIAGRAM
FA3.00	FIRE ALARM SITE PLAN
FA3.01	FIRE ALARM PLAN - BASEMENT
FA3.02	FIRE ALARM PLAN - 1ST STORY AND 2ND STORY
FA3.03	FIRE ALARM PLAN - 3RD STORY AND LOWER ROOF
FA4.00	ETCHEVERRY HALL PARTIAL RISER DIAGRAM, EQUIPMENT LIST, DETAILS AND CALCULATIONS

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PERMIT No:	
SCALE:	Not Applicable

SHEET TITLE

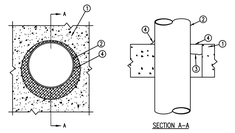
COVER SHEET AND DRAWING INDEX

SHEET No

FA0.00

THROUGH-PENETRATION FIRESTOP SYSTEM DETAILS

SYSTEM NO. CAJ1044
T RATING – 0 HR
L RATING AT AMBIENT – 2 CFM/SQ FT (SEE ITEM 4)
L RATING AT 400 F – LESS THAN 1 CFM/SQ FT (SEE ITEM 4)



1. FLOOR WALL ASSEMBLY–LIGHTWEIGHT OR NORMAL WEIGHT (100–150 PCF) CONCRETE, EXCEPT AS NOTED IN TABLE UNDER ITEM 4, MIN THICKNESS OF SOLID CONCRETE FLOOR OR WALL ASSEMBLY IS 4–1/2 IN. FLOOR MAY ALSO BE CONSTRUCTED OF ANY MIN 6 IN. THICK UL CLASSIFIED HOLLOW–CORE, PRECAST CONCRETE UNITS. WHEN FLOOR IS CONSTRUCTED OF HOLLOW–CORE PRECAST CONCETE UNITS, PACKING MATERIALS (ITEM 3) AND CAULK FILL MATERIAL (ITEM 4) TO BE INSTALLED SYMETRYCALLY ON BOTH SIDES OF THE FLOOR, FLUSH WITH FLOOR SURFACE. WALL ASSEMBLY MAY ALSO BE CONSTRUCTED OF CLASSIFIED CONCRETE BLOCKS. MAX DIA. OF OPENING IS 32 IN.
   SEE CONCRETE BLOCKS (CAZT) AND PRECAST CONCRETE UNITS (CSTV) CATEGORY IN THE FIRE RESISTANCE DIRECTORY FOR NAMES OF MANUFACTURER

1A. STEEL SLEVE – (OPTIONAL NOT SHOWN) NOM 16 IN. (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL SLEEVE CAST OR GROUTED INTO FLOOR OR WALL ASSEMBLY. SLEEVE MAY EXTEND A MAX OF 2 IN. ABOVE TOP FLOOR OR BEYOND EITHER SURFACE OF WALL.

2. PIPE OR CONDUIT – NOM 30 IN.DIA. (OR SMALLER) CAST IRON OR SCHEDULE 10 (OR HEAVIER) STEEL PIPE, NOM 6 IN. DIA. (OR SMALLER) STEEL CONDUIT, NOM 3 IN. DIA. (OR SMALLER) TYPE L (OR HEAVIER) COPPER TUBE OR NOM 4 IN. DIA. (OR SMALLER) STEEL ELECTRICAL METALIC TUBING. MAX ANNULAR SPACE BETWEEN PIPE OR CONDUIT AND EDGE OF THROUGH OPENING NOT TO EXCEED 2 IN. MIN ANNULAR SPACE BETWEEN PIPE OR CONDUIT AND EDGE OF THROUGH OPENING IS 0 IN. (POINT CONTACT). PIPE OR CONDUIT TO BE RIGIDLY SUPPORTED ON BOTH SIDE OF FLOOR OR WALL ASSEMBLY.

3. PACKING MATERIAL – POLYETHYLENE BACKER ROD OR NOM 1 IN. THICKNESS OF THIGHTLY–PACKYRD MINERAL WOOL BATT OR GLASS FIBER INSULATION FIRMLY PACKED INTO OPENING AS A PERMANENT FORM. PACKING MATERIAL TO BE RECESSED FROM TOP SURFACE OF FLOOR OR FROM BOTH SURFACES OF WALL AS REQUIRED TO ACCOMODATE THE REQUIRED THICKNESS OF CAULK FILL MATERIAL (ITEM 4).

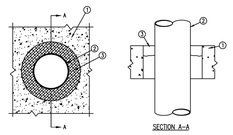
4. FILL, VOID OR CAVITY MATERIAL – CAULK – APPLIED TO FILL THE ANNULAR SPACE FLUSH WITH TOP SURFACE OF FLOOR. IN WALL ASSEMBLIES, REQUIRED CAULK THICKNESS TO BE INSTALLED SYMMETRICALLY ON BOTH SIDES OF WALL, FLUSH WITH WALL SURFACE. THE HOURLY F RATING AND THE MIN REQUIRED CAULK THICKNESS ARE DEPENDENT UPON A NUMBER OF PARAMETERS, AS SHOWN ON THE FOLLOWING TABLE.

MIN FLOOR OR WALL THKNS, IN	NOM PIPE TUBE OR CONDUIT DIA, IN.	MAX ANNULAR SPACE, IN	MAX CAULK THKNS, IN	F RATING, HR
2–1/2	1/2–12	1–3/8	1/2	2
2–1/2	1/2–12	2–7/8	1	2
4–1/2	1/2–6	1–3/8	1/4(a)	2
4–1/2	1/2–12	1–1/4	1/2	3
4–1/2	1/2–20	2	1	3
4–1/2	22–30	2	2	3
5–1/2	1/2–6	1–3/8	1(b)	4

(a) MIN 2 IN THICKNESS OF MINERAL–WOOL BATT INSULATION REQUIRED IN ANNULAR SPACE.
(b) MIN 1 IN. THICKNESS OF MINERAL–WOOL BATT INSULATION REQUIRED IN ANNULAR SPACE ON BOTH SIDES OF FLOOR OR WALL ASSEMBLY. MIN 1IN. THICKNESS OF CAULK TO BE INSTALLED FLUSH WITH EACH SURFACE FLOOR OR WALL ASSEMBLY.

MINNESOTA MINING & MANUFACTURING CO – TYPES CP–25 WB, CP–25 WB+.
(NOTE: L RATING AND OR USE OF OPTIONAL SLEEVE APPLY ONLY WHEN TYPE CP–25WB+ CAULK IS USED).

SYSTEM NO. CAJ1027
F RATING – 3 HOUR
T RATING – 0 HOUR



1. FLOOR OR WALL ASSEMBLY – MIN 4–1/2 IN. THICK LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE. WALL MAY ALSO BE CONSTRUCTED OF ANY UL CLASSIFIED CONCRETE BLOCKS. MAX THROUGH OPENING SIZE IS 12.4 SQ. IN.

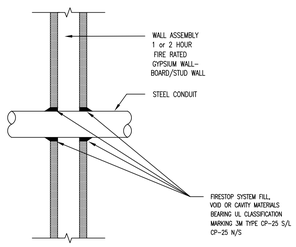
SEE CONCRETE BLOCKS (CAZT) CATEGORY IN FIRE RESISTANCE DIRECTORY FOR NAMES OF MANUFACTURERS.

2. PIPE OR CONDUIT – NOM. 10 IN. DIA. (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE, NOM 6 IN. DIA. (OR SMALLER) RIGID STEEL CONDUIT, NOM 4 IN. DIA. (OR SMALLER) STEEL EMT OR NOM 3 IN. DIA. (OR SMALLER). TYPE L (OR HEAVIER) COPPER PIPE. MAX ONE PIPE OR CONDUIT PER THROUGH OPENING. MAX ANNULAR SPACE BETWEEN PIPE OR CONDUIT AND EDGE OF OPENING IS 3/4 IN. MIN ANNULAR SPACE BETWEEN PIPE OR CONDUIT AND EDGE OF OPENING IS 0 IN. (POINT CONTACT). PIIPE OR CONDUIT TO BE RIGIDLY SUPPORTED ON BOTH SIDES OF FLOOR OR WALL ASSEMBLY.

3. FILL VOID OR CAVITY MATERIALS – PUTTY–MOLDABLE PUTTY MATERIAL KNEEDED BY HAND AND APPLIED TO FILL ANNULAR SPACE TO A MIN DEPTH OF 1 IN FLUSH WITH TOP SURFACE OF FLOOR. IN WALL ASSEMBLIES, REQUIRED PUTTTY THICKNESS TO BE INSTALLED SYMMETRICALLY ON BOTH SIDES OF WALL.

MINNESOTA MINING & MFG. CO.– MPS–2+.
*BEARING THEUL CLASSIFICATION MARKING.

SYSTEM NO. WL1001
F RATING – 1 & 2 HOUR
T RATING – 0, 1, 1–1/2 & 2 HOUR



1. SEAL ALL PENETRATIONS IN ACCORDANCE WITH APPLICABLE CODES TO PRESERVE ORIGINAL FIRE HOUR RESISTANCE OF WALLS, FLOORS OR CEILINGS. USE UL DIRECTOY ASSEMBLY NOS. 49 & 328, AS APPLICABLE FOR ALL FIRE WALL PENETRATIONS.

2. AT FIRE SEPARATION WALLS, WRAP CONDUIT WITH 3M CONDUIT WRAP FI–195 TO WITHIN 1/4" OF OPENING; FILL THE GAP AND COVER EDGE OF WRAP WITH 3M–CP25 CAULK AND/OR #303 PUTTY.

FIRE ALARM EQUIPMENT LIST

CATEGORY	ITEM NO.	SYMBOL	QTY	MODEL NUMBER	DESCRIPTION	MANUFACTURER	DATA SHEET NUMBER	CALIFORNIA STATE FIRE MARSHAL LISTING NUMBER
XLS – FIRE ALARM CONTROL UNIT	1		1	CAB3–BB	LARGE (3 ROW) BACK BOX BLACK	SIEMENS	6327	7165–0067:0222
	2		1	CAB3–BD	LARGE (3 ROW) INNER & OUTER DOOR BLACK	SIEMENS	6327	7165–0067:0222
	3		3	CAB–MP	MOUNTING PLATE	SIEMENS	6327	7165–0067:0222
	4		2	OD–LP	OUTER DOOR LENS PLATE	SIEMENS	6327	7165–0067:0222
	5		1	OD–BP	OUTER DOOR BLANK PLATE	SIEMENS	6327	7165–0067:0222
	6		2	ID–SP	INNER DOOR SINGLE BLANK PLATE	SIEMENS	6327	7165–0067:0222
	7		1	ID–FP	INNER DOOR FULL BLANK PLATE	SIEMENS	6327	7165–0067:0222
	8		3	CC–5	CARD CAGE – 5 SLOTS	SIEMENS	6320	7165–0067:0222
	9		1	PMI–2	PERSON MACHINE INTERFACE	SIEMENS	6359	7165–0067:0222
	10		1	NIC–C	NETWORK MODULE	SIEMENS	6338	7165–0067:0222
	11		2	DLC	DEVICE LOOP CARD	SIEMENS	6312	7165–0067:0222
	12		2	ZIC–4A	ZONE INDICATING CARD	SIEMENS	6315	7165–0067:0222
	13	FACP	1	CRC–6	CONTROLLABLE RELAY CARD	SIEMENS	6314	7165–0067:0222
	14		1	PSC–12	POWER SUPPLY CHARGER MODULE	SIEMENS	6322	7165–0067:0222
	15		1	PSX–12	POWER SUPPLY EXTENDER	SIEMENS	6322	7165–0067:0222
	16		1	PTB	POWER SUPPLY	SIEMENS	6322	7165–0067:0222
	17		1	CAB–BATT	BATTERY CABINET	SIEMENS	6322	7165–0067:0222
	18		2	PDC–121000	100 AMP/HOUR BATTERY, 12 VDC	POWER SONIC	---	Not Applicable
	19		1	TSP–40A	THERMAL STRIP PRINTER	SIEMENS	5007	7300–0067:0172
	20		3	TSP–40–PP	TSP–40 PRINTER PAPER	SIEMENS	5007	---
	21		1	TSP–XB	XLSTSP–40A BRACKETS	SIEMENS	5007	---
	22		1	TSP–XC	XLSTSP–40A CABLES	SIEMENS	5007	---
	23		2	BCL	60 PIN FLAT RIBBON CABLE	SIEMENS	---	Not Applicable
	24							
	25							
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DIGITAL DIALER	31		1	5129	FOUR CHANNEL DIGITAL COMMUNICATOR (SILENT KNIGHT)	SILENT KNIGHT	4000	7300–0559:0120
	32	DIALER	2	TIK–512	DUAL PACK–RJ31X BLOCK	SILENT KNIGHT	4000	---
	33		1	5230	PROGRAMMER/ANNUNCIATOR	SILENT KNIGHT	4000	7165–0559:0114
ANN	34	ANN	1	SSD–C	SYSTEM STATUS DISPLAY WITH CONTROL	SIEMENS	6326	7165–0067:0222
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FIRE ALARM EQUIPMENT LIST

CATEGORY	ITEM NO.	SYMBOL	QTY	MODEL NUMBER	DESCRIPTION	MANUFACTURER	DATA SHEET NUMBER	CALIFORNIA STATE FIRE MARSHAL LISTING NUMBER
FIELD DEVICES & SYSTEM MISCELLANEOUS	1	HTRI–S	1	HTRI–S	INTELLIGENT INTERFACE MODULE SINGLE INPUT	SIEMENS	6304	7165–0067:0222
	2	HTRI–R	28	HTRI–R	INTELLIGENT INTERFACE MODULE W/RELAY	SIEMENS	6304	7165–0067:0222
	3	HTRI–D	5	HTRI–D	INTELLIGENT INTERFACE MODULE DUAL INPUT	SIEMENS	6304	7165–0067:0222
	4		18	HMS–S	INTELLIGENT MANUAL PULL STATION (SINGLE ACTION)	SIEMENS	6306	7150–0067:0036
	5	P	18	SB–SR	SURFACE BACKBOX	SIEMENS	6306	Not Applicable
	6		39	FDO421	INTELLIGENT PHOTOELECTRIC SMOKE DETECTOR	SIEMENS	6152	7272–0067:0258
	7		39	DB–11	DETECTOR BASE FOR FDO421 DETECTOR	SIEMENS	6152	7300–0067:0134
	8		3	FDT421	INTELLIGENT THERMAL DETECTOR	SIEMENS	6151	7270–0067:0262
	9		3	DB–11	DETECTOR BASE FOR HFPT–11 DETECTOR	SIEMENS	6151	7300–0067:0134
	10		18	FDO421	INTELLIGENT PHOTOELECTRIC SMOKE DETECTOR	SIEMENS	6152	7272–0067:0258
	11		18	FDBZ492–HR	AIR–DUCT HOUSING WITH RELAY	SIEMENS	6156	3240–0067:0265
	12		6	ST–10	SAMPLING TUBE FOR DUCT WIDTH OF 6" TO 1.0'	SIEMENS	6156	Not Applicable
	13		10	ST–25	SAMPLING TUBE FOR DUCT WIDTH OF 1.0' TO 3.0'	SIEMENS	6156	Not Applicable
	14		2	ST–50	SAMPLING TUBE FOR DUCT WIDTH OF 3.0' TO 5.0'	SIEMENS	6156	Not Applicable
	15							
	16	15cd	16	ZR–MC–R	MULTI CANDELA STROBE, 15cd (Red) Wall Mtd.	SIEMENS	2584	7125–0067:0252
	17	30cd			MULTI CANDELA STROBE, 30cd (Red) Wall Mtd.	SIEMENS	2584	7125–0067:0252
	18	75cd			MULTI CANDELA STROBE, 75cd (Red) Wall Mtd.	SIEMENS	2584	7125–0067:0252
	19	110cd			MULTI CANDELA STROBE, 110cd (Red) Wall Mtd.	SIEMENS	2584	7125–0067:0252
	20							
	21	15cd	15	ZH–MC–R	MULTI CANDELA HORN/STROBE, 15cd (Red) Wall Mtd.	SIEMENS	2584	7125–0067:0248
	22	30cd			MULTI CANDELA HORN/STROBE, 30cd (Red) Wall Mtd	SIEMENS	2584	7125–0067:0248
	23	75cd			MULTI CANDELA HORN/STROBE, 75cd (Red) Wall Mtd	SIEMENS	2584	7125–0067:0248
	24	110cd			MULTI CANDELA HORN/STROBE, 110cd (Red) Wall Mtd.	SIEMENS	2584	7125–0067:0248
	25							
	26	135cd	2	ZH–HMC–R	HIGH CANDELA HORN/STROBE, 135cd (Red) Wall Mtd.	SIEMENS	2584	7125–0067:0248
	27	185cd			HIGH CANDELA HORN/STROBE, 185cd (Red) Wall Mtd.	SIEMENS	2584	7125–0067:0248
	28							
	29		32	FM–998	TRI–VOLT MAGNETIC DOOR HOLDER (24VDC)	RIXON	---	3550–0047:0001
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MISCELLANEOUS SYMBOLS	71	J	--	Not Applicable	JUNCTION BOX (PROVIDED BY ELECTRICAL CONTRACTOR)	BY OTHERS	---	---
	72		--	BY OTHERS	END–OF–LINE DEVICE (VALUE AS SPECIFIED)	BY OTHERS	---	---
	73	FATC	--	BY OTHERS	FIRE ALARM TERMINAL CABINET	BY OTHERS	---	---
	74	FSD	--	BY OTHERS	FIRE SMOKE DAMPER	BY OTHERS	---	---
	75		--	Not Applicable	RISER UP OR DOWN	BY OTHERS	---	---
	76		--	Not Applicable	WATERFLOW SWITCH	BY OTHERS	---	---
	77		--	Not Applicable	TAMPER SWITCH	BY OTHERS	---	---
	78		--	Not Applicable	120VAC EXTERIOR SPRINKLER BELL	BY OTHERS	---	---
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STAMP

CONSULTANTS

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

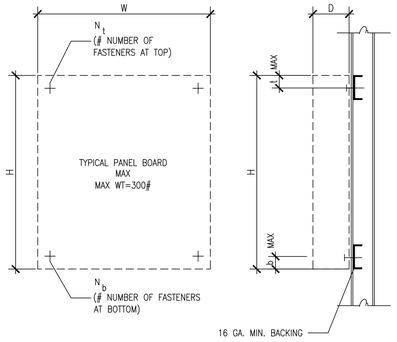
NO	REVISION	DATE
	100% DD	01/24/14
	DSA Submission	01/29/14
	100% CD / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: 100% CD
PERMIT No:
SCALE: Not Applicable

SHEET TITLE
EQUIPMENT LIST

SHEET No
FA0.01

MOUNTING DETAILS



(E) TYPICAL MOUNTING OF EQUIPMENT WEIGHING OVER 20 LBS.
(300 LBS. MAXIMUM)

FIRE ALARM UNIT MOUNTING DETAIL

LATERAL FORCE DESIGN CRITERIA:

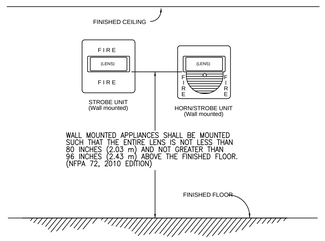
SEISMIC ZONE 4: Z = 0.4

I_p = 1.5 N_a = 1.5 C_a = 0.44 (N_a) = 0.66

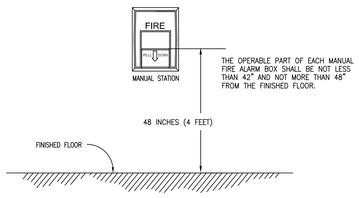
WALL PANEL ANCHORAGE:

a_p = 1.0 R_p = 3.0 h_x = 1.0 h_r = 1.0

PANEL DESCRIPTION	HEIGHT (H)	WIDTH (W)	DEPTH (D)	MAXIMUM WEIGHT	Nt	t	Nb	b
CAB-3 (XLS)	63.0"	26.0"	8.0"	173 Lbs.	2	1.0"	2	7.75"
CAB-BATT (100 A/H)	12.0"	26.0"	7.0"	136 Lbs.	2	1.06"	2	1.94"



TYPICAL ELEVATION DETAIL OF AUDIBLE & VISUAL ALARM DEVICES



TYPICAL ELEVATION DETAIL OF MANUAL PULL STATION

U.C. BERKELEY XLS WIRING SCHEDULE

SYMBOL	RECOMMENDED WIRE TYPE	USED ON
A	2-CONDUCTOR, #16 AWG SOLID TWISTED, SHIELDED (+) RED, (-) BLACK	ADDRESSABLE ALARM INITIATING DEVICES: – FDO-SERIES SMOKE DETECTORS – FDT-SERIES HEAT DETECTORS – HTRI-SERIES INTERFACE MODULES – HMS-SERIES PULL STATION
C	2-CONDUCTOR, #14 AWG SOLID, THHN (+) ORANGE, (-) YELLOW	AUDIBLE/VISUAL SIGNAL DEVICES: – HORN/STROBES (2-WIRE NAC CIRCUITS)
D	2-CONDUCTOR, #14 AWG SOLID, THHN (+) BLACK, (-) WHITE	24 VDC POWER TO: – MAGNETIC DOOR HOLDER – PMI TO CC-5 CARD CAGE (5 SLOTS)
G	2-CONDUCTOR, #18 AWG SOLID, THHN (+) BLACK, (-) BLACK	HTRI to MONITORED DEVICES: – WATERFLOW SWITCH – TAMPER SWITCH – DIGITAL DIALER
Na / Nb	2-CONDUCTOR, #16 AWG SOLID, TWISTED, SHIELDED (+) RED, (-) BLACK	"H-NET" – XLS NETWORK WIRING: – MODULES that "SPEAK" H-NET: – PMI/CPU, CPC to (ZIC, CDC, CRC, RPM, DLC, PSC, PSX, NIC-C, SSD, RNI)
Z	2-CONDUCTOR, #14 AWG SOLID, THHN (+) RED, (-) BLACK	24 VDC POWER TO: – DIGITAL DIALER – REMOTE ANNUNCIATOR (SSD-C)
	2-CONDUCTOR, #12 AWG SOLID, THHN COLOR TO MATCH NEC AC DEVICE WIRE	120 VAC TO FIRE ALARM CONTROLLED AUX DEVICES: – AIR HANDLING UNIT – SECURITY DOOR – FIRE SMOKE DAMPER
120 VAC	2-CONDUCTOR WITH GROUND #12 AWG SOLID, THHN COLOR TO MATCH NEC	120 VAC POWER TO CONTROL UNITS – XLS FACU

NOTE: WIRE SIZES WILL VARY (USUALLY LARGER) TO ACCOMMODATE THE VOLTAGE DROP.

WIRING GUIDELINES

PLENUM CABLE VS. NON-PLENUM

THE NEC RECOGNIZES 3 TYPES OF POWER LIMITED FIRE ALARM CABLING:

FPL – THIS IS A GENERAL USE POWER LIMITED FIRE ALARM CABLE. IT CANNOT BE USED IN A PLENUM SPACE OR FOR RISERS (CABLING BETWEEN FLOORS), CABLE MUST BE IN CONDUIT.

FPLR – THIS IS A POWER LIMITED RISER RATED CABLE THAT CAN BE USED FOR GENERAL PURPOSES OR BETWEEN FLOORS. IT CANNOT BE USED IN A PLENUM SPACE, CABLE MUST BE IN CONDUIT.

FPLP – THIS IS A POWER LIMITED CABLE THAT CAN BE USED IN A PLENUM, RISER, OR FOR GENERAL PURPOSE.

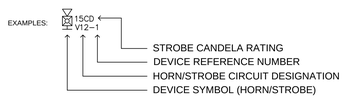
A PLENUM IS ANY AREA USED TO CONDUCT ENVIRONMENTAL AIR. PLENUM SPACES CAN BE DUCTWORK, THE SPACE ABOVE A DROP CEILING, OR BELOW A RAISED FLOOR. BECAUSE THESE SPACES ARE BEING USED FOR THE AIR HANDLING SYSTEM. THERE ARE STRICT RULES THAT MUST BE FOLLOWED TO REDUCE THE RISK OF INTRODUCING TOXIC FUMES IN THE EVENT OF A FIRE. SINCE FIRE ALARM CABLING IS OFTEN INSTALLED EXPOSED, WITHOUT CONDUIT, ABOVE DROP CEILINGS THE CABLING MUST BE RATED FOR USE IN A PLENUM SPACE.

WIRING REQUIREMENTS

- NOTIFICATION APPLIANCES (I.E. – HORN/STROBES, HORNS, ETC.) REQUIRE NON-SHIELDED CABLE.
- UNDERGROUND CABLE, WHETHER OR NOT INSTALLED IN CONDUIT, SHALL BE LISTED AS UNDERGROUND BURIAL TYPE.
- WIRING IS TO BE INSTALLED POINT TO POINT WITH NO SPLICING.

DEVICE DESIGNATION LEGEND

INITIATING DEVICES



FIRE ALARM SEQUENCE OF OPERATIONS

INPUT & OUTPUT MATRIX / SYSTEM OUTPUTS	MANUAL PULL STATION	AREA SMOKE DETECTOR	AREA HEAT DETECTOR	DUCT SMOKE DETECTOR (AHU-1)	DUCT SMOKE DETECTOR (ASSOCIATED FSD's)	ELEVATOR LOBBY SMOKE DETECTOR 1ST STORY ONLY	ELEVATOR LOBBY SMOKE DETECTORS IN OTHER FLOORS EXCEPT 1ST STORY	ELEVATOR MACHINE ROOM SMOKE DETECTOR	ELEVATOR SHAFT SMOKE DETECTOR	ELEVATOR PIT SMOKE DETECTOR	ELEVATOR MACHINE ROOM HEAT DETECTOR	ELEVATOR SHAFT HEAT DETECTOR	ELEVATOR PIT HEAT DETECTOR	SPRINKLER WATERFLOW SWITCH	SPRINKLER TAMPER SWITCH	POWER FAILURE	WIRE OPEN, GROUND & SHORT		
ANNUNCIATE ALARM AT THE FIRE ALARM CONTROL UNIT (FACU)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO		
ANNUNCIATE SUPERVISORY AT THE FIRE ALARM CONTROL UNIT (FACU)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO		
ANNUNCIATE TROUBLE AT THE FIRE ALARM CONTROL UNIT (FACU)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES		
ANNUNCIATE ALARM AT THE FIRE ALARM ANNUNCIATOR PANEL (SSD-C)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO		
ANNUNCIATE SUPERVISORY AT THE FIRE ALARM ANNUNCIATOR PANEL (SSD-C)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO		
ANNUNCIATE TROUBLE AT THE FIRE ALARM ANNUNCIATOR PANEL (SSD-C)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES		
TRANSMIT AN ALARM SIGNAL TO UCB POLICE DEPARTMENT	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO		
TRANSMIT A SUPERVISORY SIGNAL TO UCB POLICE DEPARTMENT	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO		
TRANSMIT A TROUBLE SIGNAL TO UCB POLICE DEPARTMENT	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES		
ACTIVATE AUDIBLE-VISUAL ALARM SIGNAL THROUGHOUT THE BUILDING	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO		
ACTIVATE THE FIRE SPRINKLER BELL	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO		
DE-ENERGIZE MAGNETIC DOOR HOLDERS THROUGHOUT THE BUILDING	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	NO		
SHUT DOWN BASEMENT AIR HANDLING UNIT (AHU-1)	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
SHUT DOWN ASSOCIATED FIRE SMOKE DAMPER	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
PRIMARY ELEVATOR RECALL (1ST STORY)	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO		
ALTERNATE ELEVATOR RECALL (2ND STORY)	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
SHUNT ELEVATOR POWER	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	NO	NO	NO	NO		
SIGNAL TO ELEVATOR HAT LIGHT	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO		

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PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% DD	01/24/14
	DSA Submission	01/29/14
	100% CD / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: 100% CD
PERMIT No:
SCALE: Not Applicable

SHEET TITLE
MISCELLANEOUS NOTES AND DETAILS

SHEET No
FA0.02

XLS FACU BATTERY CALCULATIONS

SUPERVISORY CURRENT

DESCRIPTION	Quantity	Standby 24 VDC Module /Card Current	Load Current Per Circuit: End of Line Device	Load Current Per Circuit: Device Current	Total Standby 24VDC Module Current
CRC-6 CONTROLLABLE RELAY CARD	1	0.051			0.051
20.5mA per Active Relay	6			0.021	0.123
DLC DEVICE LOOP CARD	2	0.145			0.290
1.8mA per Device (252 Devices per DLC)	2			0.454	0.908
NIC-C NETWORK INTERFACE CARD	1	0.120			0.120
PMI-2 PERSON MACHINE INTERFACE	1	0.190			0.190
PSC-12 PWR SUPPLY CHARGER MODULE	1	0.150			0.150
20mA per Active Relays	4			0.020	0.080
PSX-12 POWER SUPPLY EXTENDER	1	0.170			0.170
TSP-40A THERMAL STRIP PRINTER	1	0.070			0.070
SSD/SSD-C SYSTEM STATUS DISPLAY	1	0.200			0.200
ZIC-4A ZONE INDICATING CARD	2	0.090			0.180
# NAC Circuits	8		0.006		0.048
5129 DIGITAL DIALER	1	0.084			0.084
TOTAL SUPERVISORY CURRENT					**2.664**

MODULE ALARM CURRENT

DESCRIPTION	Quantity	Module Alarm Current	Output Alarm Current		TOTAL ROW CURRENT
DLC DEVICE LOOP CARD	2	0.145			0.290
1.8mA per Device (252 Devices per DLC)	2			0.454	0.908
5129 DIGITAL DIALER	1	0.154			0.154
TSP-40A THERMAL STRIP PRINTER	1	0.700			0.700
TOTAL MODULE ALARM CURRENT					**2.052**

XLS FACU NOTIFICATION CIRCUITS

			TOTAL CKT CURRENT LOAD
PSC-12	1.975	CIRCUIT V01	0.273
		CIRCUIT V02	0.39
		CIRCUIT V11	0.678
		CIRCUIT V12	0.634
PSX-12	3.565	CIRCUIT V21	0.806
		CIRCUIT V22	0.609
		CIRCUIT V31	0.787
		CIRCUIT V32	0.723
		CIRCUIT DH	0.64
TOTAL ALARM CURRENT (AMPS)			**7.592**

SUMMARY

A = TOTAL SUPERVISORY CURRENT
x SUPERVISORY TIME REQUIRED
2.664 AMPS x 24 HR
= **63.936** (AMP-HR)

B = TOTAL ALARM CURRENT
x ALARM TIME REQUIRED
7.592 AMPS x .167 HR
= **1.268** (AMP-HR)

C = (A + B) (1.2)
= **78.245** (AMP-HR)

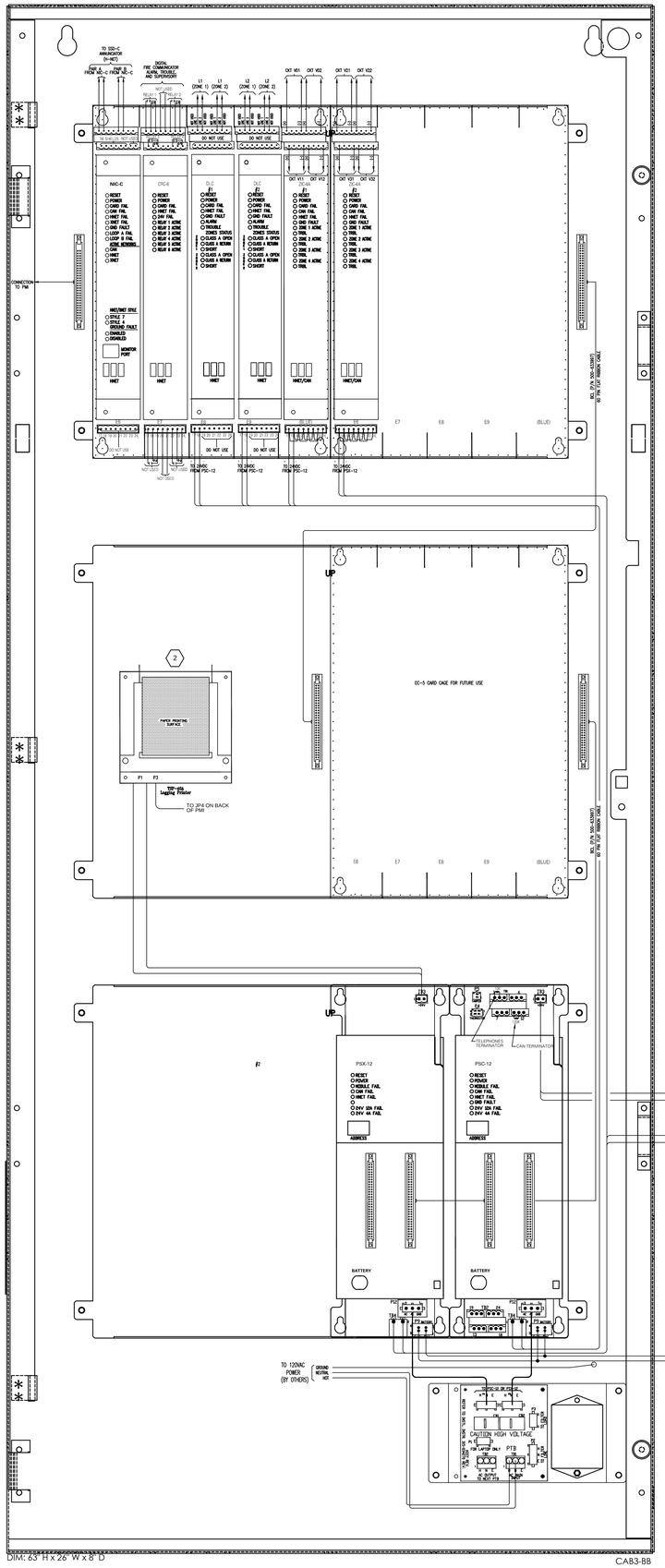
SUPERVISORY TIME REQUIRED----------24 HR
ALARM TIME REQUIRED------10 MINS. or .167 HR

BATTERY PROVIDED..... **PDC-121000**
BATTERY SIZE..... **100** (AMP-HR)

TOTAL SYSTEM REQUIRED (A/H)
= **78.245** **AMP/HOUR**
BATTERY RESERVE AFTER
24 HOURS SUPERVISORY
& 10 MINUTES ALARM (AMP-HOUR)

= **21.755** **AMP-HOUR**

CKT & LOAD	DEVICE DESCRIPTION	QTY	DEVICE CURRENT RATING	TOTAL ROW CURRENT
V01	STROBE 15 CANDELA Wall Mtd.	0	0.064	0
0.273	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	HORN/STROBE 15 CANDELA Wall Mtd.	1	0.078	0.078
	HORN/STROBE 75 CANDELA Wall Mtd.	1	0.195	0.195
V02	STROBE 15 CANDELA Wall Mtd.	0	0.064	0
0.39	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	HORN/STROBE 75 CANDELA Wall Mtd.	2	0.195	0.39
V11	STROBE 15 CANDELA Wall Mtd.	0	0.064	0
0.678	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	STROBE 75 CANDELA Wall Mtd.	1	0.175	0.175
	HORN/STROBE 30 CANDELA Wall Mtd.	1	0.113	0.113
	HORN/STROBE 75 CANDELA Wall Mtd.	2	0.195	0.39
V12	STROBE 15 CANDELA Wall Mtd.	2	0.064	0.128
0.634	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	STROBE 75 CANDELA Wall Mtd.	2	0.175	0.35
	HORN/STROBE 15 CANDELA Wall Mtd.	2	0.078	0.156
V21	STROBE 15 CANDELA Wall Mtd.	2	0.064	0.128
0.806	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	STROBE 75 CANDELA Wall Mtd.	1	0.175	0.175
	HORN/STROBE 30 CANDELA Wall Mtd.	1	0.113	0.113
	HORN/STROBE 75 CANDELA Wall Mtd.	2	0.195	0.39
V22	STROBE 15 CANDELA Wall Mtd.	1	0.064	0.064
0.609	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	STROBE 75 CANDELA Wall Mtd.	2	0.175	0.35
	HORN/STROBE 75 CANDELA Wall Mtd.	1	0.195	0.195
V31	STROBE 15 CANDELA Wall Mtd.	2	0.064	0.128
0.787	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	STROBE 75 CANDELA Wall Mtd.	1	0.175	0.175
	HORN/STROBE 30 CANDELA Wall Mtd.	1	0.113	0.113
	HORN/STROBE 135 CANDELA Wall Mtd.	1	0.371	0.371
V32	STROBE 15 CANDELA Wall Mtd.	1	0.064	0.064
0.723	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	STROBE 75 CANDELA Wall Mtd.	1	0.175	0.175
	HORN/STROBE 30 CANDELA Wall Mtd.	1	0.113	0.113
	HORN/STROBE 135 CANDELA Wall Mtd.	1	0.371	0.371
DH	STROBE 15 CANDELA Wall Mtd.	0	0.064	0
0.64	STROBE 30 CANDELA Wall Mtd.	0	0.098	0
	MAGNETIC DOOR HOLDER	32	0.02	0.64



DIM: 63" H x 26" W x 8" D

CAB3-BB
3 CAB-MP
(1)PSC-12 & (1) PSX-12
PTB

DIM: 12"H x 26"W x 8.75"D

XLS FIRE ALARM CONTROL UNIT
LOCATED AT BASEMENT ELECTRICAL ROOM NO. 010E

VOLTAGE DROP CALCULATIONS
WIRE GAUGE: #14 AWG

CKT	DISTANCE (ft.)	CURRENT LOAD (amps)	VOLTAGE DROP (%)	OPERATING VOLTAGE (16-33 VOLTS)	DROP BASIS (ft.)
V01	133	0.273	0.935	20.209	30
V02	95	0.39	0.954	20.205	30
V11	223	0.678	3.895	19.605	80
V12	225	0.634	3.675	19.650	100
V21	269	0.806	5.586	19.261	115
V22	229	0.609	3.593	19.667	95
V31	299	0.787	6.062	19.163	120
V32	275	0.723	5.122	19.355	110

VOLTAGE DROP CALCULATIONS PLUS 100-FEET ADDITIONAL WIRE LENGTH
WIRE GAUGE: #14 AWG

CKT	DISTANCE (ft.)	CURRENT LOAD (amps)	VOLTAGE DROP (%)	OPERATING VOLTAGE (16-33 VOLTS)	DROP BASIS (ft.)
V01	233	0.273	1.639	20.066	30
V02	195	0.39	1.959	20.000	30
V11	323	0.678	5.642	19.249	80
V12	325	0.634	5.308	19.317	100
V21	369	0.806	7.662	18.837	115
V22	329	0.609	5.162	19.347	95
V31	399	0.787	8.090	18.750	120
V32	375	0.723	6.985	18.975	110

VOLTAGE DROP CALCULATIONS
(WORST CASE SHOWN)

FORMULA: VOLTAGE DROP CALCULATIONS (FOR A GIVEN LENGTH OF CONDUCTOR) = $\frac{I \times D \times 21.6}{C.M.}$

WHERE:
I = AMPERES PER TERMINAL LOAD
D = ONE WAY DISTANCE OF CONDUCTOR (IN FEET) MEASURED FROM SOURCE OF SUPPLY TO LOAD
21.6 = CONSTANT (RESISTANCE OF CONDUCTORS AT 10.8 OHMS PER L.M. FOR TWICE THE LENGTH)
C.M. = CROSS SECTIONAL AREA IN CIRCULAR MILS (SEE TABLE AT RIGHT)

WIRE SIZE	CIRCULAR MILS (C.M.)
12 AWG	6530
14 AWG	4110
16 AWG	2580
18 AWG	1620
20 AWG	1020

GIVEN:
CIRCUIT DESIGNATION = V31
APPROX. LENGTH OF CONDUCTOR = 299 FEET
CURRENT LOAD = 0.787
WIRE SIZE USED = 14 AWG

VOLTAGE DROP = $\frac{0.787 \times 299}{4110} \times 21.6 = \frac{5082.761}{4110} = 1.237$ VOLTS

% OF VOLTAGE DROP = $\frac{1.237 \text{ VOLTS}}{20.4 \text{ VOLTS}} = 0.060622$ or 6.062 %

NOTES:
1. THE OPERATING VOLTAGE OF DEVICE USED IS 18 TO 31 VDC. THE RESULTING VOLTAGE DROP IS WITHIN THIS OPERATING RANGE.
2. PERMISSIBLE VOLTAGE DROP IS 10% OR LESS

XLS FACU – LOOP SCHEDULES

LOOP NUMBER	LOOP ADDRESS DESIGNATION	LOOP DESCRIPTION	LOCATION
L1 (ZONE 1)	1 TO 130	INITIATING DEVICES	BASEMENT
L1 (ZONE 2)	131 TO 252	INITIATING DEVICES	1ST STORY
L2 (ZONE 1)	1 TO 130	INITIATING DEVICES	2ND STORY
L2 (ZONE 2)	131 TO 252	INITIATING DEVICES	3RD STORY

XLS FACU – NAC SCHEDULES

CIRCUIT DESIGNATION	PANEL	CIRCUIT DESCRIPTION	LOCATION
V01	ZIC-4A #1	NAC DEVICES	BASEMENT
V02	ZIC-4A #1	NAC DEVICES	BASEMENT
V11	ZIC-4A #1	NAC DEVICES	1ST STORY
V12	ZIC-4A #1	NAC DEVICES	1ST STORY
V21	ZIC-4A #2	NAC DEVICES	2ND STORY
V22	ZIC-4A #2	NAC DEVICES	2ND STORY
V31	ZIC-4A #2	NAC DEVICES	3RD STORY
V32	ZIC-4A #2	NAC DEVICES	3RD STORY

SHEET NOTES:

1. INSTALL THE TERMINAL STRIP IN A PULL BOX (BY OTHERS).
2. TSP-40A SHALL BE MOUNTED TO ITS U-SHAPED BRACKET. MOUNT THE TSP-40A WITH THE BRACKET TO THE REAR OF THE INNER DOOR.

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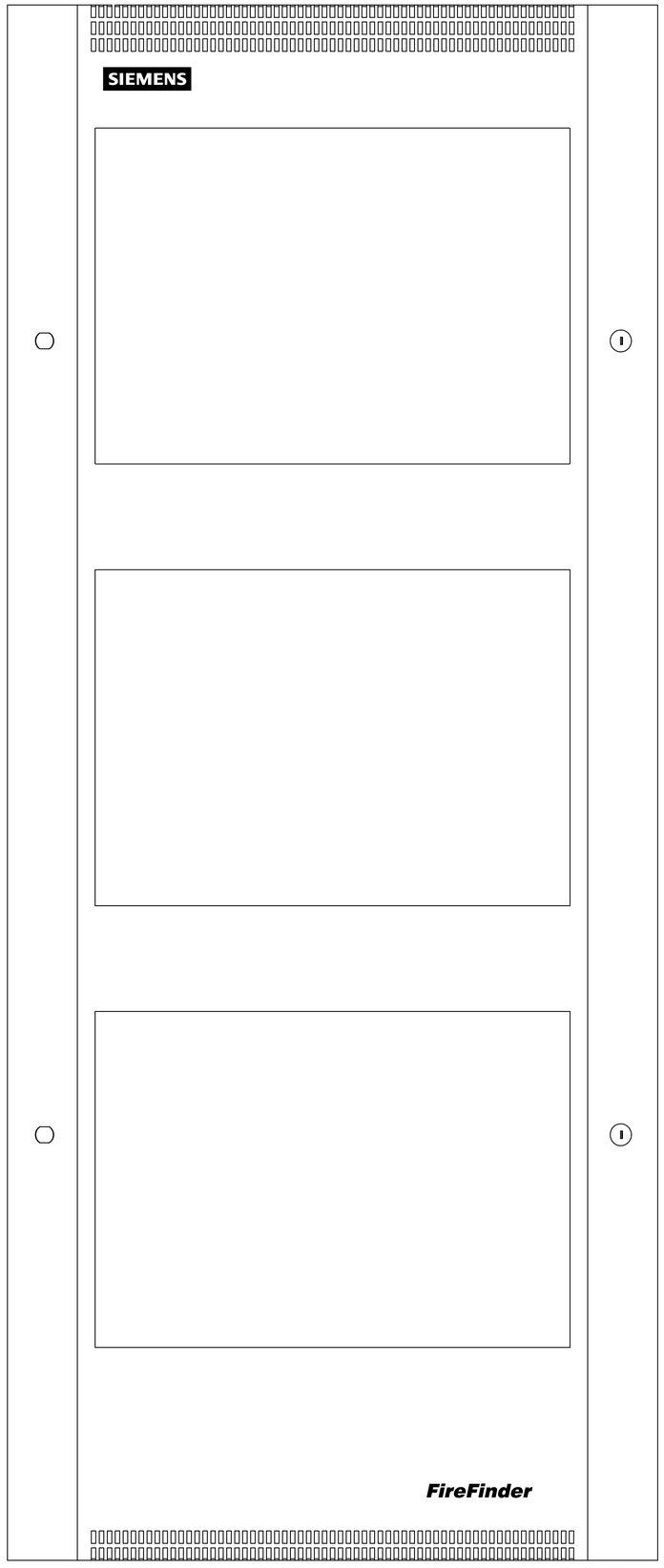
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% DD	01/24/14
	DSA Submission	01/29/14
	100% CD / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR 100% CD
PERMIT No:
SCALE: Not Applicable

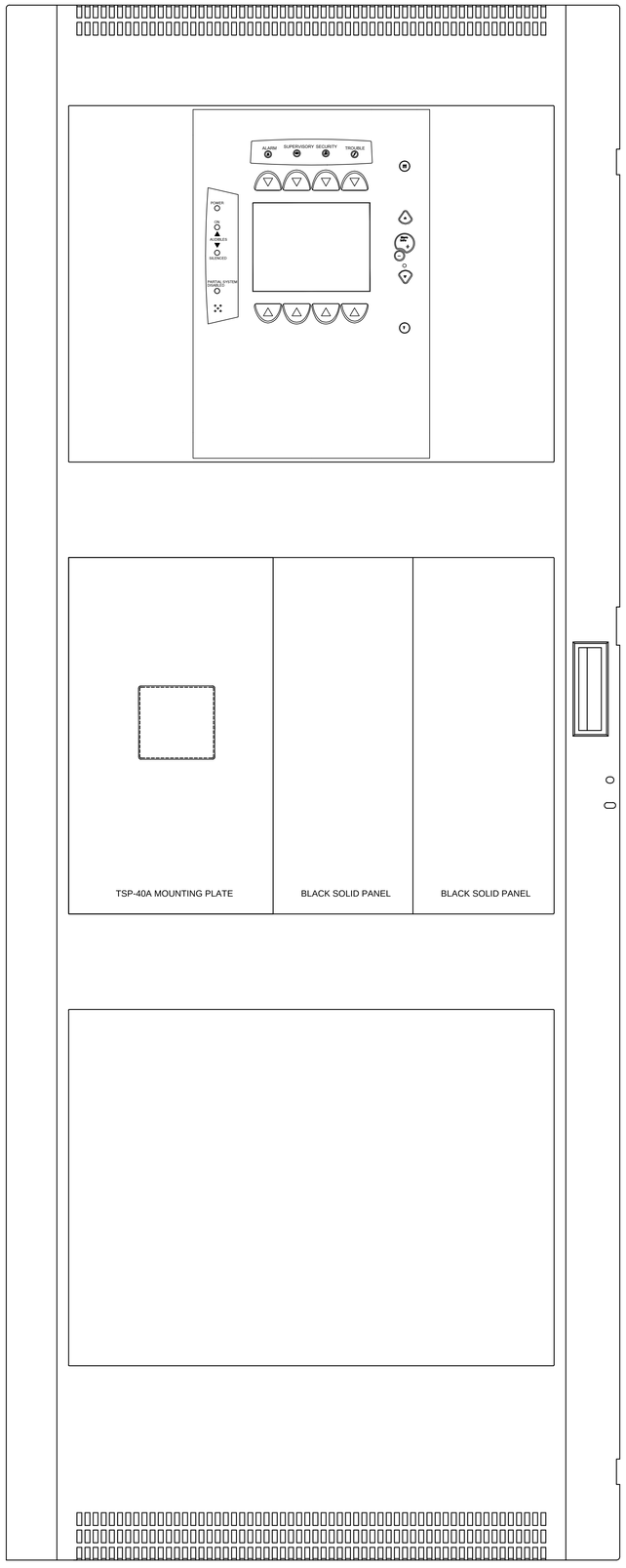
SHEET TITLE
XLS FACU DETAILS AND CALCULATIONS

SHEET No
FA1.00



CAB3-BD
2 OD-LP
1 OD-BP

XLS FACU - OUTER DOOR



CAB3-BD
PMI
2 ID-SP
1 ID-FP

XLS FACU - INNER DOOR

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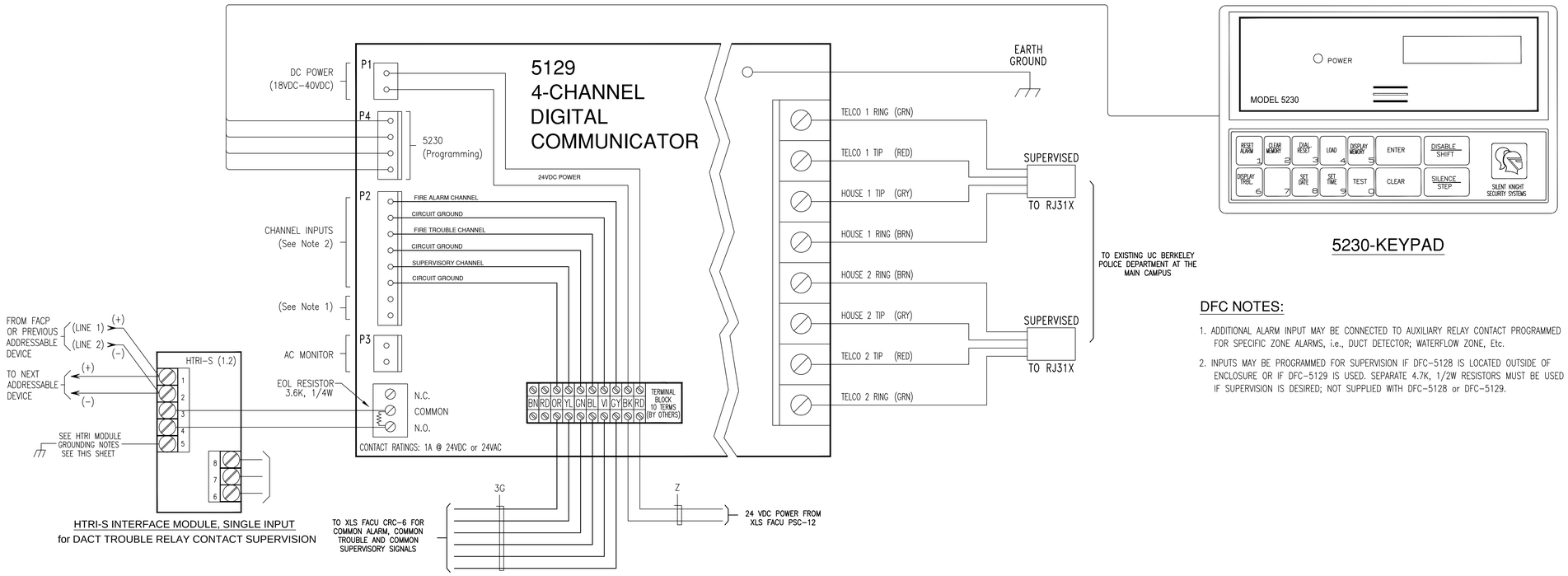
DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: 100% CD
PERMIT No:
SCALE: Not Applicable

SHEET TITLE

MAIN XLS FACU INNER & OUTER DOORS

SHEET No

FA1.01



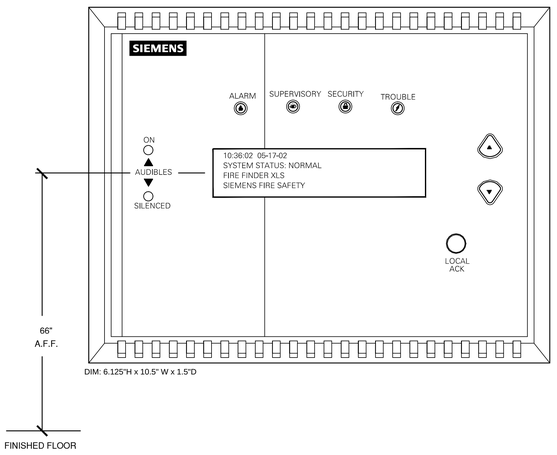
HTRI-S INTERFACE MODULE, SINGLE INPUT
for DACT TROUBLE RELAY CONTACT SUPERVISION

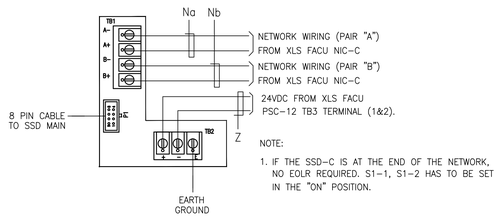
5230-KEYPAD

DFC NOTES:

1. ADDITIONAL ALARM INPUT MAY BE CONNECTED TO AUXILIARY RELAY CONTACT PROGRAMMED FOR SPECIFIC ZONE ALARMS, i.e., DUCT DETECTOR; WATERFLOW ZONE, Etc.
2. INPUTS MAY BE PROGRAMMED FOR SUPERVISION IF DFC–5128 IS LOCATED OUTSIDE OF ENCLOSURE OR IF DFC–5129 IS USED. SEPARATE 4.7K, 1/2W RESISTORS MUST BE USED IF SUPERVISION IS DESIRED; NOT SUPPLIED WITH DFC–5128 or DFC–5129.

5129 4-CHANNEL FIRE COMMUNICATOR PANEL
LOCATED IN BASEMENT ELECTRICAL ROOM 010E





NOTE:

1. IF THE SSD–C IS AT THE END OF THE NETWORK, NO EOLR REQUIRED. S1–1, S1–2 HAS TO BE SET IN THE "ON" POSITION.

REMOTE ANNUNCIATOR PANEL (FLUSH MOUNT)
LOCATED IN 1ST STORY LOBBY / EXHIBIT 101

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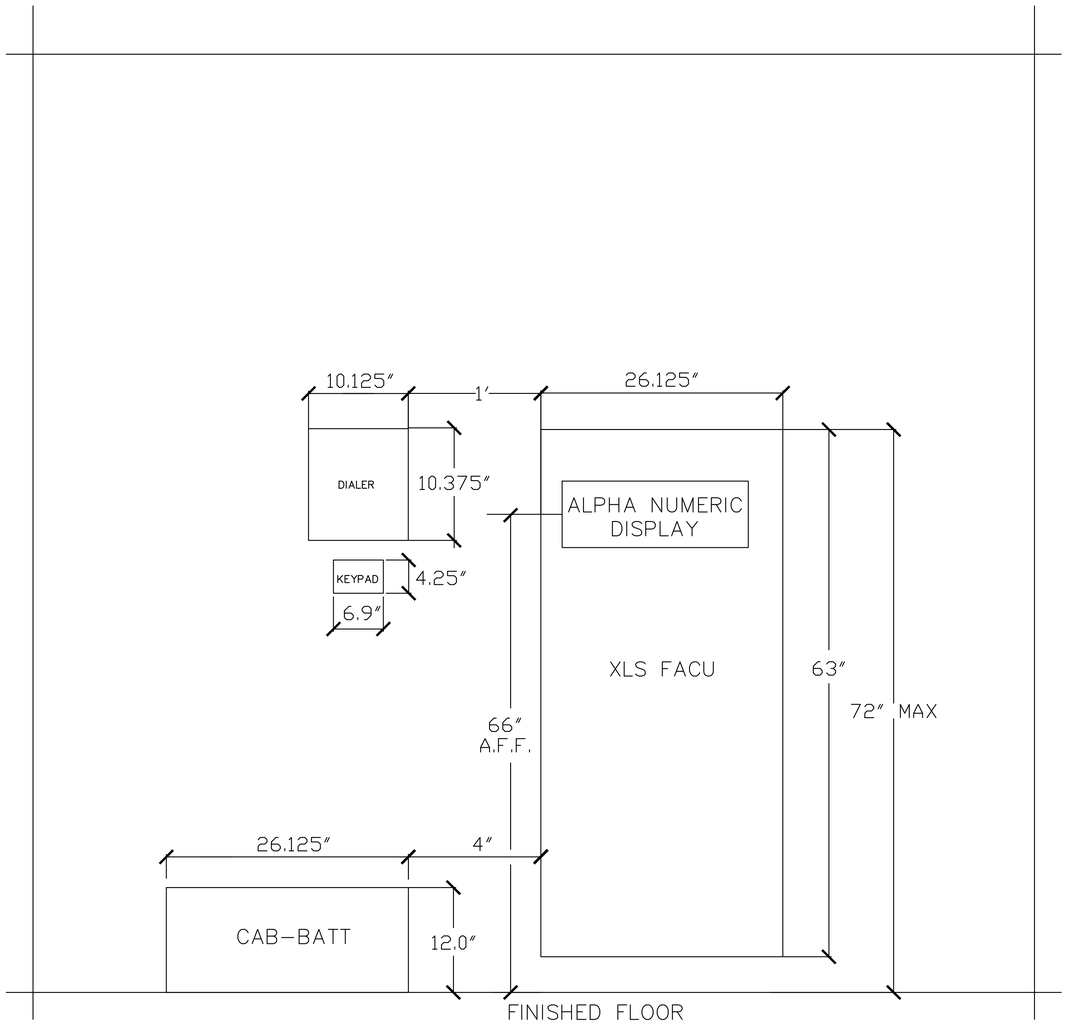
	100% DD	01/24/14
	DSA Submission	01/29/14
	100% CD / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR 100% CD
PERMIT No:
SCALE: Not Applicable

SHEET TITLE
REMOTE ANNUNCIATOR AND FIRE COMMUNICATOR

SHEET No
FA1.02



XLS FIRE ALARM CONTROL UNIT
LOCATED IN BASEMENT ELECTRICAL ROOM 010E

SCALE: N.T.S.

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No	REVISION	DATE
	100% DD	01/24/14
	DSA Submission	01/29/14
	100% CD / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: 100% CD
PERMIT No:
SCALE: Not Applicable

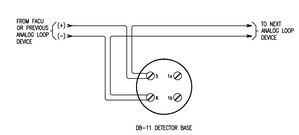
SHEET TITLE

XLS FACU MOUNTING DETAILS

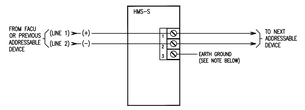
SHEET No

FA1.03

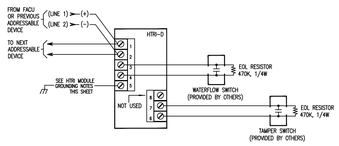
TYPICAL WIRING DETAIL OF FIELD DEVICES



FDO421 INTELLIGENT PHOTOELECTRIC FIRE DETECTOR
with DB-11 DETECTOR BASE
and
FDT421 INTELLIGENT THERMAL FIRE DETECTOR
with DB-11 DETECTOR BASE

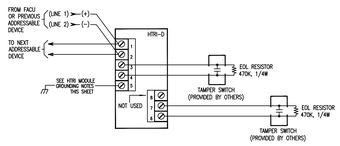


HMS-S MANUAL PULL STATION (SINGLE ACTION)



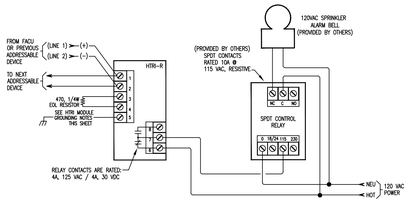
HTRI-D INTERFACE MODULE, DUAL INPUT
for WATERFLOW and TAMPER SWITCH SUPERVISION

NOTE: WATERFLOW & TAMPER SWITCHES ARE FURNISHED AND INSTALLED BY SPRINKLER CONTRACTOR. COORDINATE WITH THE CONTRACTOR FOR FURTHER DEVICE DETAILS.



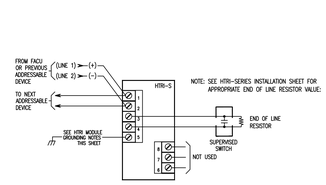
HTRI-D INTERFACE MODULE, DUAL INPUT
for BACK FLOW PREVENTER TAMPER SWITCHES SUPERVISION

NOTE: TAMPER SWITCHES ARE FURNISHED AND INSTALLED BY SPRINKLER CONTRACTOR. COORDINATE WITH THE CONTRACTOR FOR FURTHER DEVICE DETAILS.

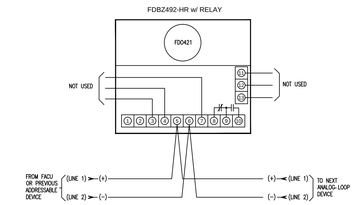


HTRI-R INTERFACE MODULE, SINGLE INPUT w/ RELAY
for CONTROLLING SPRINKLER ALARM BELL VIA SPDT CONTROL RELAY

NOTE: PROGRAM HTRI-R TO ACTIVATE SPRINKLER ALARM BELL ON ANY WATERFLOW ALARM CONDITION.

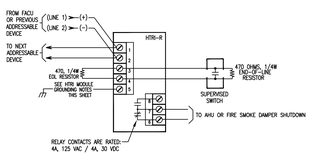


HTRI-S INTERFACE MODULE, SINGLE INPUT
for DACT TROUBLE SUPERVISION

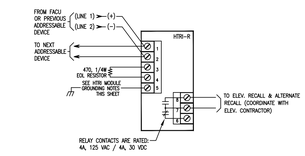


FDBZ492-HR DUCT DETECTOR HOUSING with RELAY
with FDO421 INTELLIGENT SMOKE DETECTOR FOR AHU SHUTDOWN

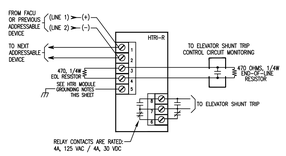
NOTE: THE AIR FLOW INSIDE THE DUCT MUST BE MORE THAN 100 FEET PER MINUTE FOR THE DUCT DETECTOR TO OPERATE PROPERLY.



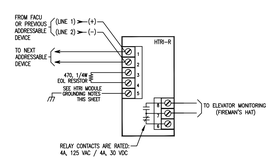
HTRI-R INTERFACE MODULE, SINGLE INPUT w/ RELAY
for AIR HANDLING UNIT or FIRE SMOKE DAMPER SHUTDOWN



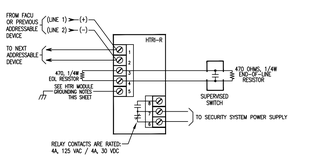
HTRI-R INTELLIGENT INTERFACE MODULE WITH RELAY
ELEVATOR RECALL & ALTERNATE RECALL



HTRI-R INTELLIGENT INTERFACE MODULE WITH RELAY
FOR ELEVATOR SHUNT TRIP



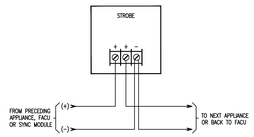
HTRI-R INTELLIGENT INTERFACE MODULE WITH RELAY
FOR ELEVATOR MONITORING (FIREMAN'S HAT)



HTRI-R INTERFACE MODULE, SINGLE INPUT w/ RELAY
for UNLOCKING SECURITY DOORS

WARNING NOTE:

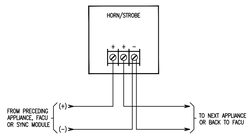
THE STROBE APPLIANCES MUST BE FIELD SET TO THE DESIRED CANDELA RATING BEFORE THEY ARE INSTALLED. REFER TO FIRE ALARM FLOOR PLAN FOR APPROPRIATE CANDELA SETTING.



ZR-MC-R STROBE (WALL MOUNTED)
(Multi-Candela Appliance 15 / 30 / 75 / 110cd)

WARNING NOTE:

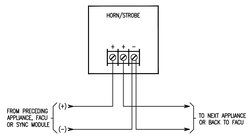
THE STROBE APPLIANCES MUST BE FIELD SET TO THE DESIRED CANDELA RATING BEFORE THEY ARE INSTALLED. REFER TO FIRE ALARM FLOOR PLAN FOR APPROPRIATE CANDELA SETTING.



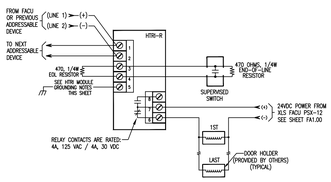
ZH-MC-R HORN/STROBE (WALL MOUNTED)
(Multi-Candela Appliance 15 / 30 / 75 / 110cd)

WARNING NOTE:

THE STROBE APPLIANCES MUST BE FIELD SET TO THE DESIRED CANDELA RATING BEFORE THEY ARE INSTALLED. REFER TO FIRE ALARM FLOOR PLAN FOR APPROPRIATE CANDELA SETTING.



ZH-HMC-R HORN/STROBE (WALL MOUNTED)
(High Candela Appliance 135 / 185cd)



HTRI-R INTERFACE MODULE, SINGLE INPUT w/ RELAY
for DOOR HOLDER CONTROL (24 VDC)

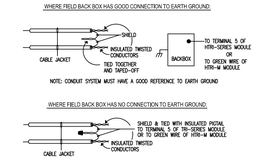
HTRI-R, HTRI-S & HTRI-D GROUNDING NOTES

1. CAUTION: GROUND SHIELD ONLY AT THE SPECIFIED LOCATION ON THE CONTROL PANEL.
2. IMPORTANT: TERMINAL 5 OF THE HTRI-S/HTRI-R/HTRI-D MUST CONNECTED TO A KNOWN GOOD EARTH GROUND FOR THE PROPER OPERATION.
3. IF A GOOD LOCAL EARTH GROUND IS AVAILABLE:
   - A. TERMINAL 5 MUST BE CONNECTED TO EARTH GROUND.
   - B. USE WIRE NUTS TO PASS THE SHIELD WIRE THROUGH THE ELECTRICAL BOX WITH NO CONNECTION TO THE DEVICE TERMINAL BLOCK OR TO LOCAL GROUND.
   - C. USE SHIELDED WIRE TO CONNECT THE SWITCH WIRING.
   - D. TIE THE SWITCH WIRING SHIELD TO THE ALD WIRING SHIELD. DO NOT CONNECT SHIELD TO TERMINAL 5 OR THE LOCAL EARTH GROUND.
4. IF A GOOD LOCAL EARTH GROUND IS NOT AVAILABLE:

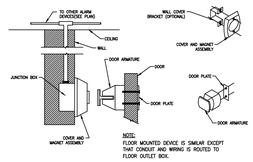
   CONNECT SHIELD TO TERMINAL 5 IF ALD WIRING IS NOT SHIELDED, THE SWITCH WIRING MUST BE IN METAL RACEWAY.

REFER TO INSTALLATION IN P/N 315-096242-2 FOR FURTHER DETAILS.

TYPICAL HTRI MODULE GROUNDING DETAIL



* ALL UNSHIELDED WIRE MUST BE ENTIRELY IN GROUND CONDUIT



TYPICAL INSTALLATION DETAIL
OF MAGNETIC DOOR HOLDER

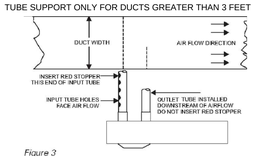


Figure 3

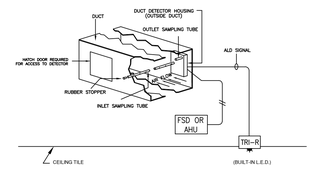
SAMPLING TUBE ORIENTATION

NOTE: MOUNTING SHOWN ARE TYPICAL. DETECTORS CAN BE INSTALLED SIDE, BOTTOM OR TOP OF DUCT AS LONG AS PROPER TUBE OPERATION AND FLOW/PRESSURE PERFORMANCE IS MAINTAINED

NOTE:

A TRI-R MODULE WITH BUILT-IN L.E.D. SHALL BE INSTALLED WHEN MOUNTED SMOKE DETECTOR IS CONCEALED OR IS OVER 10 FEET IN HEIGHT OVER STANDING AREA.

THE TRI-R MODULE WITH L.E.D. SHALL BE MOUNTED WHERE IT CAN BE SEEN FROM STANDING AREA. L.E.D. SHALL NOT BE MOUNTED MORE THAN 10 FEET ABOVE FLOOR.



TYPICAL INSTALLATION DETAIL OF DUCT DETECTOR
MOUNTED OUTSIDE DUCT & TRI-R WITH BUILT-IN L.E.D.
FOR DUCT DETECTOR ALARM INDICATION

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	100% DD	01/24/14
	DSA Submission	01/29/14
	100% CD / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR 100% CD
PERMIT No:
SCALE: Not Applicable

SHEET TITLE

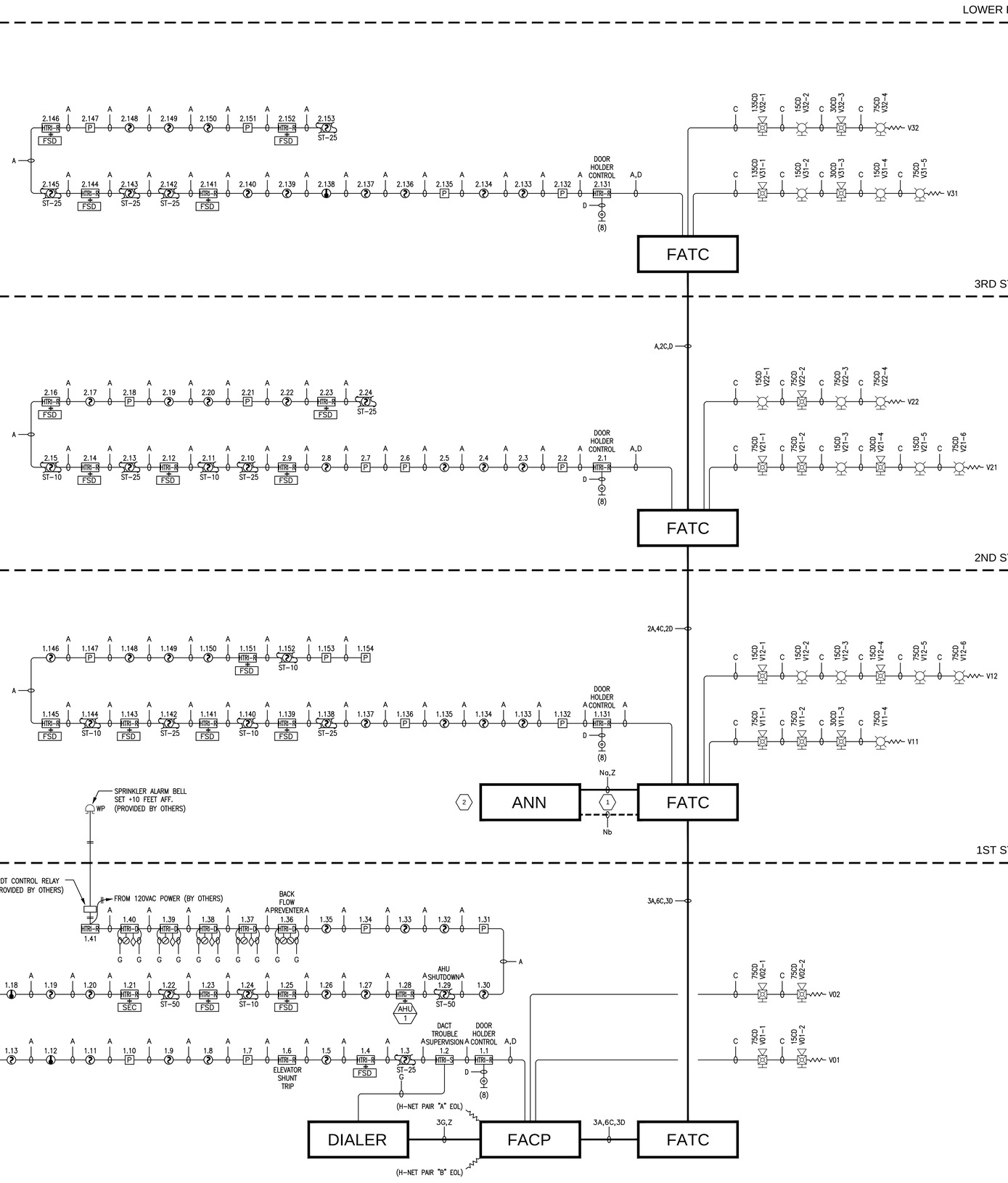
TYPICAL WIRING DETAIL OF FIELD DEVICES

SHEET No

FA1.04

SHEET NOTE:

1. ALL STYLES OF CLASS "A" NETWORK SHALL BE INSTALLED SUCH THAT OUTGOING AND RETURN CONDUCTORS, EXITING FROM AND RETURNING TO THE CONTROL UNIT ARE ROUTED SEPARATELY. THE MINIMUM SEPARATION SHALL BE 1 FEET WHERE INSTALLED VERTICALLY AND 4 FEET WHERE INSTALLED HORIZONTALLY.
2. IF THE SSD-C IS AT THE END OF THE NETWORK. NO EOLR REQUIRED. S1-1, S1-2 HAS TO BE SET IN THE "ON" POSITION.



FIRE ALARM RISER DIAGRAM

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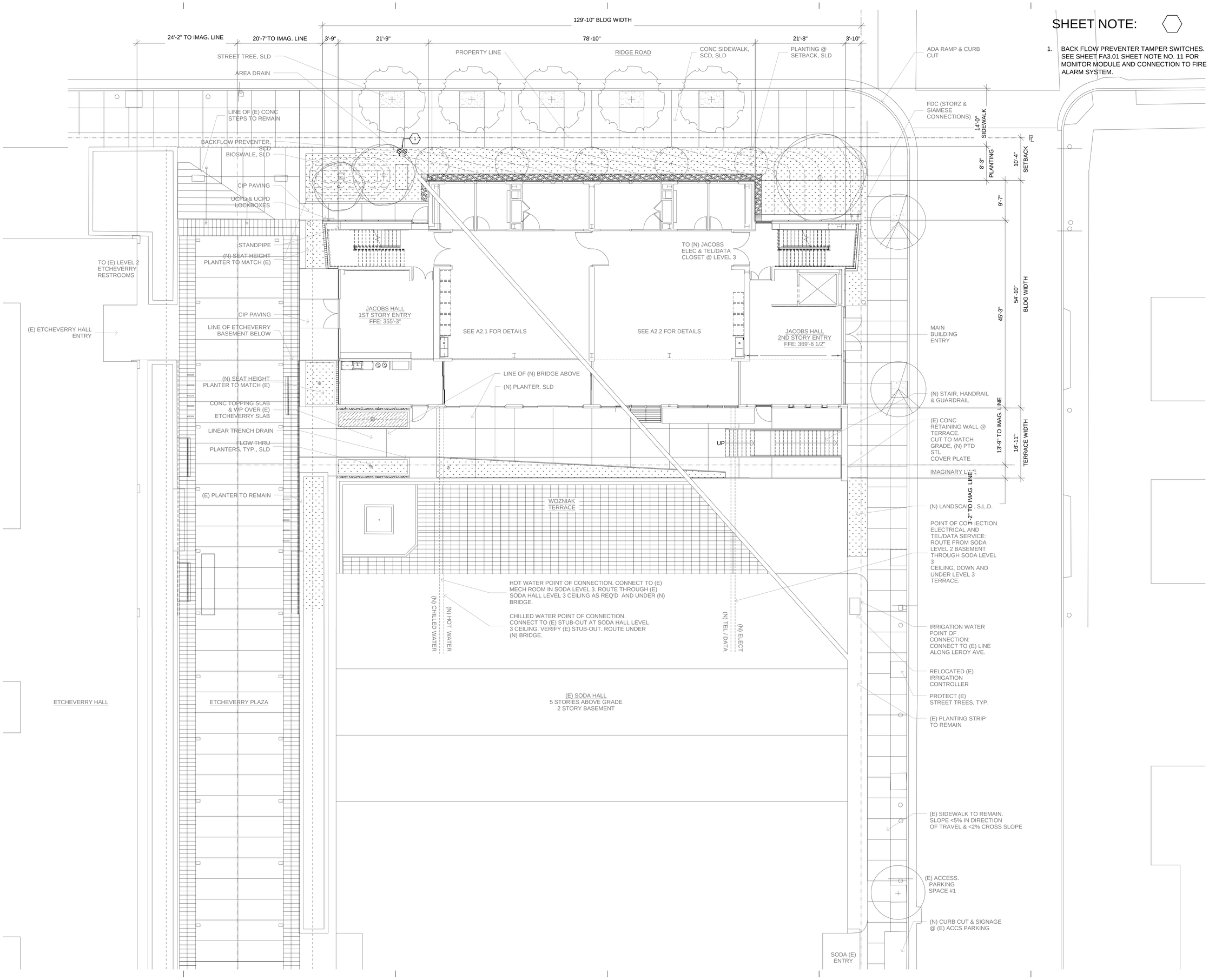
PERMIT No:
SCALE: Not To Scale

SHEET TITLE
FIRE ALARM RISER DIAGRAM

SHEET No
FA2.00



SHEET NOTE:

1. BACK FLOW PREVENTER TAMPER SWITCHES. SEE SHEET FA3.01 SHEET NOTE NO. 11 FOR MONITOR MODULE AND CONNECTION TO FIRE ALARM SYSTEM.

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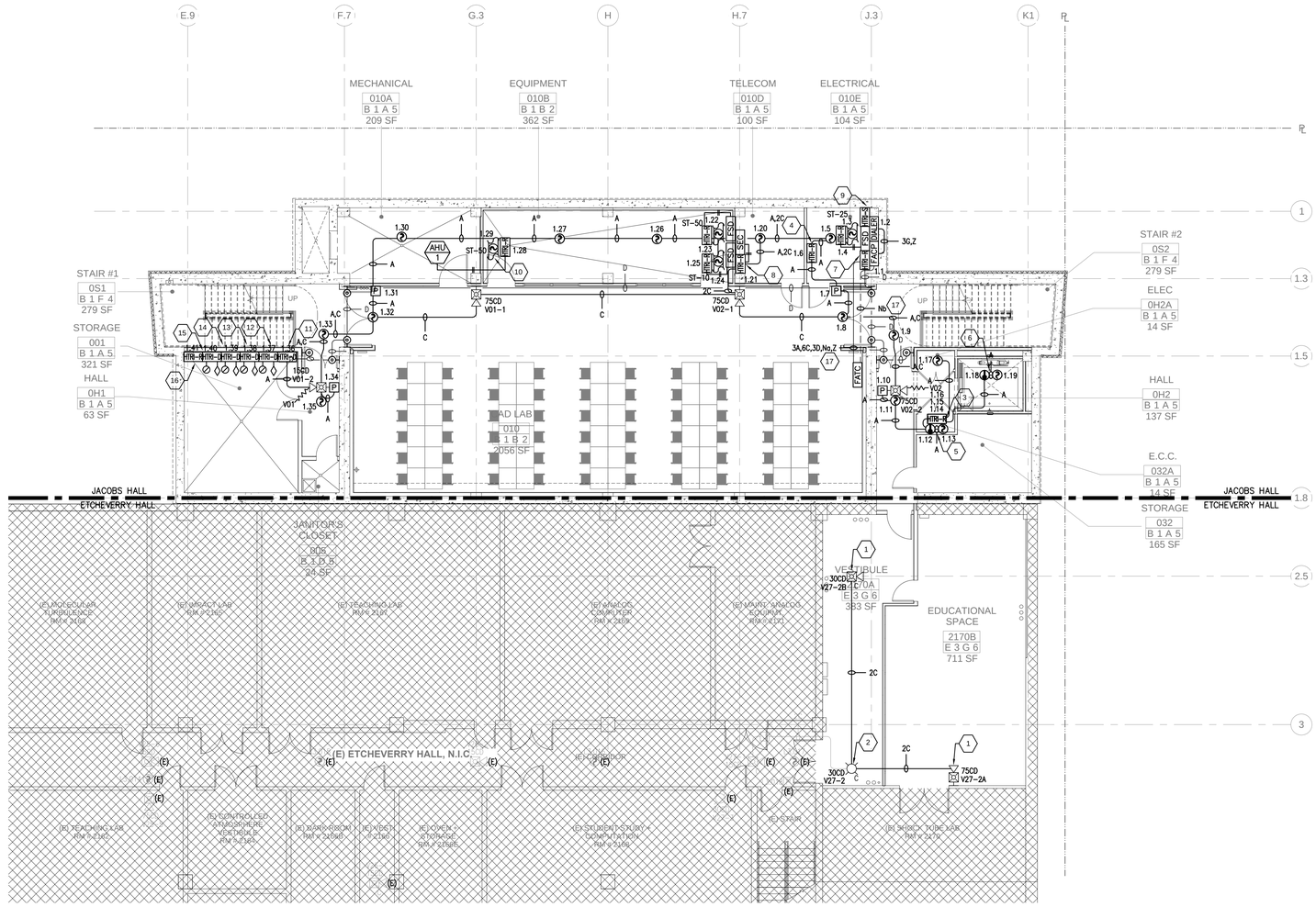
PHASE: CD
ISSUED FOR 100% CD
PERMIT No:
SCALE: 1/8" = 1'-0"

SHEET TITLE

FIRE ALARM SITE PLAN

SHEET No

FA3.00



FIRE ALARM PLAN - BASEMENT

SCALE: 1/8" = 1'-0"

GENERAL NOTE:

1. SEE SHEET M5.00 DETAIL 1 AND DETAIL 2 FOR SUPPLY DUCT CFSD AND EXHAUST DUCT CFSD RISER DIAGRAM. SEE SHEET M5.02 FOR COMBINATION CFSD DETAILS.

LEGEND:

(E) - EXISTING DEVICE TO REMAIN

SHEET NOTES:

1. NEW AUDIBLE/VISUAL DEVICE TIED-IN TO EXISTING NOTIFICATION APPLIANCE CIRCUIT V27. SEE SHEET FA4.00 FOR MORE INFORMATION.
2. REMOVE AND REPLACE EXISTING HIGH CANDELA CEILING MOUNTED AUDIBLE/VISUAL DEVICE WITH CEILING MOUNTED VISUAL DEVICE. SEE SHEET FA4.00 FOR MORE INFORMATION.
3. (3) RELAY MODULES FOR ELEVATOR INTERFACE.
4. RELAY MODULE FOR ELEVATOR SHUNT TRIP.
5. SMOKE AND HEAT DETECTORS LOCATED AT ELEVATOR MACHINE ROOM. ELECTRICAL CONTRACTOR TO INSTALL HEAT DETECTOR WITHIN 24 INCHES OF SPRINKLER HEAD. THE HEAT DETECTOR HAS A TEMPERATURE RATING OF 135°F AND A RTI RATING OF LESS THAN 45 (FEET-SEC)½ BUT NOT LESS THAN 5 (FEET-SEC)½ "QUICK".
6. SMOKE AND HEAT DETECTORS LOCATED AT ELEVATOR PIT. ELECTRICAL CONTRACTOR TO INSTALL HEAT DETECTOR WITHIN 24 INCHES OF SPRINKLER HEAD. THE HEAT DETECTOR HAS A TEMPERATURE RATING OF 135°F AND A RTI RATING OF LESS THAN 45 (FEET-SEC)½ BUT NOT LESS THAN 5 (FEET-SEC)½ "QUICK".
7. RELAY MODULE FOR 24 VDC MAGNETIC DOOR HOLDER CONTROL.
8. RELAY MODULE FOR CONTROL OF SECURITY PANEL POWER SUPPLY (BY OTHERS).
9. MONITOR MODULE FOR DACT TROUBLE SUPERVISION.
10. DUCT DETECTOR WITH RELAY BASE FOR SHUTDOWN OF AIR HANDLING UNIT.
11. MODULE TO MONITOR BACK FLOW PREVENTER TAMPER SWITCHES. SEE SHEET FA3.00.
12. MODULE TO MONITOR 3RD STORY WATER FLOW AND TAMPER SWITCHES.
13. MODULE TO MONITOR 2ND STORY WATER FLOW AND TAMPER SWITCHES.
14. MODULE TO MONITOR 1ST STORY WATER FLOW AND TAMPER SWITCHES.
15. MODULE TO MONITOR BASEMENT WATER FLOW AND TAMPER SWITCHES.
16. RELAY MODULE FOR 120VAC FIRE SPRINKLER ALARM BELL. SEE SHEET FA1.04 AND SHEET FA3.02 FOR MORE DETAILS.
17. ALL STYLES OF CLASS "A" NETWORK SHALL BE INSTALLED SUCH THAT OUTGOING AND RETURN CONDUCTORS, EXITING FROM AND RETURNING TO THE CONTROL UNIT ARE ROUTED SEPARATELY. THE MINIMUM SEPARATION SHALL BE 1 FEET WHERE INSTALLED VERTICALLY AND 4 FEET WHERE INSTALLED HORIZONTALLY.

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PERMIT No:
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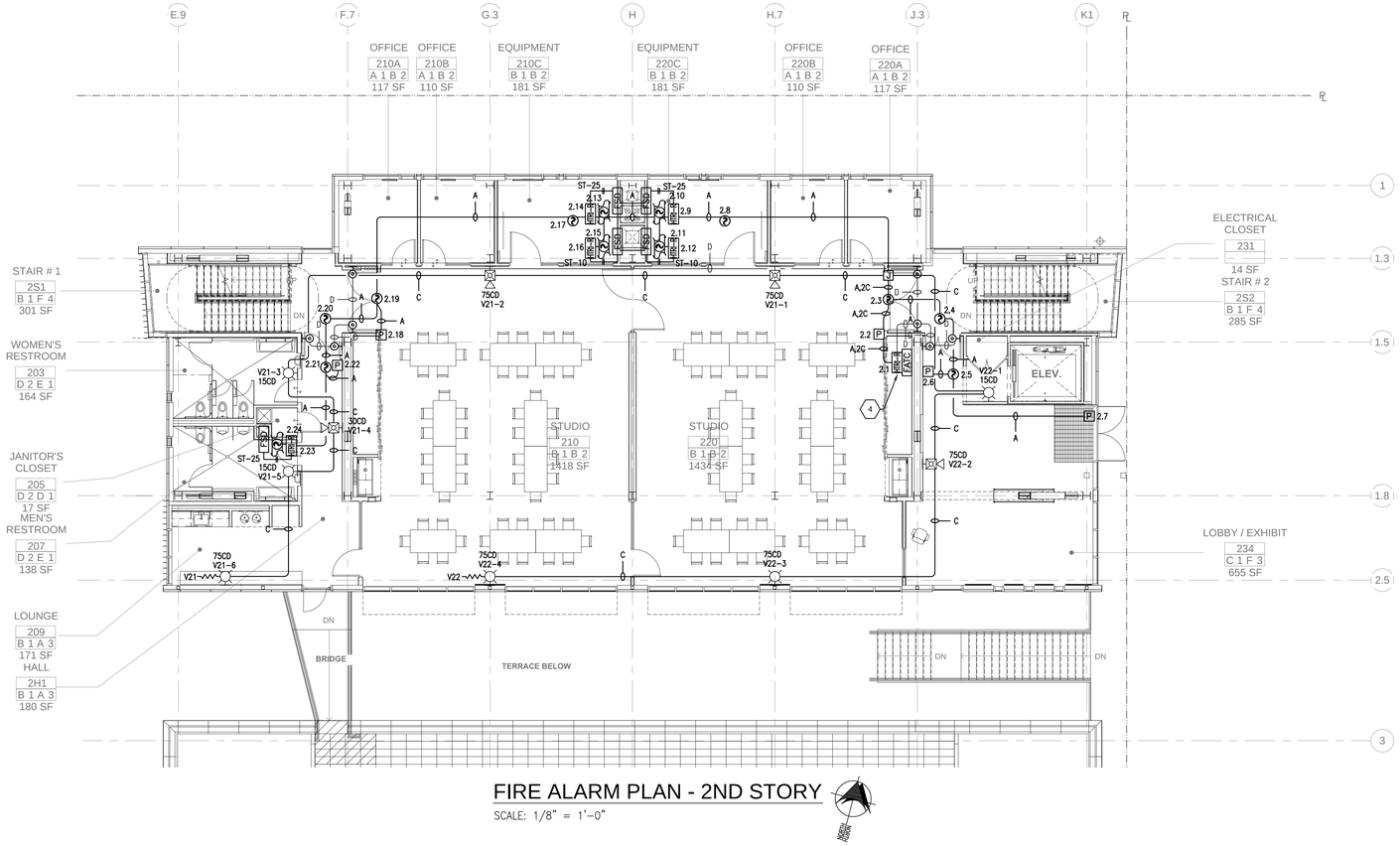
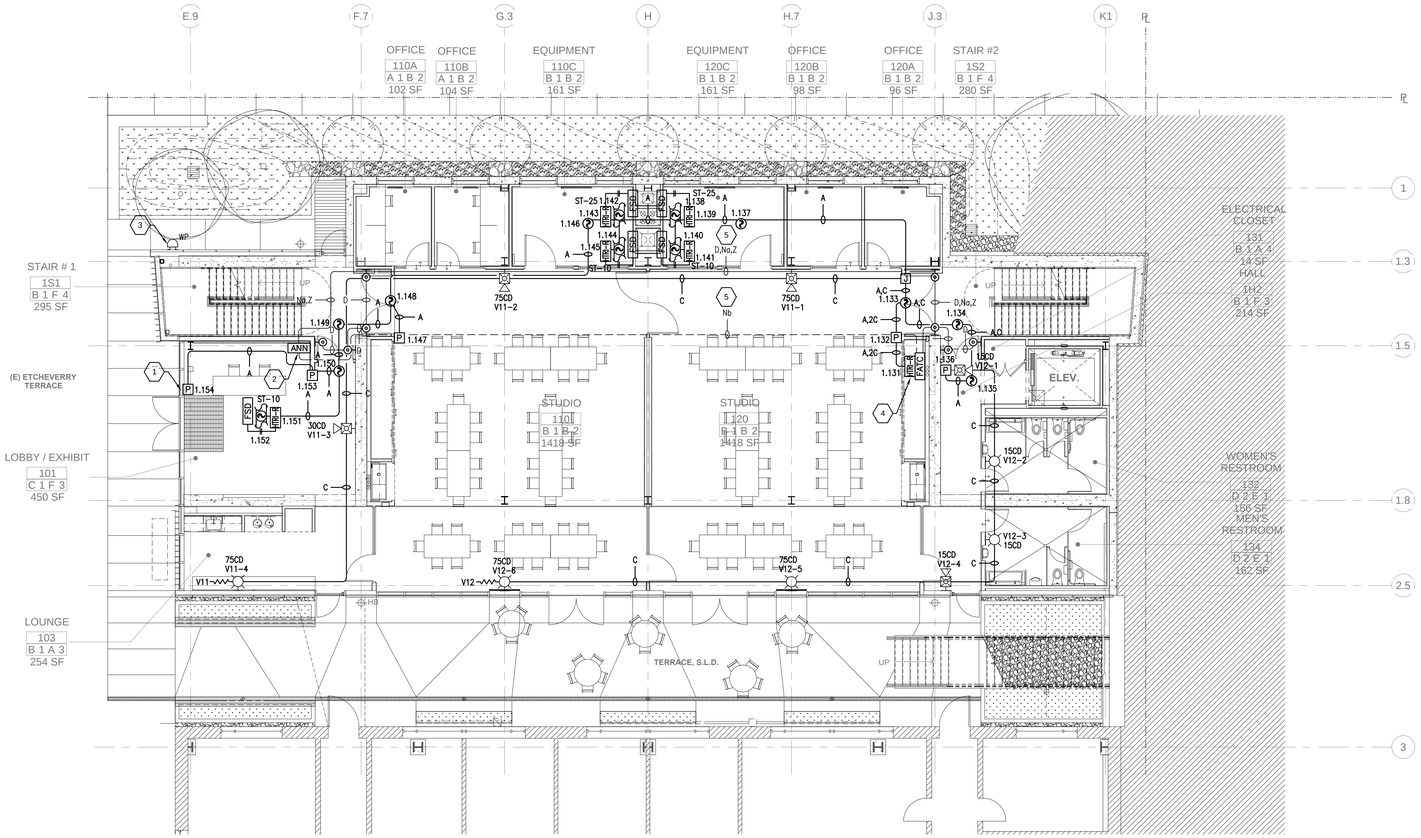
SHEET TITLE
FIRE ALARM PLAN - BASEMENT

SHEET No
FA3.01



FIRE ALARM PLAN - 2ND STORY

SCALE: 1/8" = 1'-0"



FIRE ALARM PLAN - 1ST STORY

SCALE: 1/8" = 1'-0"

GENERAL NOTE:

1. SEE SHEET M5.00 DETAIL 1 AND DETAIL 2 FOR SUPPLY DUCT CFSD AND EXHAUST DUCT CFSD RISER DIAGRAM. SEE SHEET M5.02 FOR COMBINATION CFSD DETAILS.

SHEET NOTES:

1. PEDESTAL MOUNT MANUAL PULL STATION.
2. FLUSH MOUNTED REMOTE ANNUNCIATOR.
3. 120 VAC EXTERIOR FIRE SPRINKLER BELL (PROVIDED BY SPRINKLER COMPANY). SEE SHEET FA1.04 AND FA3.01 FOR RELAY MODULE AND CONNECTION TO FIRE ALARM SYSTEM.
4. RELAY MODULE FOR 24 VDC MAGNETIC DOOR HOLDER CONTROL.
5. ALL STYLES OF CLASS "A" NETWORK SHALL BE INSTALLED SUCH THAT OUTGOING AND RETURN CONDUCTORS, EXITING FROM AND RETURNING TO THE CONTROL UNIT ARE ROUTED SEPARATELY. THE MINIMUM SEPARATION SHALL BE 1 FEET WHERE INSTALLED VERTICALLY AND 4 FEET WHERE INSTALLED HORIZONTALLY.

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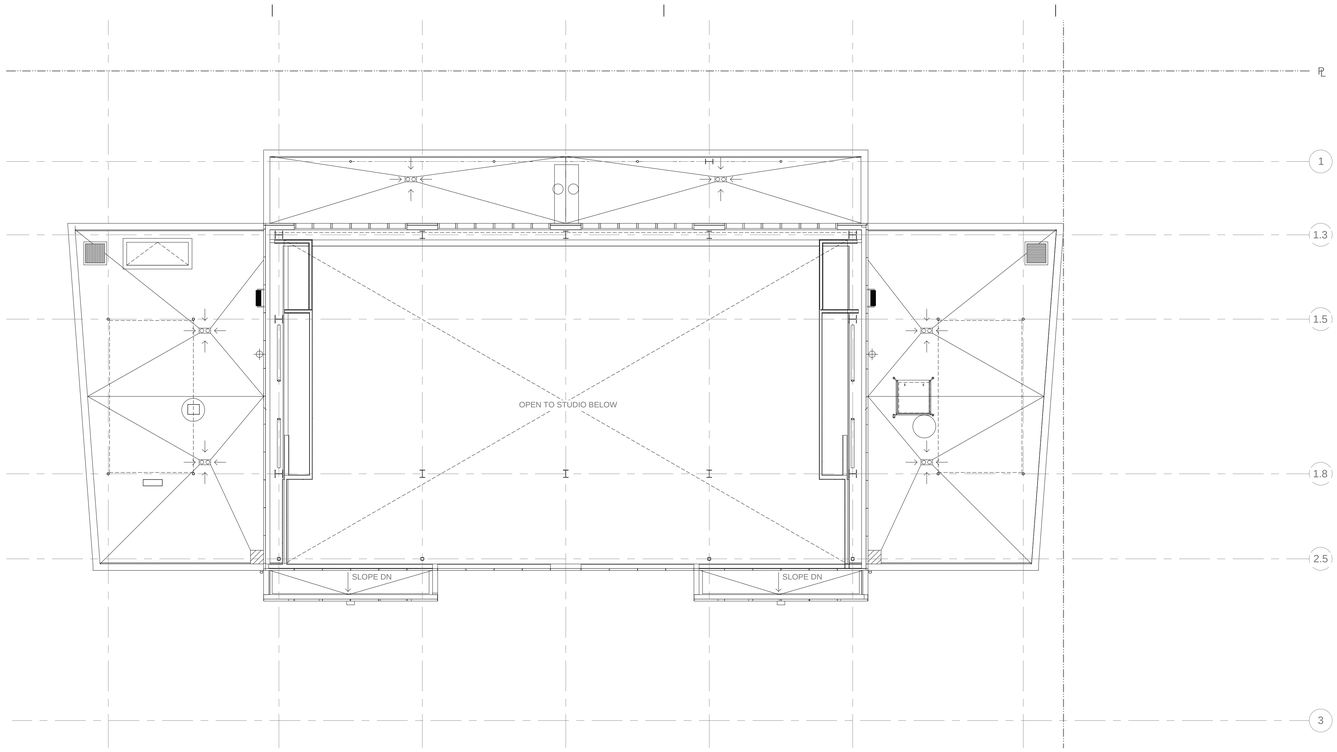
PERMIT No:
SCALE: 1/8" = 1'-0"

SHEET TITLE

FIRE ALARM PLAN - 1ST STORY & 2ND STORY

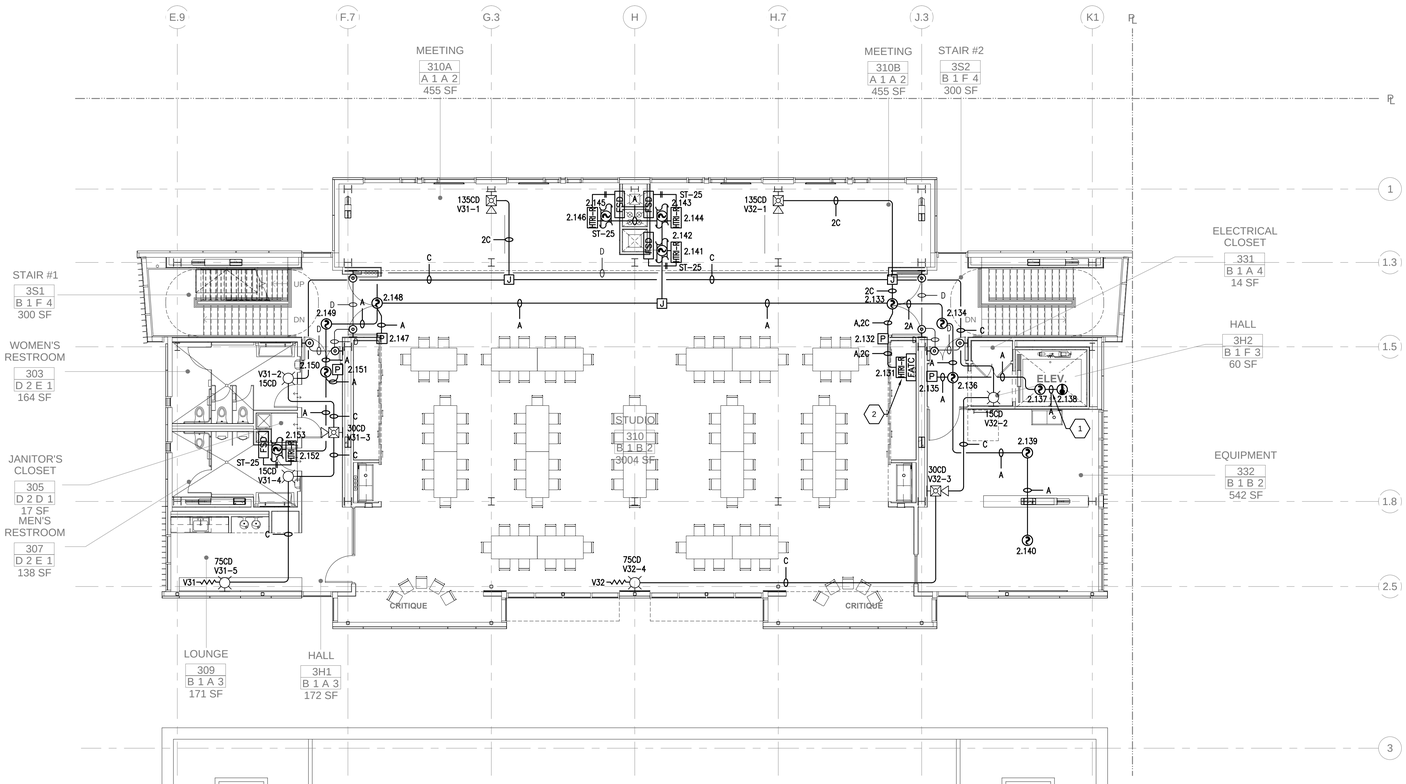
SHEET No

FA3.02



FIRE ALARM PLAN - LOW ROOF

SCALE: 1/8" = 1'-0"



FIRE ALARM PLAN - 3RD STORY

SCALE: 1/8" = 1'-0"

GENERAL NOTE:

1. SEE SHEET M5.00 DETAIL 1 AND DETAIL 2 FOR SUPPLY DUCT CFSD AND EXHAUST DUCT CFSD RISER DIAGRAM. SEE SHEET M5.02 FOR COMBINATION CFSD DETAILS.

SHEET NOTES:

1. SMOKE AND HEAT DETECTORS LOCATED AT ELEVATOR SHAFT. ELECTRICAL CONTRACTOR TO INSTALL HEAT DETECTOR WITHIN 24 INCHES OF SPRINKLER HEAD. THE HEAT DETECTOR HAS A TEMPERATURE RATING OF 135°F AND A RTI RATING OF LESS THAN 45 (FEET-SEC)½ BUT NOT LESS THAN 5 (FEET-SEC)½ "QUICK".
2. RELAY MODULE FOR 24 VDC MAGNETIC DOOR HOLDER CONTROL.

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DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: 100% CD
PERMIT No:
SCALE: 1/8" = 1'-0"

SHEET TITLE

FIRE ALARM PLAN - 3RD STORY & LOW ROOF

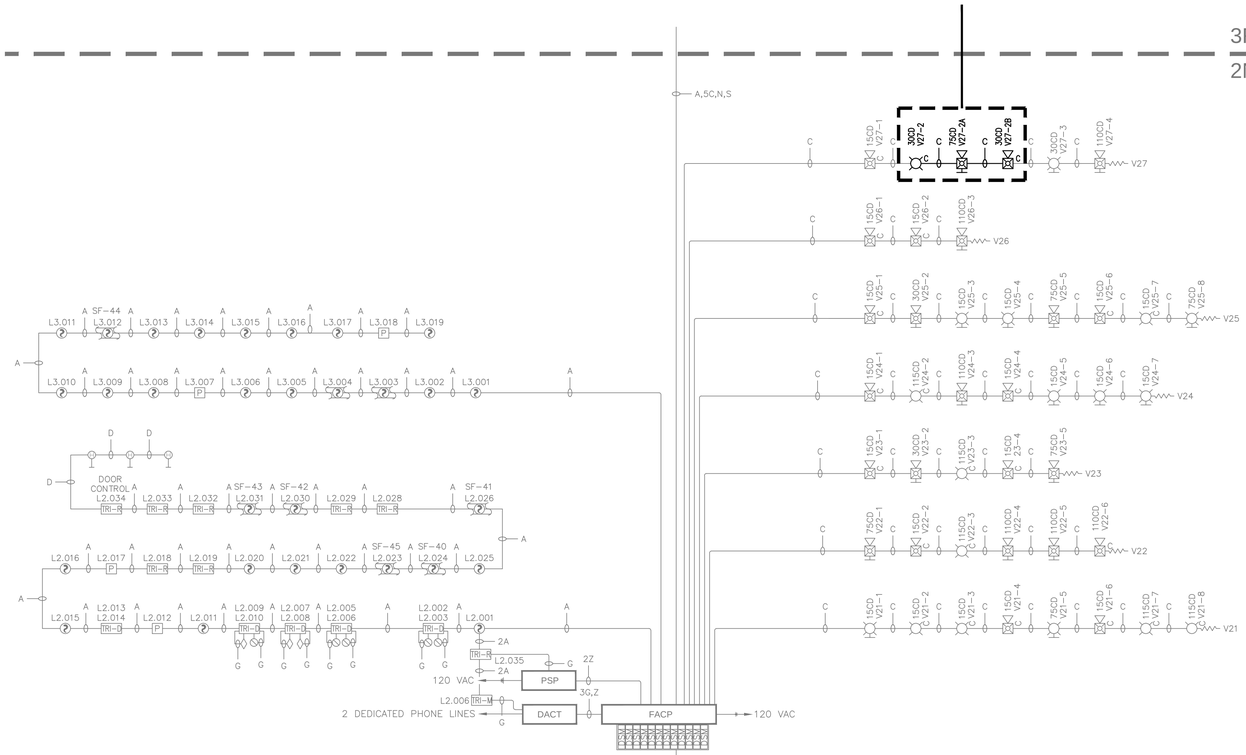
SHEET No

FA3.03

NEW SCOPE OF WORK

3RD FLOOR

2ND FLOOR



2ND FLOOR

1ST FLOOR

PARTIAL RISER DIAGRAM

ETCHEVERRY HALL FIRE ALARM EQUIPMENT LIST

CATEGORY	ITEM NO.	SYMBOL	QTY	MODEL NUMBER	DESCRIPTION	MANUFACTURER	DATA SHEET NUMBER	CALIFORNIA STATE FIRE MARSHAL LISTING NUMBER
MISCELLANEOUS FIELD DEVICES	1		1	STRC	MULTI CANDELA STROBE, 15cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	2				MULTI CANDELA STROBE, 30cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	3				MULTI CANDELA STROBE, 75cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	4				MULTI CANDELA STROBE, 95cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	5				MULTI CANDELA STROBE, 115cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	6				MULTI CANDELA STROBE, 177cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	7							
	8		1	HSRC	MULTI CANDELA HORN/STROBE, 15cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	9				MULTI CANDELA HORN/STROBE, 30cd (Red) Ceiling Mtd	WHEELOCK	---	7125-0785:0168
	10				MULTI CANDELA HORN/STROBE, 75cd (Red) Ceiling Mtd	WHEELOCK	---	7125-0785:0168
	11				MULTI CANDELA HORN/STROBE, 95cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	12				MULTI CANDELA HORN/STROBE, 115cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	13				MULTI CANDELA HORN/STROBE, 177cd (Red) Ceiling Mtd.	WHEELOCK	---	7125-0785:0168
	14							
	15		1	HSR	MULTI CANDELA HORN/STROBE, 15cd (Red) Wall Mtd.	WHEELOCK	---	7125-0785:0168
	16				MULTI CANDELA HORN/STROBE, 30cd (Red) Wall Mtd	WHEELOCK	---	7125-0785:0168
	17				MULTI CANDELA HORN/STROBE, 75cd (Red) Wall Mtd	WHEELOCK	---	7125-0785:0168
	18				MULTI CANDELA HORN/STROBE, 110cd (Red) Wall Mtd.	WHEELOCK	---	7125-0785:0168
	19				MULTI CANDELA HORN/STROBE, 135cd (Red) Wall Mtd.	WHEELOCK	---	7125-0785:0168
	20				MULTI CANDELA HORN/STROBE, 185cd (Red) Wall Mtd.	WHEELOCK	---	7125-0785:0168
	21		1	ESB-R	BACKBOX (Red)	WHEELOCK	---	Not Applicable

POWER SUPPLY PANEL BATTERY CALCULATIONS

SUPERVISORY CURRENT

DESCRIPTION	Quantity	Standby 24 VDC Module /Card Current	Load Current Per Circuit: End of Line Device	Load Current Per Circuit: Device Current	Total Standby 24VDC Module Current
CSM-4 CONTROLLABLE SIGNAL MODULE	6	0.010			0.060
12mA per NAC circuit (2 ckt. per card)	12		0.012		0.144
				TOTAL SUPERVISORY CURRENT	0.204

POWER SUPPLY PANEL NOTIFICATION CIRCUITS			TOTAL CKT CURRENT LOAD
PS-35#1	5.594	CIRCUIT V21	0.805
		CIRCUIT V22	1.016
		CIRCUIT V23	0.575
		CIRCUIT V24	0.688
		CIRCUIT V25	0.664
		CIRCUIT V26	0.37
		CIRCUIT V27	1.68
		CIRCUIT V35	0.796
PS-35#2	3.303	CIRCUIT V31	0.785
		CIRCUIT V32	1.068
		CIRCUIT V33	0.978
		CIRCUIT V34	0.472

TOTAL ALARM CURRENT (AMPS) 8.897

SUMMARY

A = TOTAL SUPERVISORY CURRENT x SUPERVISORY TIME REQUIRED
0.204 AMPS x 24 HR
= **4.896** (AMP-HR)

B = TOTAL ALARM CURRENT x ALARM TIME REQUIRED
8.897 AMPS x .25 HR
= **2.224** (AMP-HR)

C = TOTAL CURRENT RQUIRED FOR VOICE PANEL
= **16.800** (AMP-HR)

D = A + B + C
= **23.920** (AMP-HR)

SUPERVISORY TIME REQUIRED---------24 HR
ALARM TIME REQUIRED-----15 MINS. or .25 HR

BATTERY PROVIDED..... **WKA12-33C (2)**
BATTERY SIZE..... **35** (AMP-HR)

TOTAL SYSTEM REQUIRED (AMP-HR)
= **16.800** **AMP/HOUR**

BATTERY RESERVE AFTER
24 HOURS SUPERVISORY
& 15 MINUTES ALARM (AMP-HOUR)
= **18.200** **AMP-HOUR**

ACTUAL VOLTAGE DROP CALCS WIRE SIZE USED: #14 AWG DROP: 5 FEET				MAXIMUM DISTANCE TO RETAIN A 7.5% VOLTAGE DROP
CKT	DISTANCE (ft.)	CURRENT LOAD (amps)	VOLTAGE DROP (%)	MAX DISTANCE (ft.) ALLOWED
V21	400	0.805	7.051	425.47
V22	350	1.016	7.787	337.11
V23	320	0.575	4.029	595.65
V24	500	0.688	7.533	497.82
V25	500	0.664	7.270	515.81
V26	450	0.370	3.646	925.68
V27	601	0.680	8.949	503.68
V35	570	0.796	9.935	430.28
V31	390	0.785	6.704	436.31
V32	300	1.068	7.016	320.69
V33	330	0.978	7.067	350.20
V34	390	0.472	4.031	725.64

CKT & LOAD	DEVICE DESCRIPTION	QTY	DEVICE CURRENT RATING	TOTAL ROW CURRENT
V27	(E) STROBE 15 CANDELA	0	0.041	0
0.68	(E) STROBE 30 CANDELA	1	0.063	0.063
	(E) HORN/STROBE 110 CANDELA	1	0.194	0.194
	(E) HORN/STROBE 15 CANDELA (CEILING)	1	0.088	0.088
	(N) HORN/STROBE 75 CANDELA (WALL)	1	0.148	0.148
	(N) STROBE 30 CANDELA (CEILING)	1	0.085	0.085
	(N) HORN/STROBE 30 CANDELA (CEILING)	1	0.102	0.102

VOLTAGE DROP CALCULATIONS (WORST CASE SHOWN)

FORMULA: VOLTAGE DROP CALCULATIONS (FOR A GIVEN LENGTH OF CONDUCTOR) = $\frac{I \times D \times 21.6}{C.M.}$

WHERE:
I = AMPERES PER TERMINAL LOAD
D = ONE WAY DISTANCE OF CONDUCTOR (IN FEET) MEASURED FROM SOURCE OF SUPPLY TO LOAD
21.6 = CONSTANT (RESISTANCE OF CONDUCTORS AT 10.8 OHMS PER L.M. FOR TWICE THE LENGTH)
C.M. = CROSS SECTIONAL AREA IN CIRCULAR MILS (SEE TABLE AT RIGHT)

WIRE SIZE	CIRCULAR MILS (C.M.)
12 AWG	6530
14 AWG	4110
16 AWG	2580
18 AWG	1620
20 AWG	1020

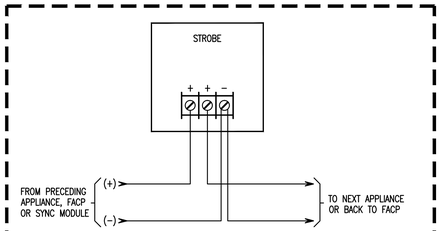
GIVEN:
CIRCUIT DESIGNATION = V27
APPROX. LENGTH OF CONDUCTOR = 601 FEET
CURRENT LOAD = 0.68
WIRE SIZE USED = 14 AWG

VOLTAGE DROP = $\frac{0.68 \times 601 \times 21.6}{4110} = \frac{8827.488}{4110} =$ 2.148 VOLTS

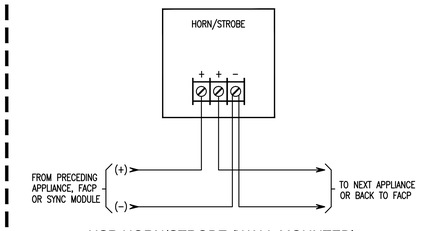
% OF VOLTAGE DROP = $\frac{2.148 \text{ VOLTS}}{24 \text{ VOLTS}} =$ 0.089492 or 8.949 %

NOTES:
1. THE OPERATING VOLTAGE OF DEVICE USED IS 18 TO 31 VDC. THE RESULTING VOLTAGE DROP IS WITHIN THIS OPERATING RANGE.
2. PERMISSIBLE VOLTAGE DROP IS 10% OR LESS

NEW SCOPE OF WORK



STRC STROBE (CEILING MOUNTED)
(Multi-Candela Appliance 15 / 30 / 75 / 95 / 115 / 177cd)



HSR HORN/STROBE (WALL MOUNTED)
(Multi Candela Appliance 15 / 30 / 75 / 110 / 135 / 185CD)
or
HSRC HORN/STROBE (CEILING MOUNTED)
(Multi Candela Appliance 15 / 30 / 75 / 95 / 115 / 177CD)

WIRING DETAILS OF FIELD DEVICES

ARCHITECTS
LMS^A
LEDDY MAYTUM STACY ARCHITECTS
677 HARRISON STREET
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CONSULTANTS

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	100% DD	01/24/14
	DSA Submission	01/29/14
	100% CD / Permit Submission	08/15/14

DATE: 15 August, 2014
JOB No: 1309
PHASE: CD
ISSUED FOR: 100% CD
PERMIT No:
SCALE: 1/8" = 1'-0"

SHEET TITLE
ETCHEVERRY HALL RISER, DETAILS AND CALCULATIONS

SHEET No
FA4.00

JACOBS HALL

LEROY AVE/RIDGE ROAD
BERKELEY, CA

FIRE SPRINKLER SUBMITTAL

FIRE PROTECTION NOTES

GENERAL NOTES:

1) THIS AUTOMATIC FIRE SPRINKLER SYSTEM SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH NFPA 13 2010 EDITION AND CONFORM TO UC BERKELEY FIRE MARSHAL STANDARDS FOR LIGHT HAZARD.
2) A SET OF APPROVED PLANS SHALL BE MAINTAINED AT THE JOBSITE AT ALL TIMES.
3) ONLY NEW FIRE SPRINKLERS SHALL BE EMPLOYED IN THE INSTALLATION OF THE FIRE SPRINKLER SYSTEM.
4) ALL VALVES SHALL HAVE A PERMANENTLY AFFIXED SIGN INDICATING IT'S FUNCTION.
5) A STOCK OF SPARE FIRE SPRINKLERS OF EACH STYLE, TYPE, AND TEMP. RATING ALONG WITH A SPRINKLER WRENCH SHALL BE LOCATED AT THE MAIN SYSTEM RISER OR OTHER APPROVED LOCATION AMOUNT DETERMINED BY NFPA 13.
6) ALL SYSTEM PIPING SHALL BE HYDROSTATICALLY TESTED AT 200 PSI FOR TWO HOURS OR AT 50 PSI ABOVE THE SYSTEM OPERATING PRESSURE. WHICHEVER IS GREATER.
7) ALL VALVES CONTROLLING THE WATER SUPPLY FOR THE SPRINKLER SYSTEM AND ALL WATER FLOW SWITCHES SHALL BE ELECTRICALLY MONITORED BY AN APPROVED CENTRAL STATION, REMOTE STATION, OR PROPRIETARY MONITORING STATION PER THE 2010 EDITION OF THE CALIFORNIA BUILDING CODE (CBC) VOLUME 1 SECTION 903.4.
8) ALL PRODUCTS USED IN THIS INSTALLATION SHALL BE U.L. LISTED FOR SERVICE IN A FIRE PROTECTION SYSTEM OR SHALL BE APPROVED BY THE AUTHORITY HAVING JURISDICTION FOR THEIR INTENDED USE.

DESIGN CRITERIA:

OCCUPANCY HAZARD CLASS = LIGHT HAZARD ASSEMBLY

BUILDING CONSTRUCTION TYPE = TYPE 2B / FULLY SPRINKLERED
BUILDING SQ. FOOTAGE = 19,150 GROSS SQ. FT.
HYDRAULIC DESIGN DENSITY = SEE CALCULATION DATA ON EACH APPLICABLE SHEET
CEILING CONSTRUCTION TYPE = OBSTRUCTED 22" MAX DEF DISTANCE

AREAS NOT REQUIRING SPRINKLER PROTECTION
1. CONCEALED SPACES - NFPA 13 - 2010 EDITION SECTIONS 8.15.1.2.
2. VERTICAL SHAFTS - NFPA 13 - 2010 EDITION SECTIONS 8.15.2.
3. TRACTION ELEVATOR HOISTWAYS NFPA 13 SECTION 2010 SECTIONS 8.15.5.2.
4. NON-COMBUSTIBLE OVERHANGS - NFPA 13 2002 EDITION SECTION 8.15.1.2.18.1.

NOTE: SPRINKLERS SHALL BE INSTALLED AT THE TOP AND BOTTOM OF STAIR SHAFTS. MECHANICAL, PLUMBING & ELECTRICAL SHAFTS ARE NOT OPEN TO THE FLOORS AND SHALL NOT HAVE SPRINKLERS AT THE TOP OR BOTTOM PER NFPA #13 SEC. 8.145.2.

PIPE & FITTINGS:

1) ALL THREADED PIPE 1" TO 2 1/2" SHALL BE SCH 40. BLACK STEEL PIPE. ALL THREADED PIPE SHALL UTILIZE THREADED DUCTILE IRON FITTINGS U.O.N. WITH A MINIMUM WORKING PRESSURE OF 175 PSI AND MUST CONFORM TO ANSI STANDARD B16.3.
2) ALL GROOVED PIPING 2" TO 4" SHALL BE SCH 40. ALL GROOVED PIPING SHALL UTILIZING GROOVED COUPLINGS AND FITTINGS.
3) PIPE PENETRATIONS THROUGH STRUCTURAL ELEMENTS SHALL BE NOMINALLY 2" LARGER FOR PIPE SIZES 1" TO 3" AND NOMINALLY 4" LARGER FOR PIPE DIAMETERS 4" AND ABOVE PER NFPA 13, 2010 EDITION, SEC. 9.3.4.2.
4) NO CLEARANCE IS REQUIRED FOR PIPING THROUGH GYPSUM BOARD OR EQUALLY FRANGIBLE CONSTRUCTION THAT IN NOT REQUIRED TO HAVE A FIRE RESISTIVE RATING PER NFPA 13, 2002 EDITION, SECTION 9.3.4.4.
5) ALL PIPING ABOVE CEILINGS IN RESIDENTIAL DWELLING AREAS AND CORRESPONDING CORRIDORS WILL BE CPVC PIPING AND GLUED FITTINGS.

HANGERS, BRACING & LINE RESTRAINT:

1) ALL HANGERS SHALL BE UL LISTED & COMPLY WITH NFPA 13 2010 ED., SECTION 9.1 AND SHALL BE SPACED PER TABLE 9.2.2.1.
2) THE END OF BRANCH LINES WITH PENDANT SPRINKLERS AND ALL ARMOVERS IN EXCESS OF 1'-0" IN LENGTH WITH HANGERS SHALL BE EQUIPPED WITH A TOLCO #25 SURGE RESTRAINER TO PREVENT EXCESSIVE VERTICAL MOVEMENT.
3) ALL BRANCH LINES WITH END-OF-LINE HANGER ROD GREATER THAN 6" AS DEFINED BY NFPA 13, SECTION 9.3.6.5 SHALL BE EQUIPPED WITH AN APPROVED LINE RESTRAINT AND RESTRAINTS AT INTERVALS NOT EXCEEDING TABLE 9.3.6.4(A) OR (B) BASED ON BRANCH LINE DIAMETER AND THE VALUE OF THE CP.
4) HANGER RODS LESS THAN 6" IN LENGTH MEASURED BETWEEN THE TOP OF PIPE & POINT OF ATTACHMENT TO THE BUILDING STRUCTURE SHALL SERVE AS LATERAL SWAY BRACING PER NFPA 13, SECTION 9.3.5.3.9. WHEN INSTALLED WITHIN 24" OF CHANGE OF A DIRECTION THE HANGER SHALL SERVE AS LONGITUDINAL BRACING PER NFPA 13 SECTION 9.3.5.3.7.

STRUCTURAL ENGINEER WILL PROVIDE REPORT TO THE CFM INDICATING ACCEPTANCE OF METHOD OF SEISMIC BRACING AND LOCATIONS OF BRACING

SHEET INDEX

PROJECT TEAM

OWNER:	UNIVERSITY OF CALIFORNIA BERKELEY, CAPITAL PROJECTS 1936 UNIVERSITY AVE., 2ND FLR. BERKELEY. CA, 94704	SANDRA BECK T: (510) 664-4383 SEBECK@BERKELEY.EDU
PROJECT MANAGEMENT CONSULTANT:	KSD GROUP 1200 CONCORD AVE., NO. 170 CONCORD, CA 94520	KEN DEFIEBRE M: (925) 487 - 4752 KEN@KSDGROUP.COM
GENERAL CONTRACTOR:	HATHAWAY DINWIDDIE 275 BATTERY STREET, SUITE 300 SAN FRANCISCO, CA 94111	MICHAEL NIEMI T:408-988-4200 (SANTA CLARA OFFICE) NIEMIM@HDCCO.COM
GEOTECHNICAL CONSULTANT:	A3GEO, INC. 1331 SEVENTH STREET, UNIT E BERKELEY, CA 94710	DONA MANN T: (415) 425 - 0247 DONA@A3GEO.COM
SURVEYOR:	BKF 4670 WILLOW RD., SUITE 250 PLEASANTON, CA 94588	WALTER STEMBERGA T: (925) 396 - 7730 WSTEMBERGA@BKF.COM
ARBORIST:	HORTSCIENCE, INC. 325 RAY STREET PLEASANTON, CA 94566	JIM CLARK T: (925) 981 - 9430 X 25 JIM@HORTSCIENCE.COM
ARCHITECT:	LEDDY MAYTUM STACY ARCHITECTS 677 HARRISON STREET SAN FRANCISCO, CA 94107	RYAN JANG T: (415) 495 - 1700 X 342 RJANG@LMSARCH.COM
STRUCTURAL ENGINEER:	FORELL / ELSESSER ENGINEERS 160 PINE ST., SUITE 600 SAN FRANCISCO, CA 94111	CHRIS PETTEYS T: (415) 837 - 0700 C.PETTEYS@FORRELL.COM
LANDSCAPE ARCHITECT:	CLIFF LOWE ASSOCIATES 1175 FOLSOM STREET SAN FRANCISCO, CA 94103	CLIFF LOWE T: (415) 431 - 0394 CLIFF@CLASCAPE.COM
MECHANICAL/ PLUMBING DESIGN-BUILD ENGINEER:	PAN-PACIFIC MECHANICAL 1205 CHRYSLER DR. MENLO PARK, CA 94025	MIKE CARTER T: (650) 815-6915 MCARTER@PPMECHANICAL.COM
ELECTRICAL + LIGHTING DESIGN-BUILD ENGINEER:	THE ENGINEERING ENTERPRISE 1305 MARINA VILLAGE PKWY. ALAMEDA, CA 94501	KRISTINA MARTIN T: (510) 769-7600 TINA@ENGENT.COM
FIRE PROTECTION DESIGN-BUILD:	TBD	TBD
MEP PEER REVIEW ENGINEER:	INTEGRAL GROUP ENGINEERS 427 13TH ST. OAKLAND, CA 94612	TYLER BRADSHAW T: (510) 663-2070 TBRADSHAW@INTEGRALGROUP.COM
ACOUSTICAL:	CHARLES SALTER ASSOCIATE, INC. 130 SUTTER STREET, SUITE 500 SAN FRANCISCO, CA 94104	JEREMY DECKER T: (415) 397 - 0442 JEREMY.DECKER@CMSALTER.COM
WATERPROOFING:	SIMPSON GUMPERTZ HAGER 100 PINE STREET, SUITE 1600 SAN FRANCISCO, CA 94111	JIM MENDYGRAL T: (415) 495 - 3700 JEMENDYGRAL@SGH.COM
CIVIL ENGINEER:	BKF 4670 WILLOW RD., SUITE 250 PLEASANTON, CA 94588	JOHN LAMON T: (925) 396 - 7700 JLAMON@BKF.COM

HYDRUALIC INFORMATION

Calculation results for Design Area 1 - 3RD FLOOR

This system as shown on COSCO company print no ____ dated 1-6-13
for JACOBS HALL at ____
contract no 20SC-5070 is designed to discharge at a rate of 0.1 gpm/ft² (L/min/m²) of floor area over a maximum area of 1534 ft² when supplied with water at a rate of 380 gpm at 88.7 psi at the base of the riser.
Hose stream allowance of ____ is included in the above.

Occupancy classification: LIGHT — Number of heads flowing: 16
Commodity classification: ____ — System Type: Wet
Maximum storage height: ____ — Maximum velocity: 15.6 ft/s
Storage arrangement: ____

Flow from In-Rack sprinklers:	0 gpm
Flow from Overhead sprinklers:	380 gpm
Flow from Inside Hoses:	0 gpm
Flow from Outside Hoses:	0 gpm
Other fixed flows:	0 gpm
Total flow in system piping:	380 gpm
Additional flow at/beyond source:	100 gpm
Total of all flows:	480 gpm

Pressure Required at Source:	88.7 psi
Pressure Available at Source:	107.5 psi
Surplus Pressure at Source:	18.8 psi

Calculation results for Design Area 2 - STANDPIPE

This system as shown on COSCO company print no ____ dated 1-6-13
for JACOBS HALL at ____
contract no 20SC-5070 is designed to discharge at a rate of 0.1 gpm/ft² (L/min/m²) of floor area over a maximum area of 0 ft² when supplied with water at a rate of 510.2 gpm at 145.1 psiat the base of the riser.
Hose stream allowance of ____ is included in the above.

Occupancy classification: NA — Number of heads flowing: 2
Commodity classification: ____ — System Type: Wet
Maximum storage height: ____ — Maximum velocity: 17.44 ft/s
Storage arrangement: ____

Flow from In-Rack sprinklers:	0 gpm
Flow from Overhead sprinklers:	0 gpm
Flow from Inside Hoses:	0 gpm
Flow from Outside Hoses:	0 gpm
Other fixed flows:	0 gpm
Total flow in system piping:	0 gpm
Additional flow at/beyond source:	0 gpm
Total of all flows:	0 gpm

Pressure Required at Source:	145.1 psi
Pressure Available at Source:	149.7 psi
Surplus Pressure at Source:	4.6 psi

Calculation results for Design Area 3 - 2ND FLOOR

This system as shown on COSCO company print no ____ dated 1-6-13
for JACOBS HALL at ____
contract no 20SC-5070 is designed to discharge at a rate of 0.1 gpm/ft² (L/min/m²) of floor area over a maximum area of 2700 ft² when supplied with water at a rate of 280.3 gpm at 86.2 psi at the base of the riser.
Hose stream allowance of ____ is included in the above.

Occupancy classification: LIGHT — Number of heads flowing: 12
Commodity classification: ____ — System Type: Wet
Maximum storage height: ____ — Maximum velocity: 16.49 ft/s
Storage arrangement: ____

Flow from In-Rack sprinklers:	0 gpm
Flow from Overhead sprinklers:	280.3 gpm
Flow from Inside Hoses:	0 gpm
Flow from Outside Hoses:	0 gpm
Other fixed flows:	0 gpm
Total flow in system piping:	280.3 gpm
Additional flow at/beyond source:	100 gpm
Total of all flows:	380.3 gpm

Pressure Required at Source:	86.2 psi
Pressure Available at Source:	108.7 psi
Surplus Pressure at Source:	22.6 psi

Calculation results for Design Area 4 - BASEMENT

This system as shown on COSCO company print no ____ dated 1-6-13
for JACOBS HALL at ____
contract no 20SC-5070 is designed to discharge at a rate of 0.1 gpm/ft² (L/min/m²) of floor area over a maximum area of 2025 ft² when supplied with water at a rate of 217 gpm at 76.4 psi at the base of the riser.
Hose stream allowance of ____ is included in the above.

Occupancy classification: LIGHT — Number of heads flowing: 9
Commodity classification: ____ — System Type: Wet
Maximum storage height: ____ — Maximum velocity: 27.42 ft/s
Storage arrangement: ____

Flow from In-Rack sprinklers:	0 gpm
Flow from Overhead sprinklers:	217 gpm
Flow from Inside Hoses:	0 gpm
Flow from Outside Hoses:	0 gpm
Other fixed flows:	0 gpm
Total flow in system piping:	217 gpm
Additional flow at/beyond source:	100 gpm
Total of all flows:	317 gpm

Pressure Required at Source:	76.4 psi
Pressure Available at Source:	109.4 psi
Surplus Pressure at Source:	33 psi

PROJECT INFORMATION

1. PARCEL ADDRESS
   ADDRESS: RIDGE ROAD & LEROY AVE, BERKELEY, CA 94709
2. OCCUPANCY
   PROPOSED USE: A-3 ASSEMBLY
3. TYPE OF CONSTRUCTION
   2-B
   FULLY SPRINKLERED
4. GROSS FLOOR AREA
   19,150 SQ FT

CODES

NFPA 13 - 2010 EDITION
INSTALLATION OF AUTOMATIC FIRE SPRINKLER SYSTEMS

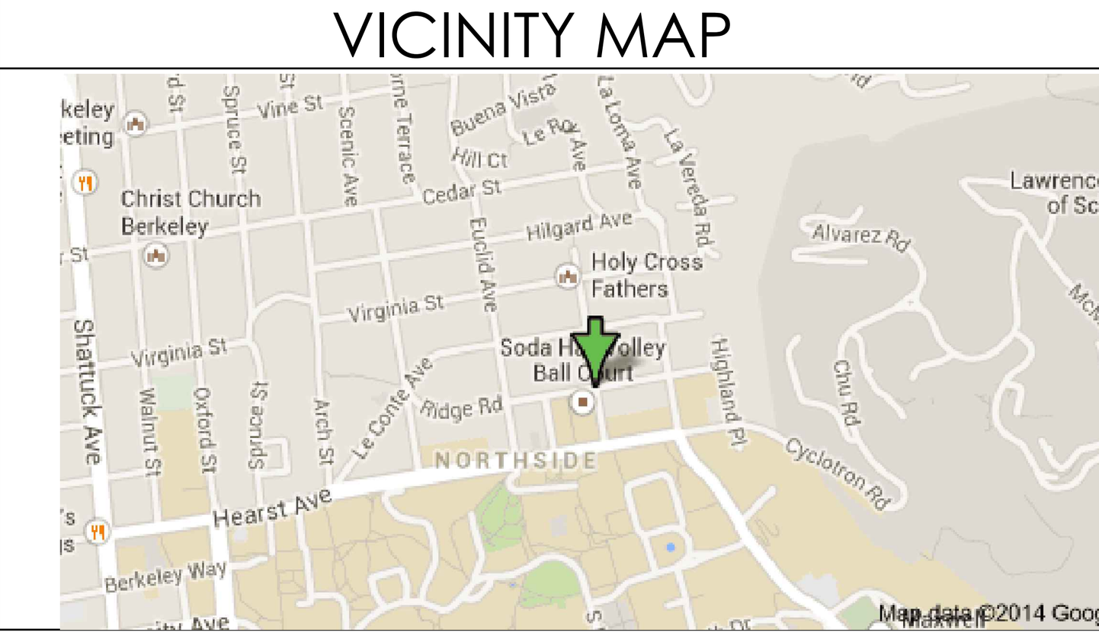
NFPA 25 - 2011 EDITION
TESTING OF WATER BASED FIRE SPRINKLER SYSTEMS

CBC - 2010 EDITION

CFC - 2010 EDITION

NFPA 24-2010 EDITION

VICINITY MAP



SYMBOL LEGEND

- RISE UP
- DROP DN
- CAP
- RIGID COUPLING
- FLEXIBLE COUPLING
- PIPE SLEEVE - STI
- FIRESTOP SYS. - W-L-1049 / FIRESTOP SYS. - C-AJ-1353
- HYDRAULIC NODE POINT
- TAMPER SWITCH
- WATER FLOW SWITCH
- SPRINKLER RISER
- 3" FIRE DEPT HOSE VA.
- HANGER #2
- HANGER #1
- LINE RESTRAINT
- PIPE ELEVATION

SEISMIC LEGEND

- DENOTES HANGER ATTACHMENT TO CONCRETE
- LR — LINE RESTRAINT WHEN HANGER ROD LENGTH'S DO NOT CONFORM TO NFPA 13 2002 ED. SECTION 9.3.5.3.7
- DENOTES 2-WAY LATERAL SWAY BRACE
- DENOTES 2-WAY LONGITUDINAL SWAY BRACE
- DENOTES 4-WAY SWAY BRACE

WALL LEGEND

- 1-HOUR FIRE BARRIER
- 2-HOUR FIRE BARRIER
- 2-HOUR FIRE WALL (HORIZONTAL EXITS)
- 3-HOUR FIRE WALL
- NON RATED PARTITION

SCOPE OF WORK

1) INSTALL A COMPLETE AUTOMATIC FIRE SPRINKLER SYSTEM THROUGHOUT THIS BUILDING PER NFPA 13, 2010 ED., CBC 2010 AND UC BERKELEY FIRE MARSHAL REQUIREMENTS.
5) INSTALL NEW FIRE WATER SERVICE FROM EBMUD CHECK VALVE TO 6" ABOVE FINISH FLOOR PER NFPA 24 2010 EDITION.

OUT OF SCOPE WORK

1) THE PREPARATION, PRIMING, PROTECTION OR PAINTING OF SPRINKLER SYSTEM COMPONENTS.
2) WIRING OF ANY KIND TO SPRINKLER SYSTEM SUPERVISORY DEVICES.
3) ELECTRICAL POWER OF ANY KIND TO SPRINKLER SYSTEM SUPERVISORY DEVICES.

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STAMP

CONSULTANTS

LICENSED FIRE PROTECTION CONTRACTOR — COSCO FIRE PROTECTION INC. — CLASSIFICATION C-16 — LICENSE NO. 577621 — LOS ANGELES — STATE OF CALIFORNIA

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14

COSCO Fire Protection
FIRE PROTECTION AND LIFE SAFETY SPECIALISTS
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LIC. # 577621
SAN DIEGO • LOS ANGELES • FRESNO • SAN FRANCISCO • SACRAMENTO • PORTLAND • SEATTLE • ANCHORAGE

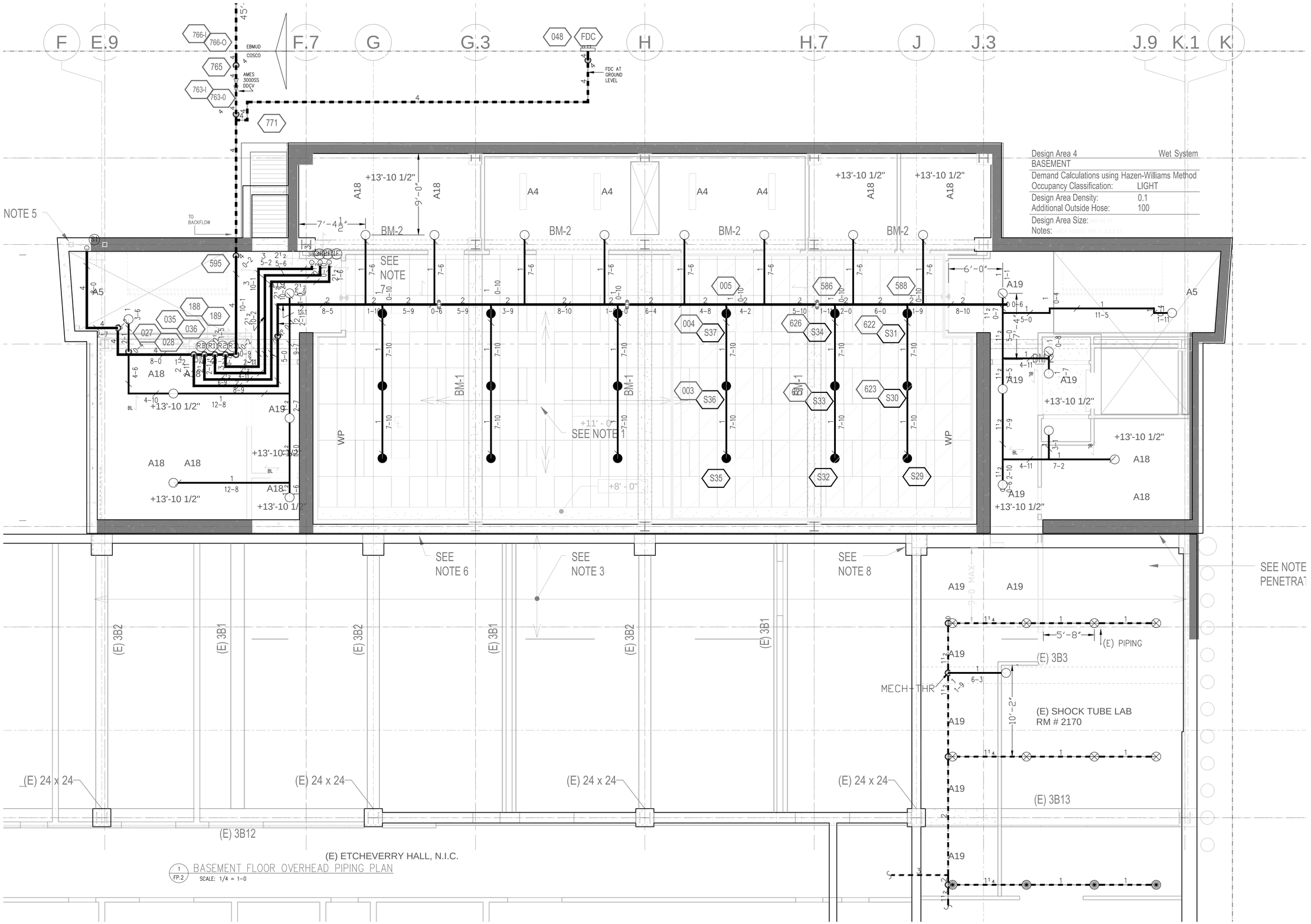
DATE : 15 AUGUST, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : 100% CD
PERMIT No :
SCALE :

SHEET TITLE

FIRE PROTECTION COVER SHEET

SHEET No

FP.1



1 FP.2 BASEMENT FLOOR OVERHEAD PIPING PLAN
SCALE: 1/4 = 1-0

Design Area 4	Wet System
BASEMENT	
Demand Calculations using Hazen-Williams Method	
Occupancy Classification:	LIGHT
Design Area Density:	0.1
Additional Outside Hose:	100
Design Area Size:	
Notes:	

SYM	CNT	POSITION	FINISH	TEMP	K	NPT	SIN	MFG.	MODEL#	ESCH.	NOTES
○	53	UPR	BRASS	200	5.60	1/2"	VK100	VIKING	VK300	SSU	MAX 22" BDD
●	68	PEND	CHROME	155	5.60	1/2"	TY3504	Tyco	RFLL	CONC WHT	
◉	112	PEND	CHROME	155	5.60	1/2"	VK302	VIKING	VK302	N/A	
✺	4	PEND	CHROME	155	5.60	1/2"	VK302	VIKING	VK302	N/A	MAX 22" BDD
⊗	8	UPR	BRASS	155	5.60	1/2"	VK100	VIKING	VK300	N/A	

SPRINKLER LEDGEND

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LICENSE NO. 577621
LOS ANGELES
STATE OF CALIFORNIA

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

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	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14

DATE : 15 AUGUST, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : 100% CD
PERMIT No :
SCALE : 1/4" = 1-0

SHEET TITLE
BASEMENT FLOOR PIPING

SHEET No
FP.2

COSCO Fire Protection
FIRE PROTECTION AND LIFE SAFETY SPECIALISTS
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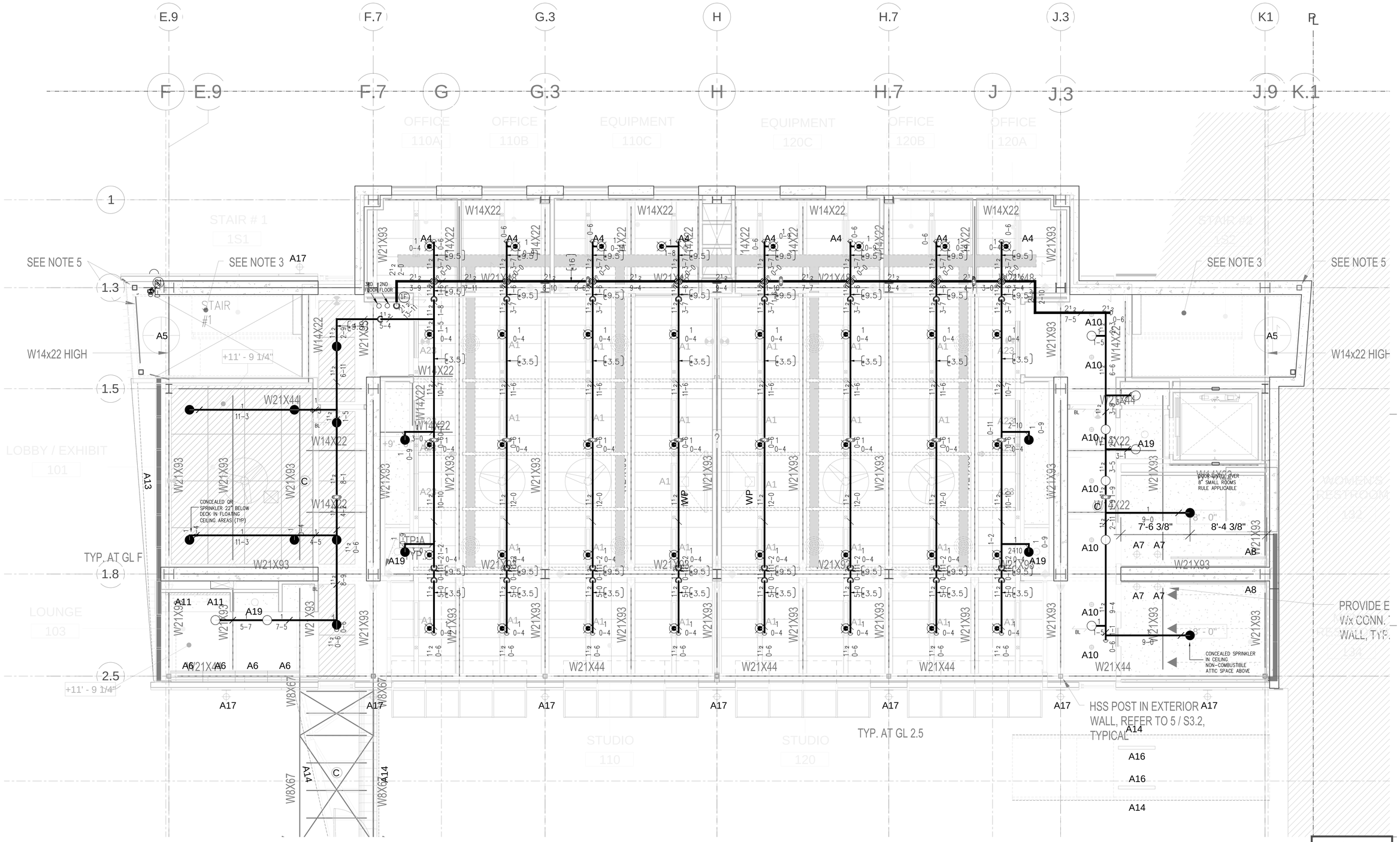

1 FP.3 1ST FLOOR OVERHEAD PIPING PLAN
SCALE: 1/4 = 1-0

SYM	CNT	POSITION	FINISH	TEMP	K	NPT	SIN	MFG.	MODEL#	ESCH.	NOTES
○	53	UPR	BRASS	200	5.60	1/2"	VK100	VIKING	VK300	SSU	MAX 22" BOD
●	68	PEND	CHROME	155	5.60	1/2"	TY3504	Tyco	RFLL	CONC WHT	
⊙	112	PEND	CHROME	155	5.60	1/2"	VK302	VIKING	VK302	N/A	
✺	4	PEND	CHROME	155	5.60	1/2"	VK302	VIKING	VK302	N/A	MAX 22" BOD
⊗	8	UPR	BRASS	155	5.60	1/2"	VK100	VIKING	VK300	N/A	

SPRINKLER LEDGEND

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CLASSIFICATION C-16
LICENSE NO. 577621
LOS ANGELES
STATE OF CALIFORNIA

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
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	CM / Contractor RFP	03/31/14

DATE : 15 AUGUST, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : 100% CD
PERMIT No :
SCALE : 1/4" = 1'-0"

SHEET TITLE
1ST FLOOR PIPING

SHEET No
FP.3

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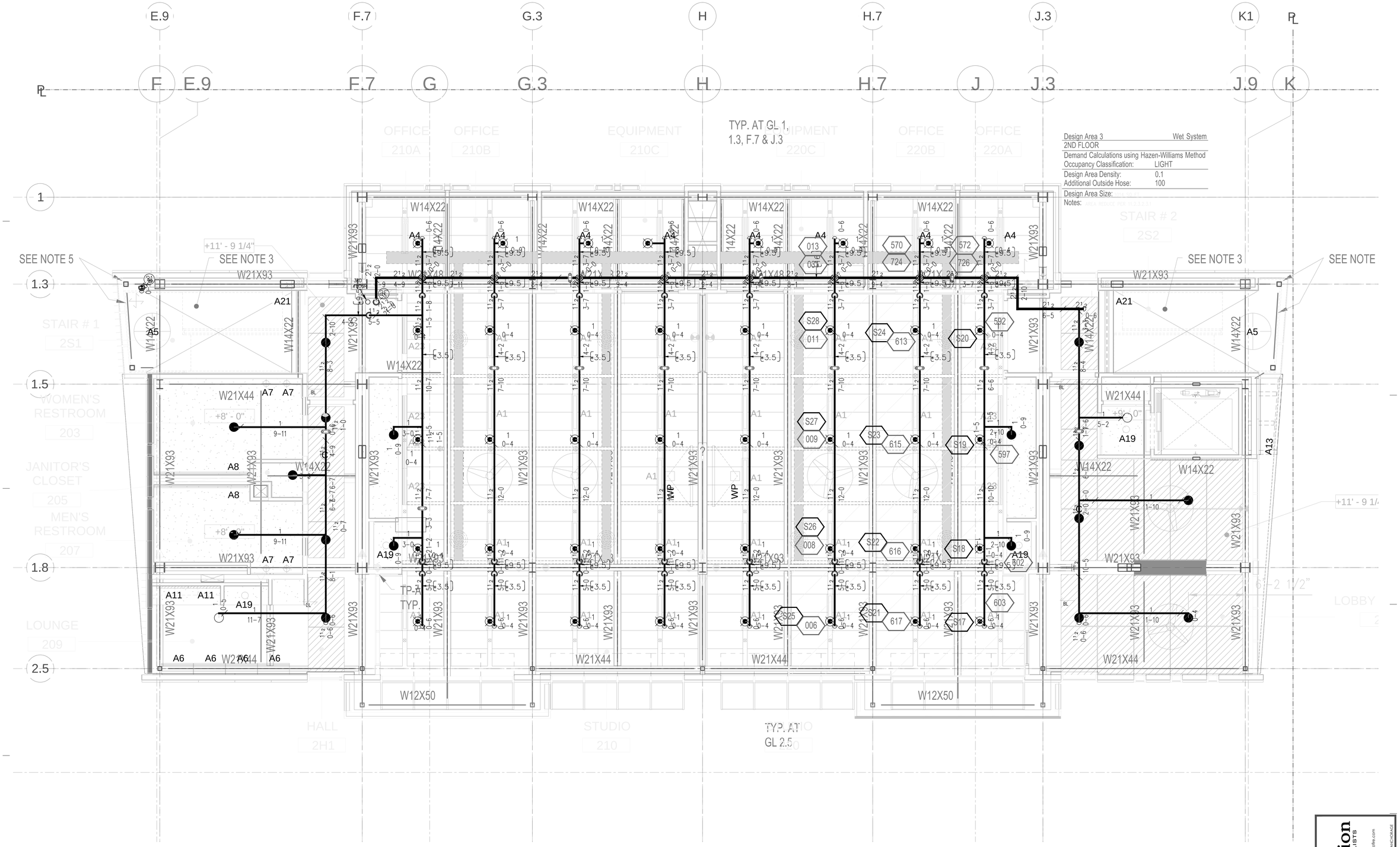

1 FP.4 2ND FLOOR OVERHEAD PIPING PLAN
SCALE: 1/4 = 1-0

SYM	CNT	POSITION	FINISH	TEMP	K	NPT	SIN	MFG.	MODEL#	ESCH.	NOTES
○	53	UPR	BRASS	200	5.60	1/2"	VK100	VIKING	VK300	SSU	MAX 22" BOD
●	68	PEND	CHROME	155	5.60	1/2"	TY3504	Tyco	RFLL	CONC WHT	
◉	112	PEND	CHROME	155	5.60	1/2"	VK302	VIKING	VIK302	N/A	
✺	4	PEND	CHROME	155	5.60	1/2"	VK302	VIKING	VIK302	N/A	MAX 22" BOD
⊗	8	UPR	BRASS	155	5.60	1/2"	VK100	VIKING	VK300	N/A	

SPRINKLER LEDGEND

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COSCO FIRE PROTECTION, INC. LICENSED FIRE PROTECTION CONTRACTOR CLASSIFICATION C-16 LICENSE NO. 577621 LOS ANGELES STATE OF CALIFORNIA

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14

DATE : 15 AUGUST, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : 100% CD
PERMIT No :
SCALE : 1/4 = 1-0

SHEET TITLE
2ND FLOOR PIPING

SHEET No
FP.4

COSCO Fire Protection
FIRE PROTECTION AND LIFE SAFETY SPECIALISTS
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7455 Longard Road
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www.coscofire.com
California C-16
LIC. # 577621
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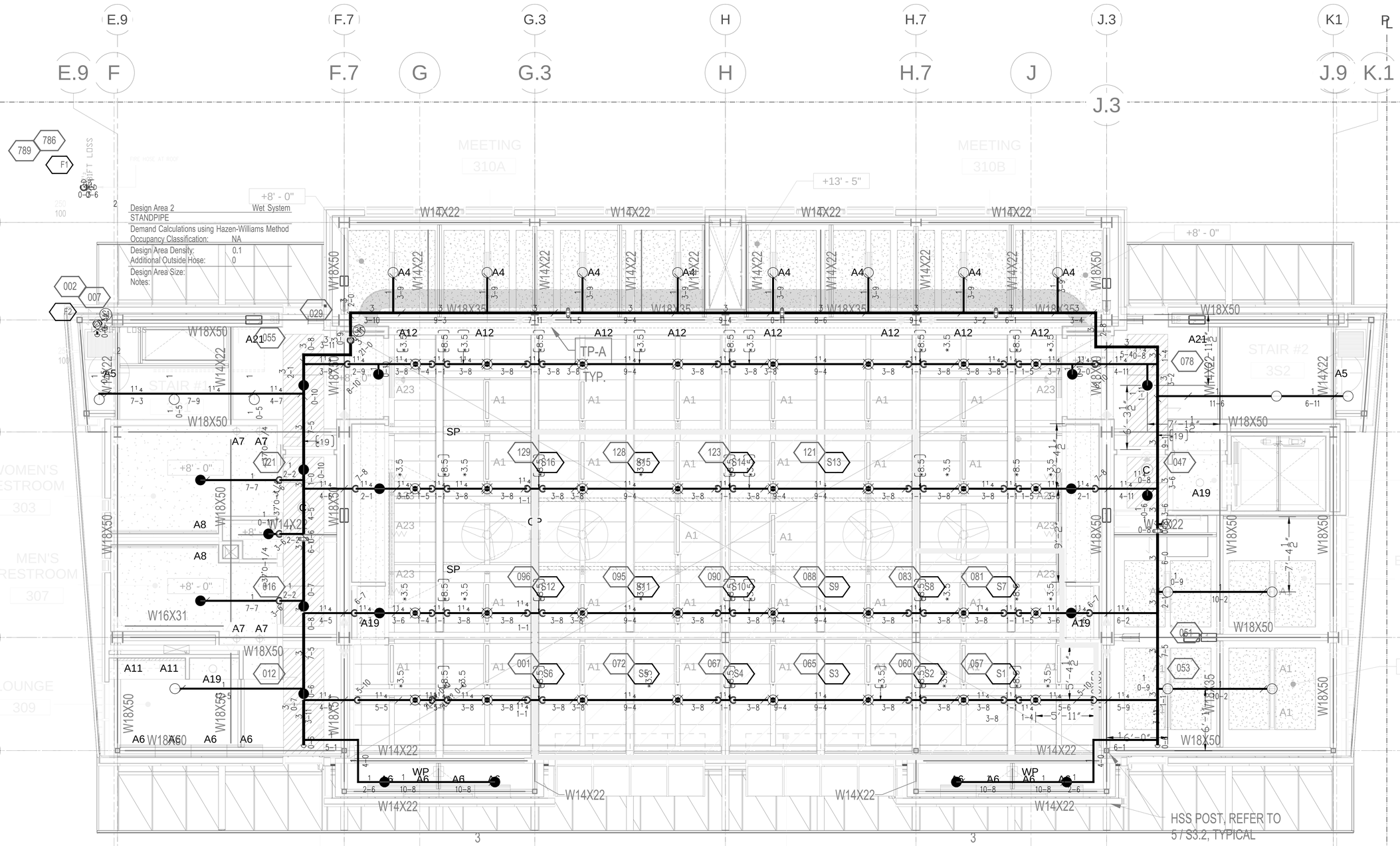

1 FP.5 3RD FLOOR OVERHEAD PIPING PLAN
SCALE: 1/4 = 1-0

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CONSULTANTS

LICENSED FIRE PROTECTION CONTRACTOR COSCO FIRE PROTECTION INC CLASSIFICATION C-16 LICENSE NO. 577621 LOS ANGELES STATE OF CALIFORNIA

PROJECT

JACOBS HALL
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SHEET TITLE
3RD FLOOR OVERHEAD PIPING

SHEET No
FP.5

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Tol-Brace Seismic Calculations

Project Address: JACOBS HALL, LEROY AVE/ RIDGE ROAD, BERKELEY, CA — Job # 577624

COSCO FIRE PROTECTION
7455 LONGARD ROAD
LIVERMORE, CA 94551
925-455-2751
577624

COOPER B-Line | TOLCO

Calculations based on 2010 NFPA Pamphlet #13

Brace Information

Maximum Spacing	40' 0" (12.19 m)
Maximum Brace Length	7' 0" (2.13 m)
Bracing Material	1" Sch.40
Angle from Vertical	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)
Force Factor (Cp)	0.9405

Fastener Information

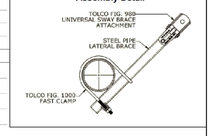
Fastener Orientation	NFPA Type H
Maximum Load	1630 lbs (830 kg)
Diameter	1/2in. (12 mm)
Length	N/A
Type	Bolt

Tolco Brace Components

Tolco Component Fig. Number	Adjusted Load
Fig.1000 Clamp	1425 lbs (646 kg)
Fig.980 Universal Swivel	1955 lbs (887 kg)

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for Tolco components only. Use of any other components voids these calculations and the listing of the assembly.

Assembly Detail



Brace Identification on Plans	3" LATERAL
Orientation of Brace	Lateral

Load Information

Braced Pipe: 3" Sch.40 Steel Pipe

Size and Type of Pipe	Total Length	Total Calculated Load
3" Sch.40 Steel Pipe (76.2 mm)	40ft (12.2 m)	407 lbs (185 kg)
Percentage added for Fittings and Sprinklers	15%	61 lbs (27.47 kg)
Total Adjusted Load of all pipe within Zone of Influence		468 lbs (212 kg)

(Tol-Brace Version 7)

Tol-Brace Seismic Calculations

Project Address: JACOBS HALL, LEROY AVE/ RIDGE ROAD, BERKELEY, CA — Job # 577624

COSCO FIRE PROTECTION
7455 LONGARD ROAD
LIVERMORE, CA 94551
925-455-2751
577624

COOPER B-Line | TOLCO

Calculations based on 2010 NFPA Pamphlet #13

Brace Information

Maximum Spacing	40' 0" (12.19 m)
Maximum Brace Length	7' 0" (2.13 m)
Bracing Material	1" Sch.40
Angle from Vertical	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)
Force Factor (Cp)	0.9405

Fastener Information

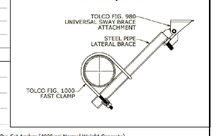
Fastener Orientation	NFPA Type B
Maximum Load	1500 lbs (680 kg)
Diameter	1/2in.
Length	3-1/2in.
Type	TOLCO Fig 109AF 1/2in. x 3-1/2in. Pre-Set Anchor (4000 psi Normal Weight Concrete)

Tolco Brace Components

Tolco Component Fig. Number	Adjusted Load
Fig.1000 Clamp	1425 lbs (646 kg)
Fig. 980 Universal Swivel (OSHPD)	1424 lbs (646 kg)

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for Tolco components only. Use of any other components voids these calculations and the listing of the assembly.

Assembly Detail



Brace Identification on Plans	4" LATERAL CONCRETE
Orientation of Brace	Lateral

Load Information

Braced Pipe: 4" Sch.40 Steel Pipe

Size and Type of Pipe	Total Length	Total Calculated Load
4" Sch.40 Steel Pipe (101.6 mm)	40ft (12.2 m)	617 lbs (280 kg)
3.5" Sch.40 Steel Pipe (88.1 mm)	60ft (18.3 m)	221 lbs (100 kg)
Percentage added for Fittings and Sprinklers	15%	126 lbs (57.15 kg)
Total Adjusted Load of all pipe within Zone of Influence		963 lbs (437 kg)

(Tol-Brace Version 7)

Tol-Brace Seismic Calculations

Project Address: JACOBS HALL, LEROY AVE/ RIDGE ROAD, BERKELEY, CA — Job # 577624

COSCO FIRE PROTECTION
7455 LONGARD ROAD
LIVERMORE, CA 94551
925-455-2751
577624

COOPER B-Line | TOLCO

Calculations based on 2010 NFPA Pamphlet #13

Brace Information

Maximum Spacing	60' 0" (18.29 m)
Maximum Brace Length	7' 0" (2.13 m)
Bracing Material	1" Sch.40
Angle from Vertical	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)
Force Factor (Cp)	0.9405

Fastener Information

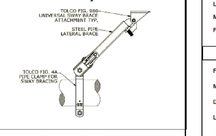
Fastener Orientation	NFPA Type B
Maximum Load	1500 lbs (680 kg)
Diameter	1/2in.
Length	3-1/2in.
Type	TOLCO Fig 109AF 1/2in. x 3-1/2in. Pre-Set Anchor (4000 psi Normal Weight Concrete)

Tolco Brace Components

Tolco Component Fig. Number	Adjusted Load
Fig.4A Clamp	1425 lbs (646 kg)
Fig.980 Universal Swivel	1955 lbs (887 kg)

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for Tolco components only. Use of any other components voids these calculations and the listing of the assembly.

Assembly Detail



Brace Identification on Plans	4" LONGITUDINAL CONCRETE
Orientation of Brace	Longitudinal

Load Information

Braced Pipe: 4" Sch.40 Steel Pipe

Size and Type of Pipe	Total Length	Total Calculated Load
4" Sch.40 Steel Pipe (101.6 mm)	60ft (18.3 m)	825 lbs (420 kg)
Percentage added for Fittings and Sprinklers	15%	130 lbs (63.05 kg)
Total Adjusted Load of all pipe within Zone of Influence		1064 lbs (483 kg)

(Tol-Brace Version 7)

Tol-Brace Seismic Calculations

Project Address: JACOBS HALL, LEROY AVE/ RIDGE ROAD, BERKELEY, CA — Job # 577624

COSCO FIRE PROTECTION
7455 LONGARD ROAD
LIVERMORE, CA 94551
925-455-2751
577624

COOPER B-Line | TOLCO

Calculations based on 2010 NFPA Pamphlet #13

Brace Information

Maximum Spacing	20' 0" (6.1 m)
Maximum Brace Length	7' 0" (2.13 m)
Bracing Material	1" Sch.40
Angle from Vertical	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)
Force Factor (Cp)	0.9405

Fastener Information

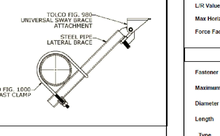
Fastener Orientation	NFPA Type B
Maximum Load	970 lbs (440 kg)
Diameter	1
Length	N/A
Type	FBG 828

Tolco Brace Components

Tolco Component Fig. Number	Adjusted Load
Fig.1000 Clamp	1425 lbs (646 kg)
Fig.980 Universal Swivel	1955 lbs (887 kg)

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for Tolco components only. Use of any other components voids these calculations and the listing of the assembly.

Assembly Detail



Brace Identification on Plans	4" LATERAL STEEL
Orientation of Brace	Lateral

Load Information

Braced Pipe: 4" Sch.40 Steel Pipe

Size and Type of Pipe	Total Length	Total Calculated Load
4" Sch.40 Steel Pipe (101.6 mm)	20ft (6.1 m)	308 lbs (140 kg)
3.5" Sch.40 Steel Pipe (88.1 mm)	60ft (18.3 m)	221 lbs (100 kg)
Percentage added for Fittings and Sprinklers	15%	79 lbs (35.83 kg)
Total Adjusted Load of all pipe within Zone of Influence		609 lbs (276 kg)

(Tol-Brace Version 7)

Tol-Brace Seismic Calculations

Project Address: JACOBS HALL, LEROY AVE/ RIDGE ROAD, BERKELEY, CA — Job # 577624

COSCO FIRE PROTECTION
7455 LONGARD ROAD
LIVERMORE, CA 94551
925-455-2751
577624

COOPER B-Line | TOLCO

Calculations based on 2010 NFPA Pamphlet #13

Brace Information

Maximum Spacing	40' 0" (12.19 m)
Maximum Brace Length	7' 0" (2.13 m)
Bracing Material	1" Sch.40
Angle from Vertical	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)
Force Factor (Cp)	0.9405

Fastener Information

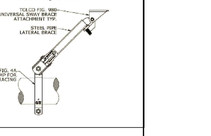
Fastener Orientation	NFPA Type B
Maximum Load	1220 lbs (553 kg)
Diameter	1/2in.
Length	N/A
Type	Bolt

Tolco Brace Components

Tolco Component Fig. Number	Adjusted Load
Fig.4A Clamp	1425 lbs (646 kg)
Fig.980 Universal Swivel	1955 lbs (887 kg)

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for Tolco components only. Use of any other components voids these calculations and the listing of the assembly.

Assembly Detail



Brace Identification on Plans	4" LONGITUDINAL STEEL
Orientation of Brace	Longitudinal

Load Information

Braced Pipe: 4" Sch.40 Steel Pipe

Size and Type of Pipe	Total Length	Total Calculated Load
4" Sch.40 Steel Pipe (101.6 mm)	60ft (18.3 m)	825 lbs (420 kg)
Percentage added for Fittings and Sprinklers	15%	126 lbs (63.05 kg)
Total Adjusted Load of all pipe within Zone of Influence		1064 lbs (483 kg)

(Tol-Brace Version 7)

Tol-Brace Seismic Calculations

Project Address: JACOBS HALL, LEROY AVE/ RIDGE ROAD, BERKELEY, CA — Job # 577624

COSCO FIRE PROTECTION
7455 LONGARD ROAD
LIVERMORE, CA 94551
925-455-2751
577624

COOPER B-Line | TOLCO

Calculations based on 2010 NFPA Pamphlet #13

Brace Information

Maximum Spacing	40' 0" (12.19 m)
Maximum Brace Length	7' 0" (2.13 m)
Bracing Material	1" Sch.40
Angle from Vertical	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)
Force Factor (Cp)	0.9405

Fastener Information

Fastener Orientation	NFPA Type B
Maximum Load	1630 lbs (830 kg)
Diameter	1/2in. (12 mm)
Length	N/A
Type	Bolt

Tolco Brace Components

Tolco Component Fig. Number	Adjusted Load
Fig.1000 Clamp	1425 lbs (646 kg)
Fig. 980 Universal Swivel (OSHPD)	1424 lbs (646 kg)

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for Tolco components only. Use of any other components voids these calculations and the listing of the assembly.

Assembly Detail

Brace Identification on Plans	4" LATERAL
Orientation of Brace	Lateral

Load Information

Braced Pipe: 4" Sch.40 Steel Pipe

Size and Type of Pipe	Total Length	Total Calculated Load
4" Sch.40 Steel Pipe (101.6 mm)	40ft (12.2 m)	617 lbs (280 kg)
Percentage added for Fittings and Sprinklers	15%	93 lbs (42.18 kg)
Total Adjusted Load of all pipe within Zone of Influence		710 lbs (322 kg)

(Tol-Brace Version 7)

Tol-Brace Seismic Calculations

Project Address: JACOBS HALL, LEROY AVE/ RIDGE ROAD, BERKELEY, CA — Job # 577624

COSCO FIRE PROTECTION
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LIVERMORE, CA 94551
925-455-2751
577624

COOPER B-Line | TOLCO

Calculations based on 2010 NFPA Pamphlet #13

Brace Information

Maximum Spacing	40' 0" (12.19 m)
Maximum Brace Length	7' 0" (2.13 m)
Bracing Material	1" Sch.40
Angle from Vertical	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)
Force Factor (Cp)	0.9405

Fastener Information

Fastener Orientation	NFPA Type B
Maximum Load	2050 lbs (930 kg)
Diameter	1/2in. (12 mm)
Length	N/A
Type	Bolt

Tolco Brace Components

Tolco Component Fig. Number	Adjusted Load
Fig.4A Clamp	1425 lbs (646 kg)
Fig.980 Universal Swivel	1955 lbs (887 kg)

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for Tolco components only. Use of any other components voids these calculations and the listing of the assembly.

Assembly Detail

Brace Identification on Plans	4" LONGITUDINAL
Orientation of Brace	Longitudinal

Load Information

Braced Pipe: 4" Sch.40 Steel Pipe

Size and Type of Pipe	Total Length	Total Calculated Load
4" Sch.40 Steel Pipe (101.6 mm)	40ft (12.2 m)	617 lbs (280 kg)
Percentage added for Fittings and Sprinklers	15%	93 lbs (42.18 kg)
Total Adjusted Load of all pipe within Zone of Influence		710 lbs (322 kg)

(Tol-Brace Version 7)

Tol-Brace Seismic Calculations

Project Address: JACOBS HALL, LEROY AVE/ RIDGE ROAD, BERKELEY, CA — Job # 577624

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577624

COOPER B-Line | TOLCO

Calculations based on 2010 NFPA Pamphlet #13

Brace Information

Maximum Spacing	40' 0" (12.19 m)
Maximum Brace Length	7' 0" (2.13 m)
Bracing Material	1" Sch.40
Angle from Vertical	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)
Force Factor (Cp)	0.9405

Fastener Information

Fastener Orientation	NFPA Type E
Maximum Load	2050 lbs (930 kg)
Diameter	1/2in. (12 mm)
Length	N/A
Type	Bolt

Tolco Brace Components

Tolco Component Fig. Number	Adjusted Load
Fig.4A Clamp	1425 lbs (646 kg)
Fig.980 Universal Swivel	1955 lbs (887 kg)

*Calculation Based on CONCENTRIC Loading
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Assembly Detail

Brace Identification on Plans	3" LONGITUDINAL
Orientation of Brace	Longitudinal

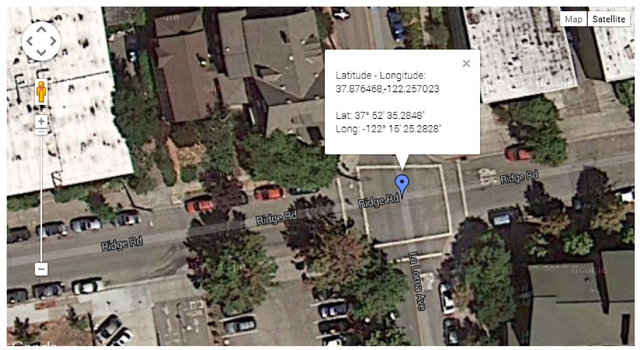
Load Information

Braced Pipe: 4" Sch.40 Steel Pipe

Size and Type of Pipe	Total Length	Total Calculated Load
4" Sch.40 Steel Pipe (101.6 mm)	40ft (12.2 m)	617 lbs (280 kg)
Percentage added for Fittings and Sprinklers	15%	93 lbs (42.18 kg)
Total Adjusted Load of all pipe within Zone of Influence		710 lbs (322 kg)

(Tol-Brace Version 7)

Latitude and Longitude of a Point




```
Conterminous 48 States
2003 NEHRP Seismic Design Provisions
Latitude = 37.876468
Longitude = -122.25702300000002
Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B -  Fa = 1.0 ,Fv = 1.0
Data are based on a 0.01 deg grid spacing
  Period    Sa
  (sec)     (g)
   0.2     2.021 (Ss, Site Class B)
   1.0     0.790 (S1, Site Class B)
```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LOS ANGELES

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SCALE :

SHEET TITLE
EQB CALCULATIONS

SHEET No
FP.6

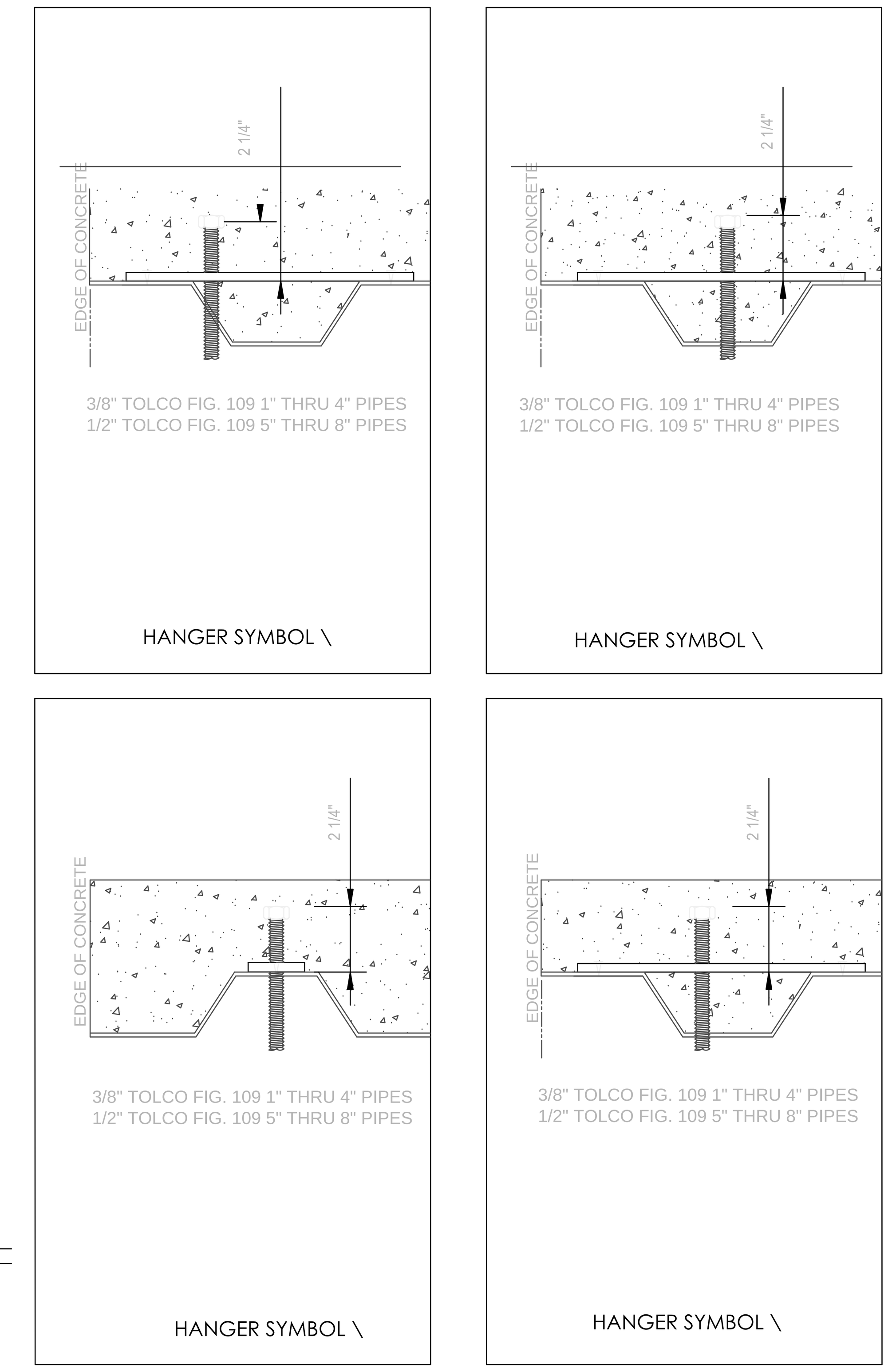
GRAVITY HANGER LOAD CALCULATIONS

PIPE SIZE	WEIGHT OF PIPE WATER FILLED PIPE PER FOOT	Fp FOR ALL LEVELS = .25 (Fv)	HANGER SPACING	WEIGHT OF WATER FILL PIPE x HANGER SPACING x Fv	(WEIGHT OF WATER FILL PIPE x HANGER SPACING x Fv) + (WEIGHT OF WATER FILLED PIPE x HANGER SPACING)	MAXIMUM TESION LOAD FOR THE HILTI KB-TZ 3/8" AND 1/2"	MAXIMUM TENSION LOAD FOR THE TOLCO 109A 3/8" AND 1/2"
1" SCH 40	2.05	.25	12'-0"	6.15	30.75	709 lb	572 lb
1¼" SCH 40	2.93	.25	12'-0"	8.79	43.95	709 lb	572 lb
1½" SCH 10	3.04	.25	15'-0"	11.4	57.0	709 lb	572 lb
2" SCH 10	4.22	.25	15'-0"	15.825	79.125	709 lb	572 lb
2½" SCH 10	5.89	.25	15'-0"	22.08	110.43	709 lb	572 lb
3" SCH 10	7.94	.25	15'-0"	29.775	148.875	709 lb	572 lb
4" SCH 10	11.78	.25	15'-0"	44.175	220.875	709 lb	572 lb
6" SCH 10	23.03	.25	15'-0"	86.36	431.81	709 lb	579 lb

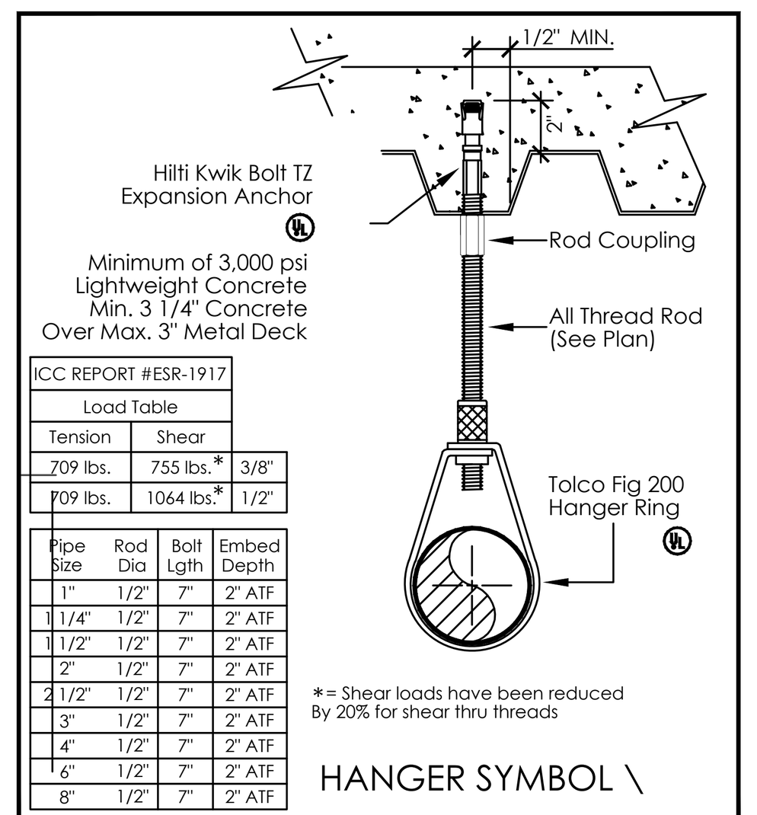
SCHEDULE 40 PIPE PER FOOT

PIPE SIZE	GALLONS OF WATER	WEIGHT OF WATER FILLED
1"	0.045	2.05
1 1/4"	0.078	2.93
1 1/2"	0.106	3.61
2"	0.174	5.13
2 1/2"	0.248	7.89
3"	0.383	10.82
4"	0.660	16.40
6"	1.502	31.69
8"	2.660	47.70

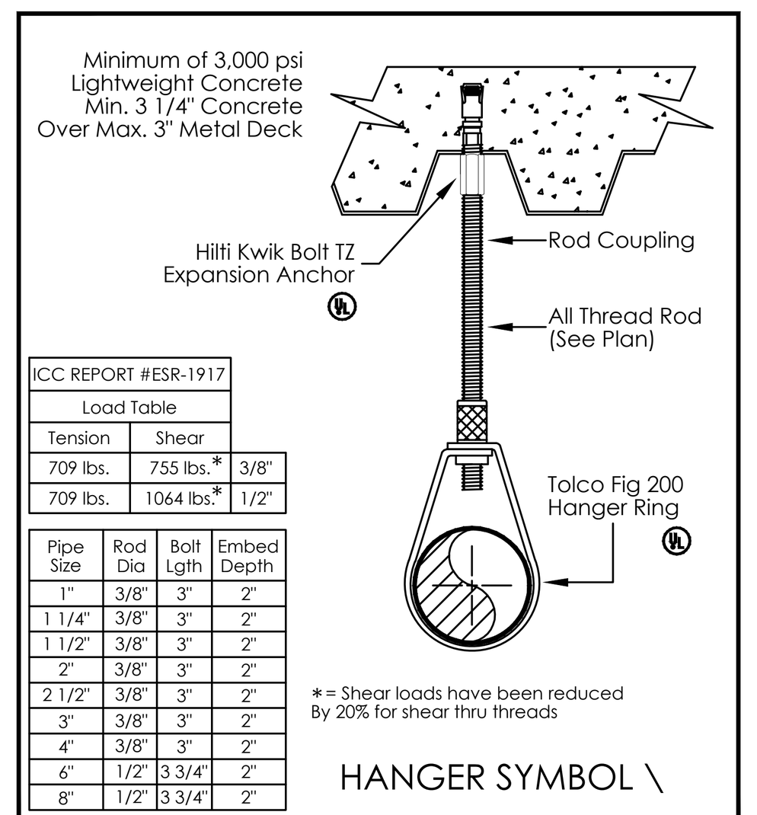
COSCO Fire Protection | PIPING WEIGHTS



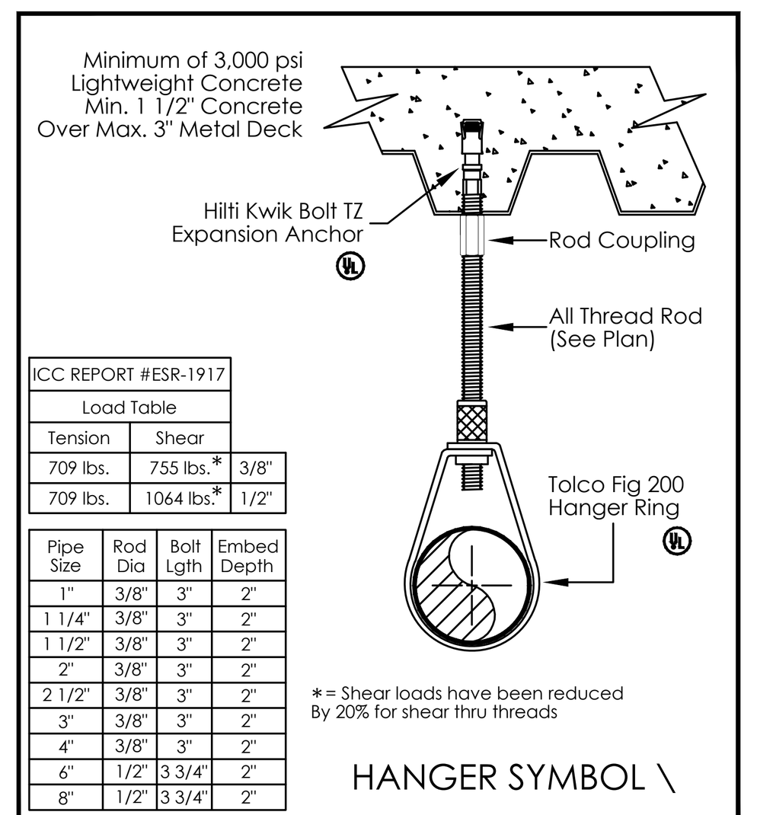
TOLCO FIG. 109A CONCRETE DECK INSERT IN 3,000 PSI LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)



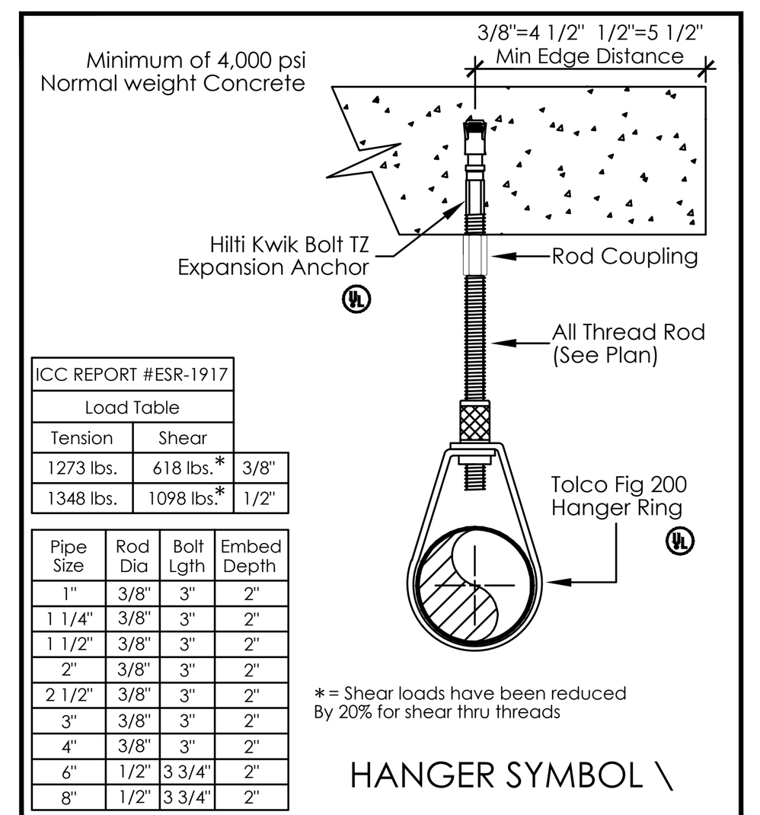
COSCO Fire Protection | STANDARD HANGER | #13A



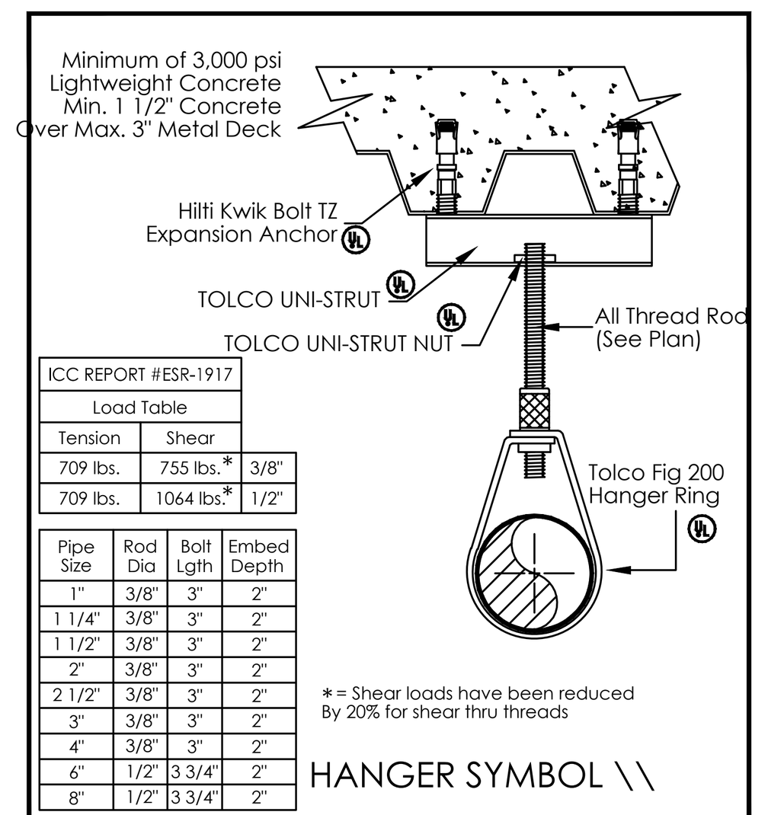
COSCO Fire Protection | STANDARD HANGER | #13B



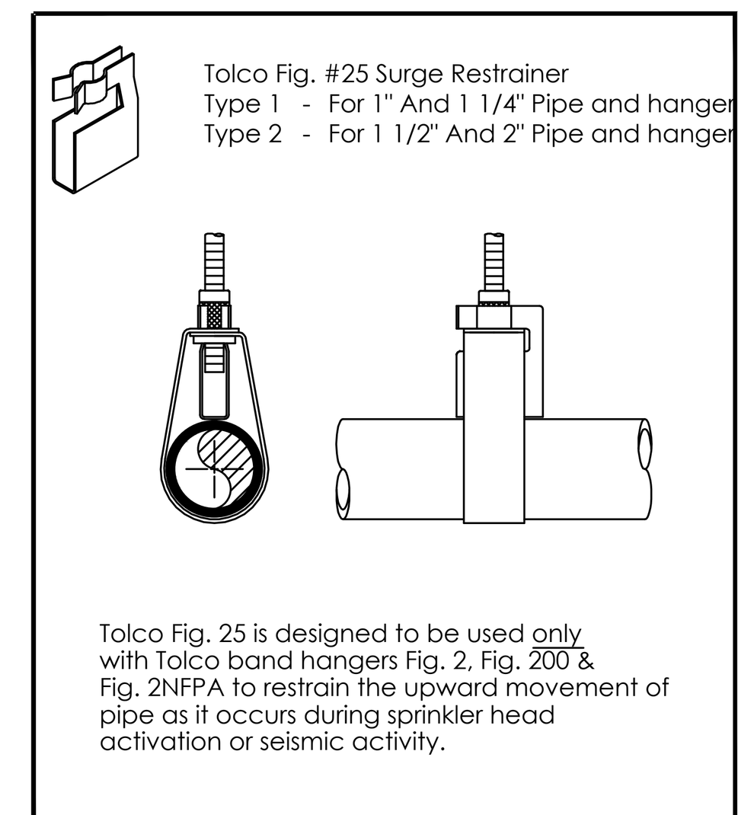
COSCO Fire Protection | STANDARD HANGER | #13C



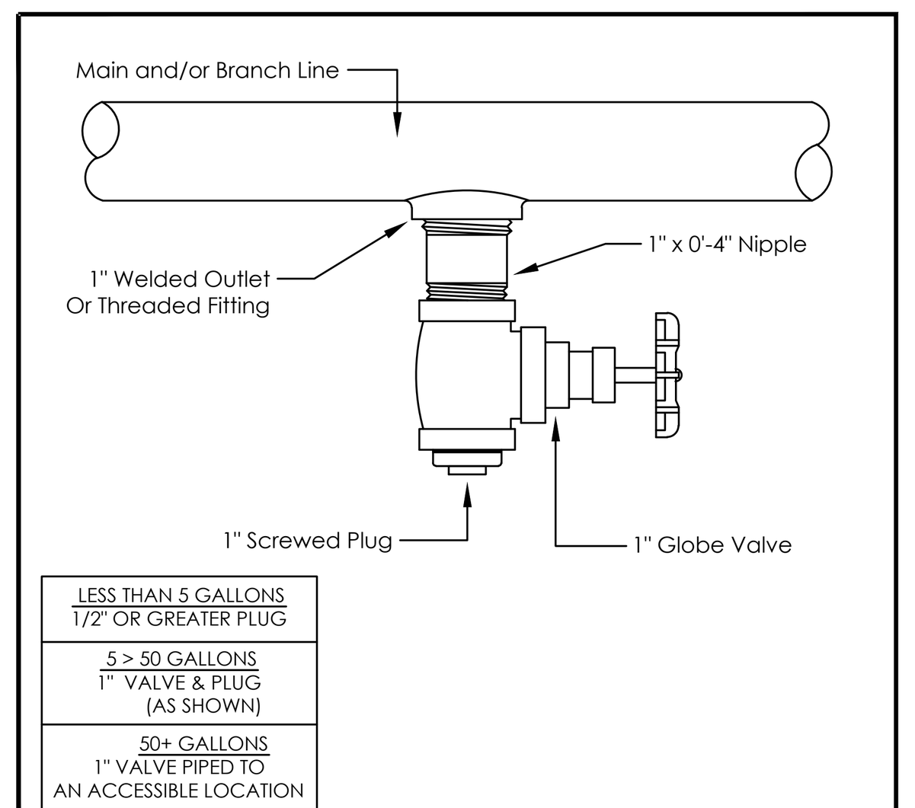
COSCO Fire Protection | STANDARD HANGER | #13D



COSCO Fire Protection | TRAPEZE HANGER | #13E



COSCO Fire Protection | FIG. 25 SURGE RESTRAINER

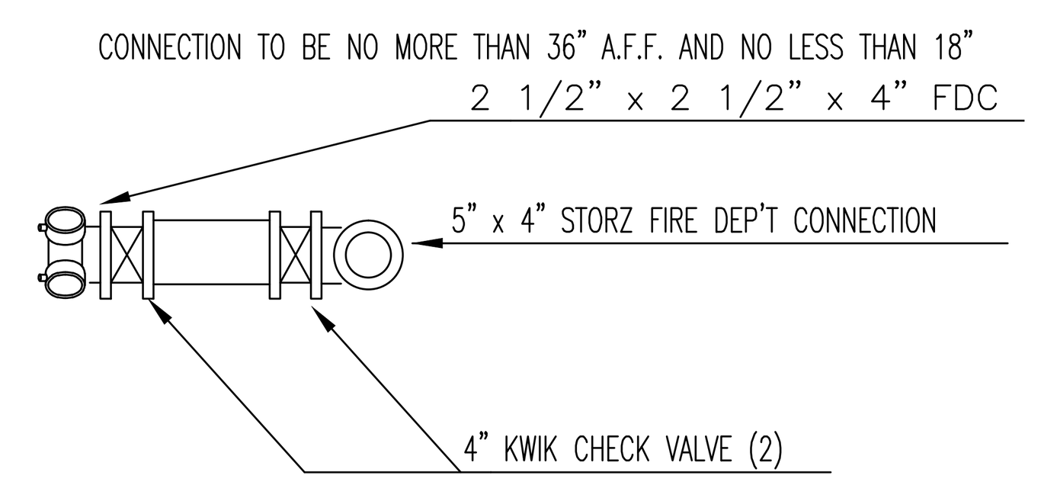


COSCO Fire Protection | AUX. DRAIN CONNECTION

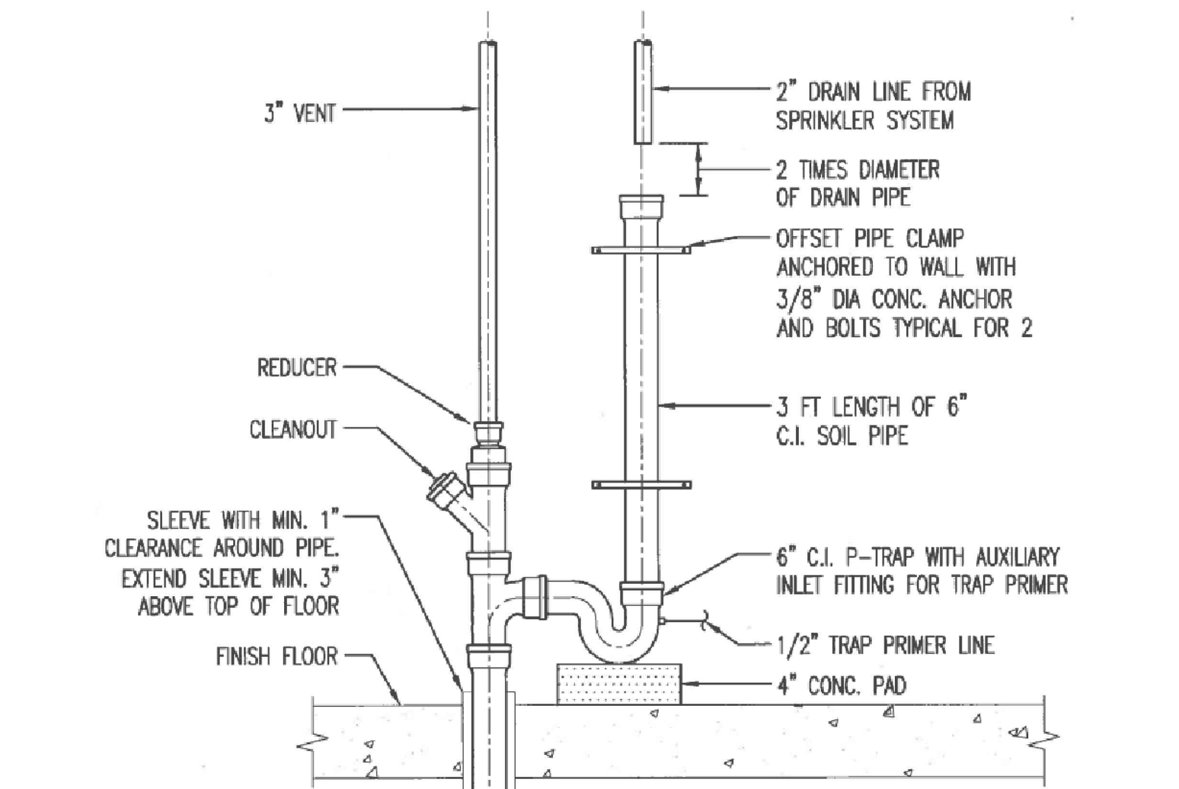
HANGER & SEISMIC NOTES:

1. WHERE PURLINS OR BEAMS DO NOT PROVIDE AN ADEQUATE LIP TO BE SECURED BY A RETAINING STRAP, THE STRAP SHALL BE THROUGH BOLTED OR SECURED BY A SELF TAPPING SCREW.
2. POWER DRIVEN FASTENING SHALL NOT BE USED TO ATTACH HANGERS & BRACES TO THE BUILDING STRUCTURE.
3. WHERE PIPE IS USED FOR SWAY BRACING, IT SHALL HAVE A WALL THICKNESS OF NOT LESS THAN SCHEDULE 40.
4. REFER TO SEISMIC DRAWINGS & STRUCTURAL CALCULATION ON FP.6 FOR HANGER & SEISMIC ATTACHMENTS TO STRUCTURE.

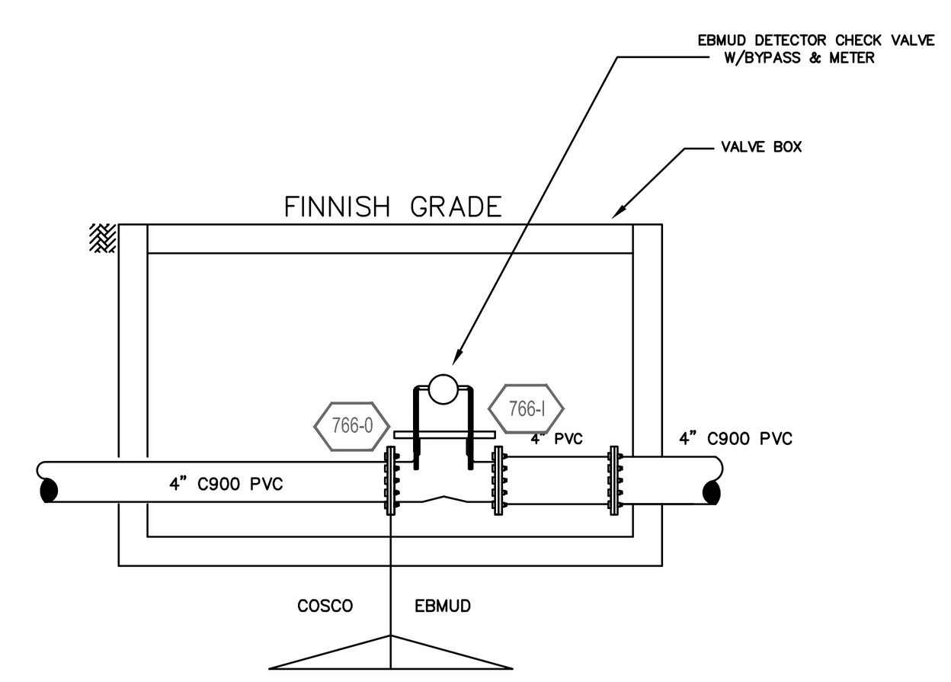
ALL THREAD ROD SIZING	
PIPE SIZE	
1" THROUGH 4"	3/8"
6"	1/2"



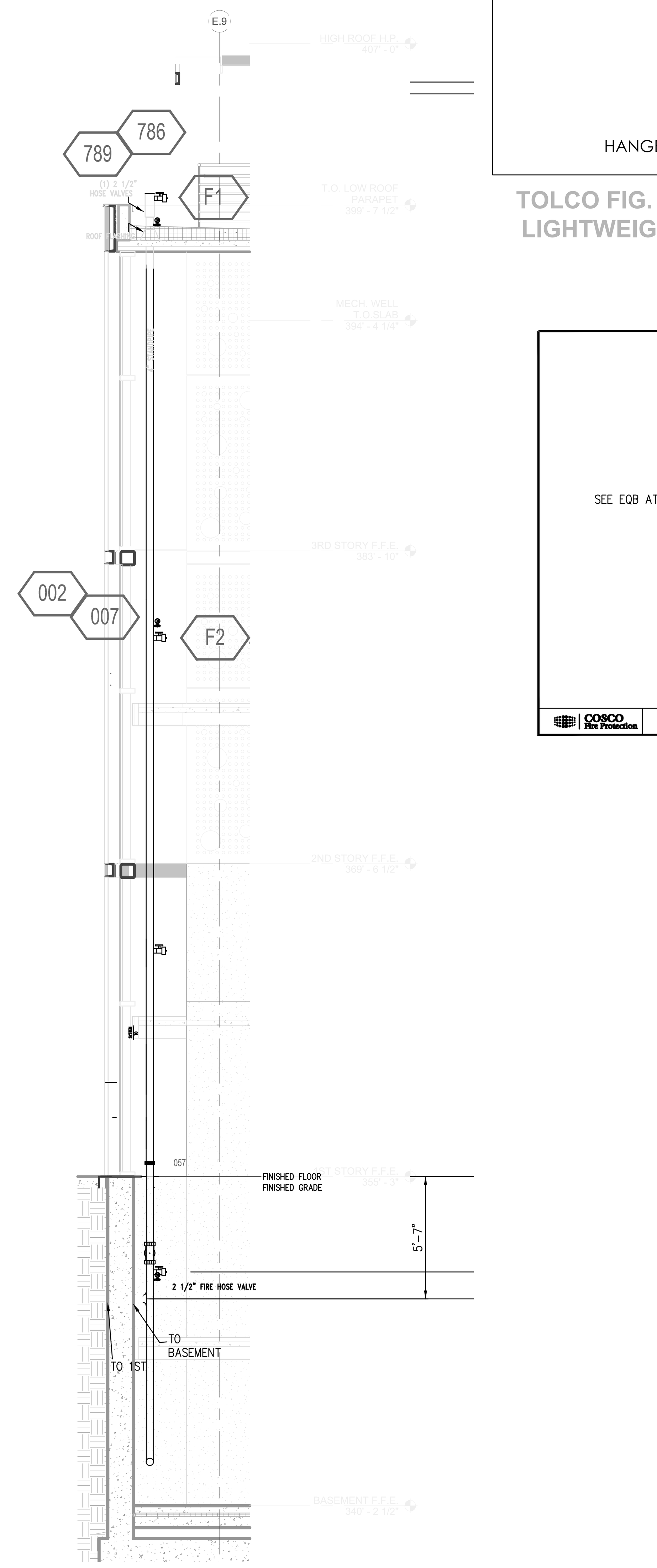
5 / FP.7 FDC CONNECTION
SCALE: NTS



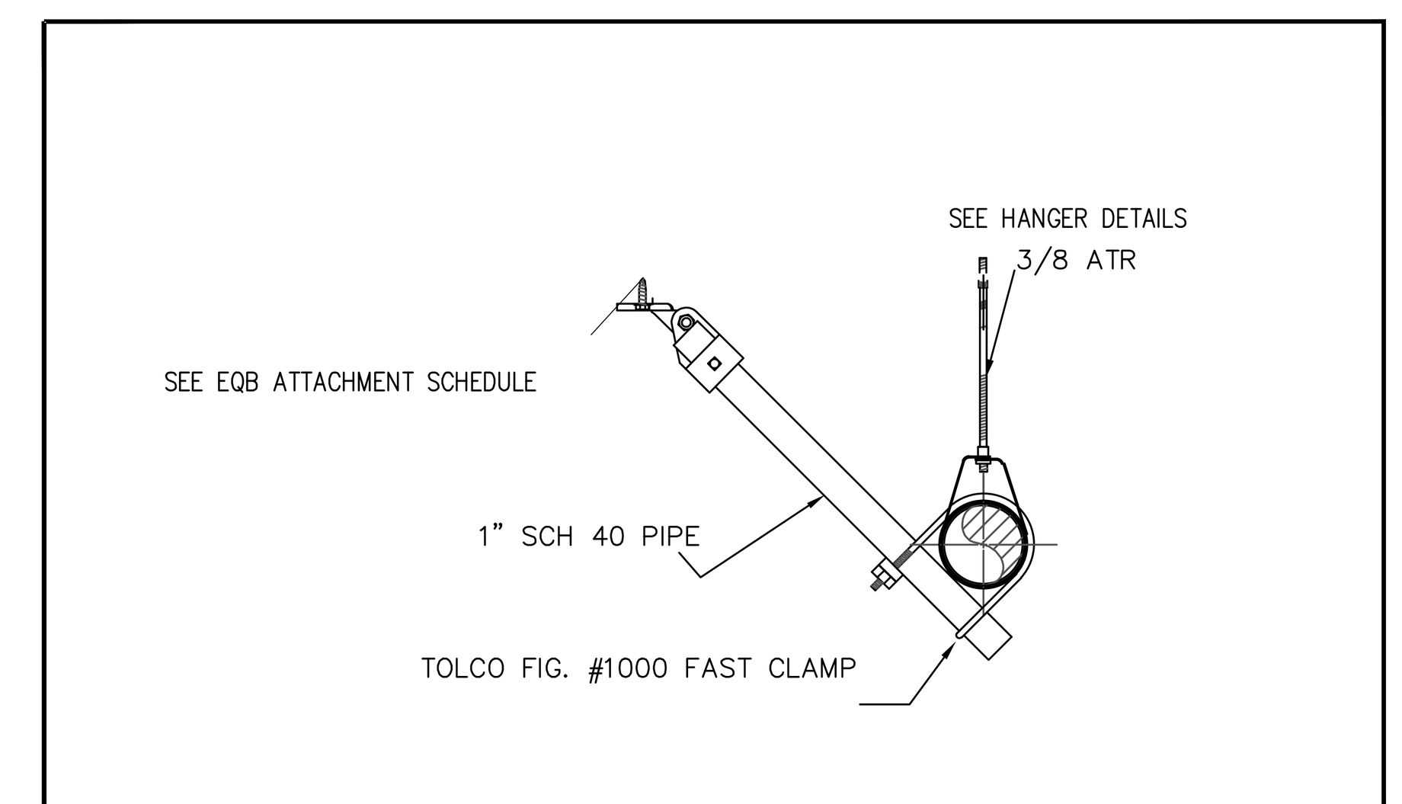
6 / FP.7 HUB DRAIN DETAIL FOR RISER DRAINAGE
(INSTALLED BY OTHERS)



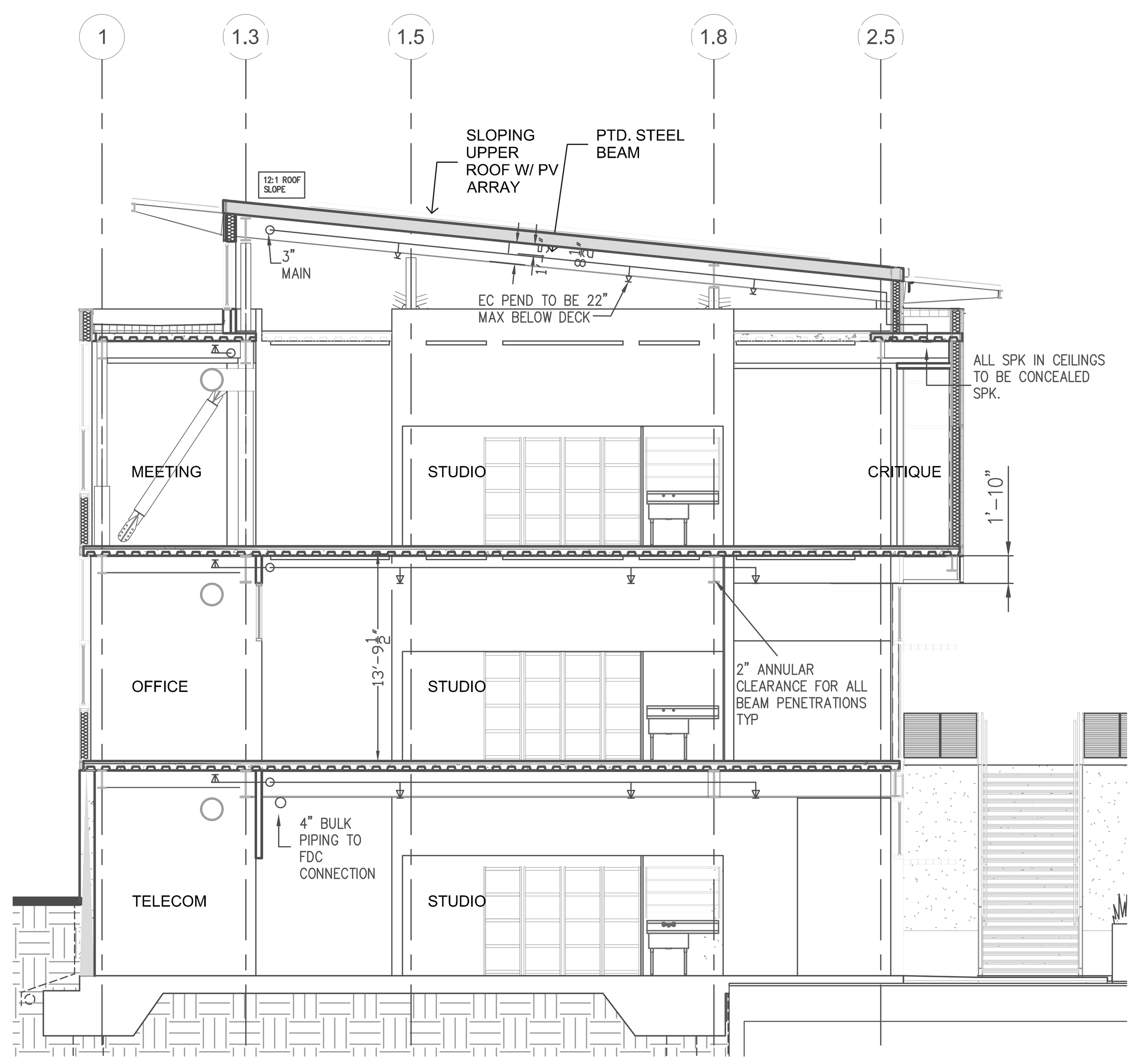
4 / FP.7 EBMUD DCV (HYDRAULIC REFERENCE ONLY)
SCALE: 1/8 = 1-0



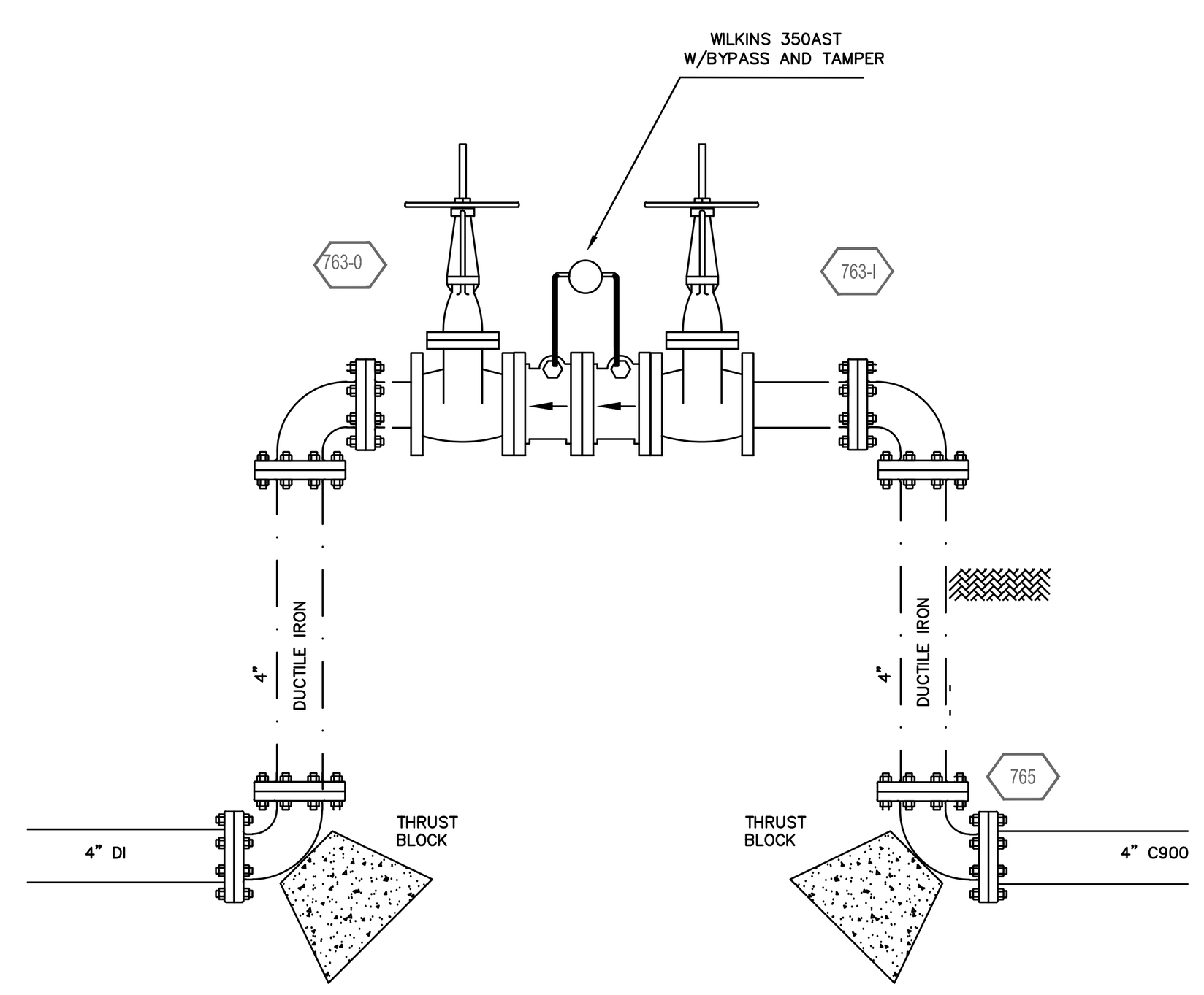
6 / FP.7 STANDPIPE RISER AND FLOOR CONTROL DETAILS
SCALE: NTS



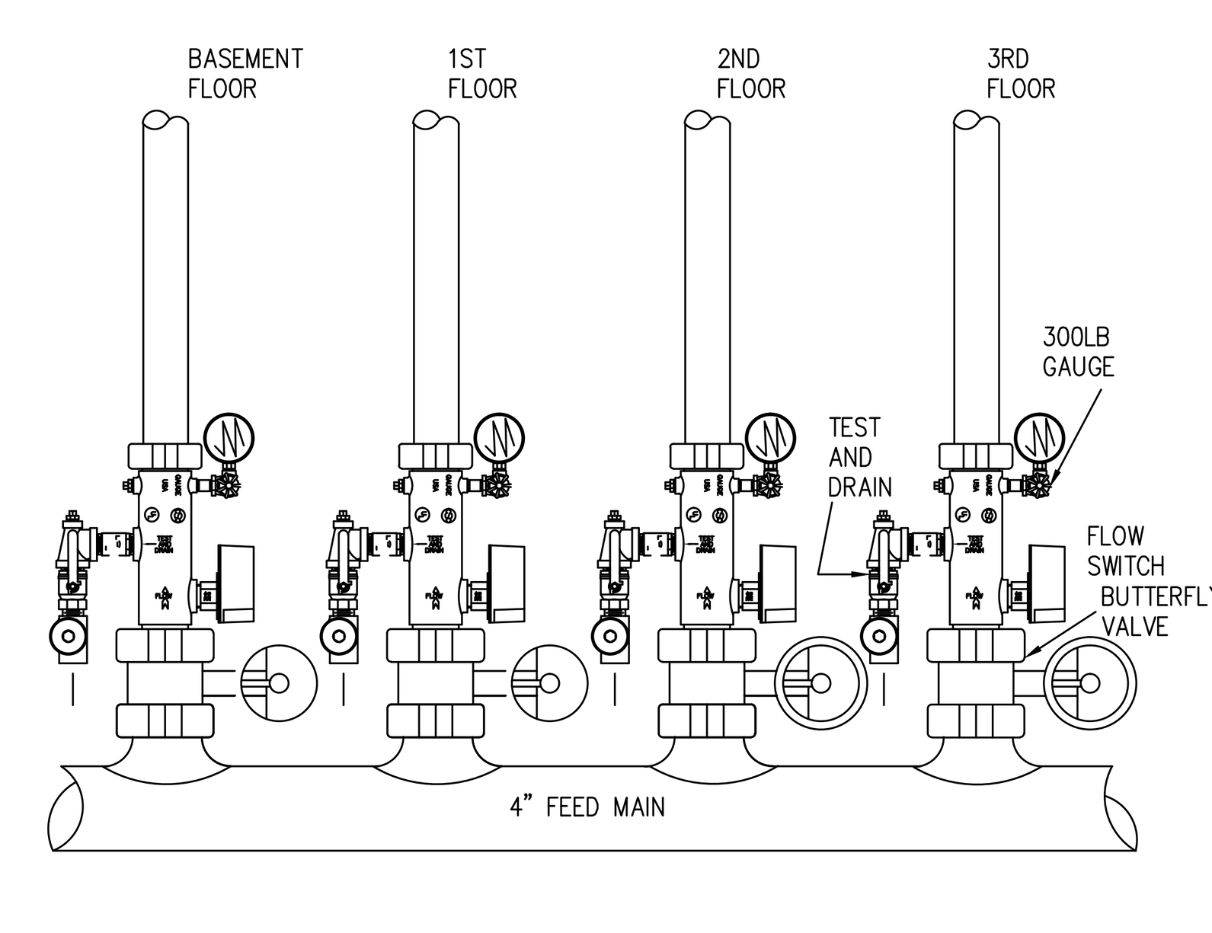
COSCO Fire Protection | BRANCHLINE RESTRAINT



2 / FP.7 BUILDING SECTION
SCALE: 1/8 = 1-0



3 / FP.7 BFP DETAIL (HYDRAULIC REFERENCE ONLY)
SCALE: NTS



3 / FP.7 RISER MANIFOLD DETAIL
SCALE: NTS

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SAN FRANCISCO, CA 94107
T 415 495 1700
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W www.lmsarch.com

STAMP

CONSULTANTS

LICENSED FIRE PROTECTION CONTRACTOR
COSCO FIRE PROTECTION INC.
CLASSIFICATION C-16
LICENSE NO. 577621
LOS ANGELES
STATE OF CALIFORNIA

PROJECT

JACOBS HALL
UNIVERSITY OF CALIFORNIA, BERKELEY

No	REVISION	DATE
	Fire Marshal Submission	12/20/13
	DSA Submission	01/29/14
	CM / Contractor RFP	03/31/14

COSCO Fire Protection
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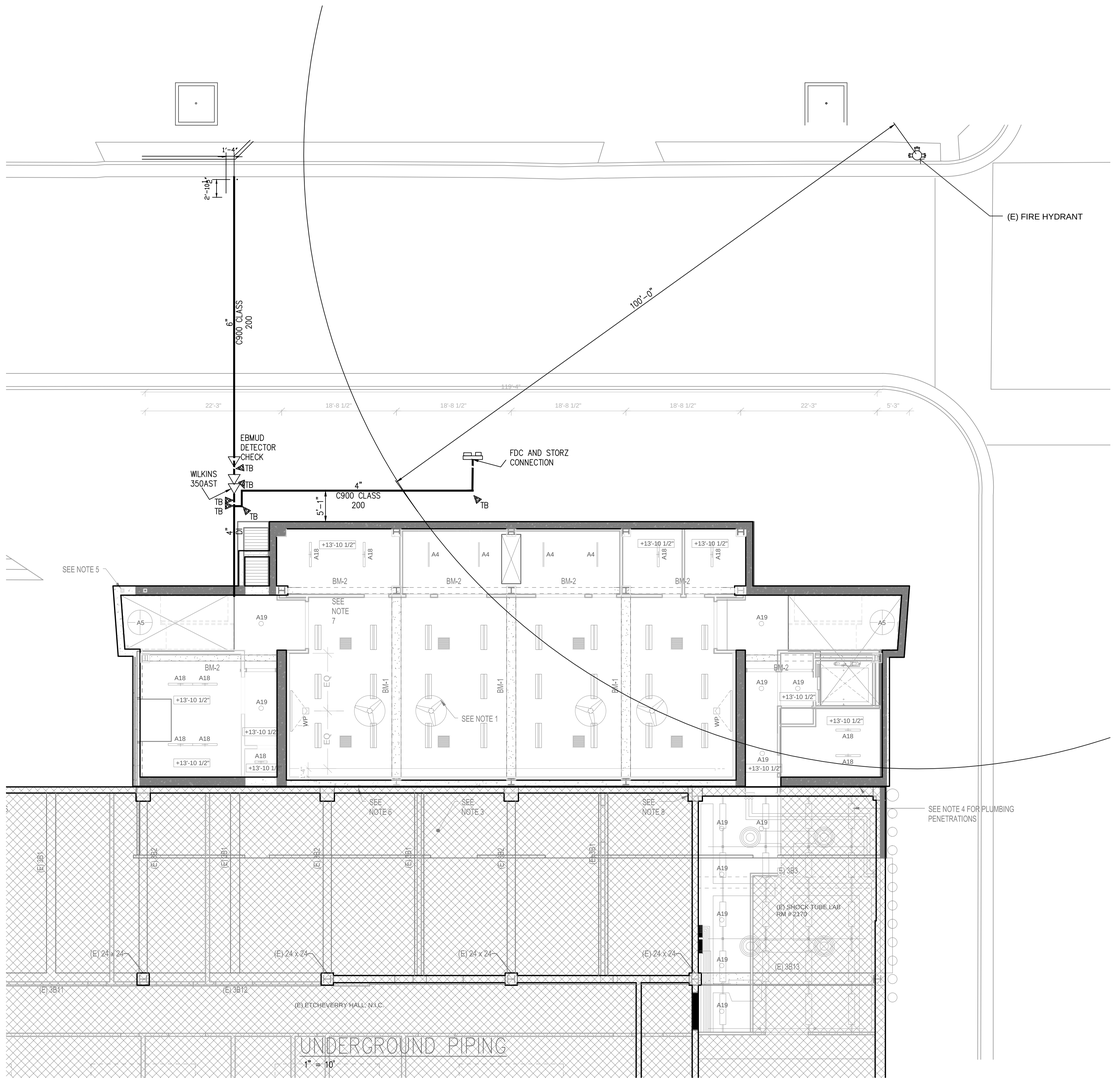
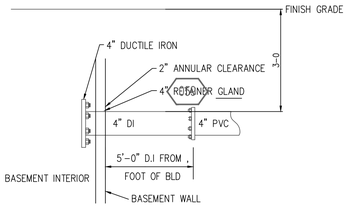
California C-16
LIC. # 57621
SAN DIEGO • LOS ANGELES • FRESNO • SAN FRANCISCO • SACRAMENTO • PORTLAND • SEATTLE • ANCHORAGE

DATE : 15 AUGUST, 2014
JOB No : 1309
PHASE : CD
ISSUED FOR : 100% CD
PERMIT No :
SCALE :

SHEET TITLE
DETAILS AND BUILDING SECTION

SHEET No
FP.7





RISER STUB

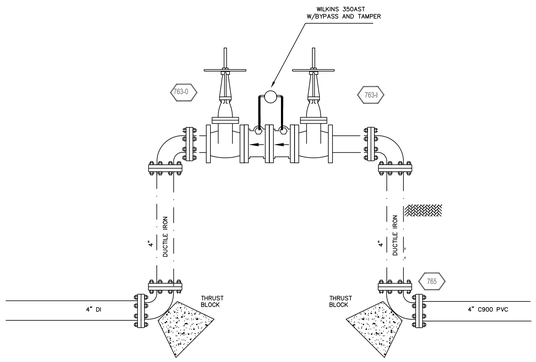
SCALE: N.T.S.

1) ALL MATERIALS AND METHODS SHALL CONFORM TO NFPA 24 (2010 ED) AND THE UC BERKELEY FIRE DEPARTMENT.
2) THRUST BLOCKING SHALL BE PLACED AND FORMED PER NFPA 24
3) U/G PIPING TO BE DUCTILE IRON CLASS 52 AND PVC C900 CLASS 200.
4) U/G FITTINGS SHALL HAVE A EPOXY COATING APPLIED AND WRAPPED FOR CORROSION PROTECTION. AND ALL BOLTS SHALL BE STAINLESS STEEL.
5) PIPING SHALL HAVE A MINIMUM BURY OF 36 INCHES BELOW GRADE.
6) U/G PIPE TO BE HYDROSTATICALLY TESTED PER NFPA 24
7) U/G PIPE TO BE FLUSHED PER NFPA 24
8) VERIFY LOCATION OF ALL EXISTING UTILITIES BEFORE PROCEEDING WITH INSTALLATION.

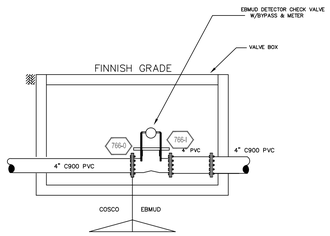
UNDERGROUND INSTALLATION NOTES

THRUST BLOCK SOIL BEARING AREA PER NFPA#24				
6" Fitting Type	Lbs. of Thrust Per PSI	Thrust at 100 psi	Allowable Bearing (Soft Clay)	Block Bearing Area (Sq.Ft.)
Dead end,cross or Tee	37.4	3,739	1,000 lb / sq.ft.	3.8
90 Deg. ELL	52.9	5,288	1,000 lb / sq.ft.	5.3
45 Deg. ELL	28.6	2,862	1,000 lb / sq.ft.	2.9
22 1/2 Deg. ELL	14.6	1,459	1,000 lb / sq.ft.	1.5
11 1/4 Deg. ELL	7.4	733	1,000 lb / sq.ft.	1.0

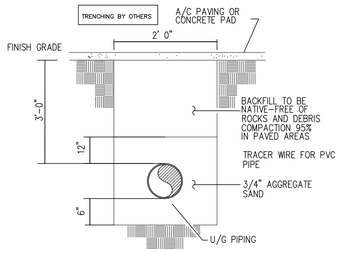
THRUST BLOCK DETAIL (WORST CASE)



BFP DETAILS



EBMUD DETECTOR CHECK



TRENCH DETAIL

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PERMIT No :
SCALE :

SHEET TITLE
UG FIRE SERVICE

SHEET N#
FP.8

COSCO Fire Protection
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JACOBS HALL

UNIVERSITY OF CALIFORNIA, BERKELEY
COLLEGE OF ENGINEERING

100% CD / PERMIT SPECIFICATIONS

AUGUST 15TH, 2014
UC PROJECT NO: 12605A

Prepared by:
Leddy Maytum Stacy Architects, Inc
677 Harrison Street, San Francisco, CA 94107

DOCUMENT 01 0110

INDEX TO SPECIFICATIONS

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--	--	11 3100	Appliances and Equipment	
DIVISION 12 – FURNISHINGS				
--	--	12 2400	Window Shades	
--	--	12 3623	Plastic-Laminate-Clad Countertops	
--	--	12 4819	Entrance Floor Gratings and Frames	
--	--	12 9300	Site Furnishings and Features	
DIVISION 13 – SPECIAL CONSTRUCTION				
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DIVISION 14 – CONVEYING EQUIPMENT				
08/01/14	--	14 2100	Electric Traction Elevator	
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--	--	23 0500	Basic HVAC Materials and Methods	
--	--	23 0593	Testing, Adjusting, and Balancing	
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DIVISION 26 – ELECTRICAL				
--	--	26 0010	Basic Electrical Requirements	
--	--	26 0011	Short Circuit Study	
--	--	26 0519	Building Wire and Cable	

Initial Issue	Current Revision			Number of Pages
APPENDIX A – INFORMATIONAL & REFERENCE DOCUMENTS				
05/30/14	--	A1	Geotechnical Report - Available Upon Request	
		A2	LEED Registered Project Checklist	
06/18/14	--	A3	Mechanical and Plumbing Basis of Design	
08/05/14	--	A4	Electrical Basis of Design	

END OF DOCUMENT

SECTION 01 1100
SUMMARY OF WORK

PART 1 - GENERAL

1.01 NAME, LOCATION AND ACCESS TO PROJECT

A. Project Location: University of California at Berkeley Campus.

B. Work Location: Northeast corner of the property currently occupied by Etcheverry Hall and Soda Hall.

C. Access: Permission for access to the site may be revoked for any and all persons who violate the University traffic regulations including speed limits and parking restrictions. All Contractor's personnel, operations affiliates and delivery personnel shall be made aware of and shall comply at all times with campus traffic regulations. Repeated GC failure to stringently enforce access requirements may result in the suspension of all GC and subcontractor on-site and campus parking.

1.02 DESCRIPTION OF WORK

A. General Requirements: The Contractor shall provide qualified supervision, lead-men, workmen, shall supply all labor, materials, equipment, services, transportation, insurance, licenses, building permits and all other items and work required to properly execute the intentions of the Contract.

B. The proposed project would construct a Design Institute of approximately 24,000 gross square feet for the University of California, Berkeley, College of Engineering.

1. Approximate Space Assignments are as Follows:

a. 9,300 square feet of studio space
b. 1,300 square feet of shop and equipment spaces
c. 1,800 square feet of office and meeting spaces
d. 1,300 square feet of gallery and display spaces
e. 3,000 square feet of circulation space
f. 4,900 square feet of basement space
g. 2,400 square feet of utility and service spaces
h. 7,800 square feet of sitework and surface improvement

2. Building systems in the proposed facility would include fire sprinklers, HVAC, plumbing, electrical, fire and life safety, telecommunications data and security. Chilled water, domestic water, hot water, and electric power are available from neighboring Soda Hall. Fire water, domestic water, storm sewer and sanitary sewer service is available from the bordering streets and may need to be extended, upgraded or replaced.

3. The building will occupy the site of the existing volleyball court at the northeast corner of the property currently occupied by Etcheverry Hall and Soda Hall. Ridge Road fronts the north property line, LeRoy Avenue fronts the east property line, Soda Hall fronts the south project limit, and Etcheverry Hall fronts the west project limit.

4. The building adjoins and will be connected via bridges to Soda Hall to the south and adjoins Etcheverry Hall and Promenade to the west. The building is three levels partially and fully above grade, with an additional basement level below grade, and connects to an existing basement that is part of Etcheverry Hall.

5. The new building will house collaborative and interdisciplinary undergraduate studios focused on engineering design and manufacturing innovation. Spaces will include precision manufacturing equipment for custom prototyping, large collaborative studios, smaller interactive and private workspaces, offices, student lounge areas and exhibit space.

C. Intent of Document:

1. It is the intent of the Contract Documents to include everything necessary for the proper completion of the project. Work necessary for completion or reasonably inferred by the Documents, even though not specifically shown or specified, shall be supplied.

2. Where removal of existing construction is required for performance of any work under this Contract, removal and replacement will be accomplished whether shown or not.

D. Since the General and Supplementary Conditions of the Contract and the General Requirements (Division 1) of these Specifications apply to the activities required under each Section hereof, the Contractor shall instruct each subcontractor to become fully familiar with them.

1.03 INTERPRETATIONS OF TERMS

A. The term "University's Representative," used in these Specifications, is synonymous with the “Owner’s Representative” and “Project Manager.” "As directed," "as required," "as permitted," "approved," "acceptable," "satisfactory," means by or to the Owner's Representative.

1.04 DEFINITION OF TERMS USED

A.	Owner:	The Regents of the University of California
B.	University’s Representative and Project Manager	The KSD Group, Inc. 1200 Concord Avenue, Suite 170 Concord, CA 94520 Tel: (925) 827-0841 Attn: Ken Defiebre Tel: (925) 827-0841 Ext. 23 Cell: (925) 487-4752 E-Mail: ken@ksdgroup.com (Note: All project communications, reviews, direction and approvals will be addressed to and from the Project Manager)
C.	Design Professional:	Leddy Maytum Stacy Architects 677 Harrison Street San Francisco, CA 94107 Tel: (415) 495-1700 Fax: (415) 495-1717
D.	Project Inspector:	Assigned by Owner’s Representative after Announcement of Bid.
E.	Contractor:	Hathaway Dinwiddie Construction Company 565 Laurelwood Road Santa Clara, CA 95054 Tel: (408) 988-4200 Attn: Michael Niemi Cell: (408) 221-0399 E-Mail: niemim@hdcco.com

1.05 DEFINITIONS

A. The following terms, when used on the Drawings or in the Specifications, shall have the following meanings:

TERM	MEANING
Adequate; Careful; Proper; Sufficient; Suitable; Satisfactory	These terms refer to interpretation by Owner's Representative, and are subject to approval upon request.
Applicable Codes	"Codes listed in Section 01 4100" referencing the Regulatory Requirements.
Approved	"As approved by Owner's Representative."
As Directed	"As directed by Owner's Representative."
As Required	"As required by Applicable Code Requirements; by good building practice; by the conditions prevailing; by the Contract Documents; by Owner, or by Owner's Representative."
As Selected	"As selected by Owner's Representative."
By Others	Work on this Project that is outside the scope of Work to be performed by Contractor under this Contract, but that will be performed by Owner, other contractors, or other means.
Equal	Of same quality, appearance, and utility to that specified, as determined by Owner's Representative. Contractor bears the burden of proof of equality.
Furnish	"Supply only, not install (unless required to be provided or installed elsewhere in the Contract Documents)."
Include/Including	"Include/including, without limitation."
Install	"Install or apply only, not furnish (unless required to be provided or furnished elsewhere in the Contract Documents)."
Manufacturer's Directions, Instructions, Recommendations, Specifications	Manufacturers' written directions, instruction, recommendations, specifications.
Must; shall; to; will	When used as a directive to Contractor, these terms indicate a mandatory action.
Necessary	"Essential to completion of Work."

Owner-Furnished, Contractor Installed	"To be furnished by Owner at its cost and installed by Contractor as part of the work."
Project Site; Job Site	Geographical location of the Project.
Provide	"Furnish and install."
Shown	"As indicated on the Drawings."
Specified	"As written in the Contract Documents."
Submit	"Submit to Owner's Representative."

1.06 INCONSISTENCIES IN CONTRACT DOCUMENTS

A. In addition to the requirements of the General Conditions, if there is an inconsistency in the Contract Documents, the stricter, more stringent standards and requirements shall be followed at no additional cost to Owner.

1.07 BUILDING PERMITS

A. The Contractor is not required to take out building permits for work done on University property. However, permits are required by the City of Berkeley for work encroaching on City property. Prior to obtaining such permit, the Contractor shall submit it to Owner for review and approval prior to executing.

1.08 PARKING AND ACCESS TO SITE

A. Vehicular access to the site is not shown on plans and shall be by routes on University property and project site as designated by Owner’s Representative, University Parking & Transportation Office, and the City of Berkeley.

B. The Contractor is responsible for complying with University regulations regarding on-campus parking on University property and vehicle access to the project site. The University will provide parkling for construction workers at a nearby location.

C. Construction Worker & Site Management Commuter Vehicles:

1. Provision of parking by the University for construction workers' commuter vehicles shall be assumed, although the total amount will be limited. Contractor is encouraged to promote and consider alternative modes of travel to the campus including carpooling and public transit systems. The Contractor is not responsible for arranging off-campus parking for his own forces and those of his subcontractors.

2. The University will offer the Contractor commuter vehicle parking in limited quantity. Exact location is to be determined. All vehicles parked in a University lot must be permitted.

3. All permitted vehicles must be properly parked in marked and/or designated spaces.

D. Construction Staging Areas:

1. Parking in construction staging areas is limited to working construction vehicles.

2. All vehicles parked in staging area are to have University parking permits.

3. No commuter vehicles are to be parked in staging area.

4. If a dedicated staging area is anticipated, Contractor, Project Manager and Parking & Transportation Office may review the extent and cost of allowing non-construction vehicle parking on-site. Such use will require review and approval of proposed Site Utilization Plan. When approved, permits for such spaces may be purchased at the current cost per month. This rate is subject to change at University's discretion.

E. Campus Parking Permit Procurement Procedures: Parking Permit Requests shall be submitted to the Project Manager for processing to the Parking & Transportation Office. Permits will be issued by Parking & Transportation Visitor & Construction Services Office, 2150 Kittredge Street, Berkeley.

1. All vehicles parked on University's property must properly and visibly display a valid University parking permit unless specifically exempted. Violators are subject to citation and/or towing. Parking & Transportation is the enforcement agency.

2. All vehicles must observe posted hours of control, permit requirements and parking instructions.

3. Overnight parking is not permitted on University property.

4. Access to the site may be revoked for violations of University traffic regulations, including speed limits and parking restrictions.

1.09 NOTIFICATION

A. Notify Owner's Representative not less than two (2) working days in advance of any inspection, meeting or consultation requiring the Representative's presence.

B. Notify Owner's Representative not less than eleven (11) calendar days in advance of any shut downs or activity requiring PPCS presence or assistance.

1.10 WORK HOURS

A. The Work of this project shall be accomplished during the following hours only, unless otherwise approved by the Owner's Representative:

1. Monday through Friday, 7:00 a.m. to 7:00 p.m.,

2. Saturday, Sunday and Legal Holidays, 9:00 a.m. to 8 p.m.

B. Work that is performed on Saturdays, Sundays or University holidays must be approved by the Owner's Representative. Provide minimum 72 hours-notice for approval of hours.

C. All roto-hammering, chipping, doweling, pneumatic fastening, or other activity that will cause excessive noise and vibration shall be performed between approved working hours and must be scheduled with the Owner's Representative 10 days before the activity.

D. Compliance is required with the City of Berkeley Noise Ordinance. City of Berkeley Construction Noise Standards can be found via the following website: www.ci.berkeley.ca.us

1.11 WEATHER-CAUSED DELAYS

A. Time lost in the progress of the Work caused by stormy or inclement weather conditions shall not be considered an Excusable Delay as defined in the General Conditions, unless the aggregate of such lost time exceeds the average number of rain days for the project duration.

B. The average number of rain days when precipitation amounts are greater than 0.50 inches occur shall be based on the data published for Berkeley, California by:

National Climatic Data Center
Climatic Services Branch
151 Patton Avenue
Ashville, North Carolina 28801-5001
Telephone (828) 271-4800

C. Approved weathers caused delays are excusable delays, not compensable.

1.12 CM/GC SUPERINTENDENT

A. In addition to requirements of General Conditions:

1. Submit qualifications confirming compliance with staff commitments included in Contractor's Prequalification submittal document, and University's Request for Proposals.

2. Failure to maintain a Superintendent on the Project site at all times work is in progress shall be considered a material breach of this Contract, entitling Owner to terminate the Contract or, alternatively, issue a stop Work order until the Superintendent is on Project site. If, by virtue of issuance of said stop order, Contractor fails to complete the Contract on time, it will be assessed liquidated damages in accordance with the Agreement. No other Contractor employees may fill the role.

3. Superintendent approved for this Project shall be able to read, write, and verbally communicate fluently in English.

4. Superintendent may not perform the work of any trade, pick up materials, or perform any work not directly related to the supervision and coordination of the work at the Project site when work is in progress.

1.13 SITE DECORUM

A. Contractor shall control the conduct of its employees so as to prevent unwanted interaction initiated by Contractor's employees with University students, University staff, or other individuals (except those associated with the Project), adjacent to the Project site. Without limitation, unwanted interaction by Contractor employees would include whistling at or initiating conversation with passerby. In the event that any Contractor employee initiates such unwanted interaction, Contractor shall, either upon request of Owner's Representative or on its own initiative, replace said employee with another of equivalent technical skill, at no additional cost to Owner.

1.14 NO SMOKING

A. The University has adopted a no-smoking provision in all campus buildings. The Contractor, his forces and his employees will observe this requirement while performing work in University buildings.

B. (Effective January 2014, smoking, the use of smokeless tobacco products, and the use of unregulated nicotine products (e.g., "e-cigarettes") will be strictly prohibited in all campus indoor and outdoor spaces, including parking lots, private residential spaces and construction job site areas.)

1.15 NO EATING, DRINKING OR CHEWING TOBACCO IN CAMPUS BUILDINGS

A. The eating of food (including sunflower seeds and gum) is prohibited within the building envelope upon installation of the sheetrock.

B. This provision also prohibits the chewing of tobacco within the building envelope or on the scaffolding at all times.

1.16 RADIOS

A. The playing of radios on University project sites is prohibited at all times. The Contractor, his forces, and his employees will observe this requirement while performing work on the University project site.

1.17 SANITARY FACILITIES

A. There are no sanitary facilities at the site which may be used by the Contractor. The Contractor will be responsible for providing adequate sanitary facilities at the site and for maintaining their cleanliness and utility.

1.18 JOB SIGNS AND PUBLICITY RELEASES

A. Advertising Signage: The use of Contractor or subcontractor advertising signage is prohibited. Do not display such advertising or job signs except as may be required for identification and deliveries.

B. Owner-Furnished Warning Signs: Whenever required by Owner's Representative, post Owner-furnished warning signs in locations as directed.

C. Do not release any information, story, photograph, plan or drawing relating information about the project to anyone, including press or other public communications medium.

D. Contractor to furnish and install a project sign, with general project information and contact information, as agreed to by the University.

1.19 PROJECT SECURITY

A. The Contractor is responsible for project security of materials, tools, equipment, supplies and partially completed construction.

1.20 NOT USED

1.21 CLEAN-UP DURING CONSTRUCTION

A. Maintain job in a clean, orderly fashion. Pick up and remove debris daily if required, but not less frequently than weekly. If work under this Contract creates dusty, dirty or unsightly conditions in adjacent areas, the Contractor will immediately clean up the affected areas.

B. No combustibles shall be left near construction fencing.

C. Comply with construction mitigation measures in EIR and Section 01 7410, “Clean Up and Disposal.” EIR is available for review at www.cp.berkeley.edu LRDP_2020.htm.

1.22 NOISE AND DUST CONTROL

A. Contractor shall note that adjacent facilities will remain in operation during the entire construction period and shall take all reasonable precautions to eliminate dust and minimize noise.

B. Erect temporary structures to confine noise and dust as required.

C. Electric, mechanical equipment and tools shall be equipped with dampers, mufflers, isolators or some other appropriate means for reducing noise emissions. Engine driver equipment shall be fitted with noise mufflers.

D. See Sections 01 7300, “Execution Requirements, and 01 5010, “Contractor's Use of Project Site,” for additional noise and dust control measures.

1.23 ACCESS AND EXIT-WAYS

A. Do not interfere with use of or access to occupied buildings or adjacent property.

B. Maintain all corridors, stairs, halls and other exit-ways of occupied buildings clear and free of debris or obstructions at all times.

C. Maintain well lit access per approved exiting plans at all times. No changes shall occur without written acceptance of the Fire Marshal.

1.24 WELDING AND BURNING

A. Welding and burning of steel shall be eliminated as much as possible. Where unavoidable, welding and burning shall be done with all possible precaution to avoid fire hazard. Contractor shall provide a fire watch for 1/2 hour after burning stops. Contractor shall provide protection for all adjacent surfaces.

B. No welding power is available. Trailer mounted welding machines complying with campus noise mitigation standards are required. No diesel generators allowed.

1.25 ANCHORS AND FASTENERS

A. See Section 01 7325, “Anchors and Fasteners.”

1.26 SURROUNDING SITE CONDITION SURVEY

A. Prior to commencing the Work, Contractor and Owner shall tour the Project site together to examine and record the damage to existing adjacent buildings and improvements. This record shall serve as a basis for determination of subsequent damage due to Contractor's operations, and shall be signed by all parties making the tour. Any cracks, sags, or damage to the adjacent buildings and improvements not noted in the original survey, but subsequently discovered, shall be reported to Owner's Representative.

1.27 EXCAVATION AND TRENCHING

A. Pursuant to labor Code 6707, the Contractor shall include adequate sheeting, shoring, bracing or equivalent method for the protection of life and limb, which conforms to applicable Federal and State safety orders.

B. Before beginning any excavation 5 feet or more in depth, submit to the Owner's Representative a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during excavations. Comply with the Standards established by the State of California Construction Safety Orders Title 24 of the California Administrative Code. If the detailed plan varies from such shoring system Standards it shall be prepared by a registered civil or structural engineer whose name and registration number shall be indicated on the Drawing. If a dispute arises as to whether the plan must be prepared by a registered civil or structural engineer, the Owner's Representative's determination of the matter shall be final and conclusive. The cost of required engineering services shall be borne by the Contractor and shall be deemed to have been included in the amount of bid for the work as stated in the Agreement.

C. Neither the review nor approval of any plan showing design of shoring, bracing, sloping or other provisions for worker protection shall relieve Contractor from his obligations to comply with Construction Safety order Standards and Title 24 CCR for design and construction of such protective work, and Contractor shall indemnify Owner and Owner's Representative from any and all claims, liability, costs, actions and a cause of action arising out of or related to the failure of such protective system. The Contractor shall defend the Owner, its officers, employees and agents and the Owner's Representative in any litigation or proceeding brought with respect to the failure of such protective systems.

D. The Contractor shall comply with Section 382 of the Civil Code of the State of California relating to lateral, general and sub-adjacent supports wherever structures or improvements adjacent to an excavation may be damaged by such excavation.

1.28 MATERIAL AND EQUIPMENT

A. General:

1. All material and equipment incorporated in the Work shall be:
   a. New.
   b. In condition acceptable to Owner's Representative.
   c. Suitable for intended use.

2. Keep materials clean, dry, and undamaged.

B. UL Label: Materials and equipment, for which UL standards have been established and their label service is available, shall bear the appropriate UL Label.

C. Manufacturer's Trade Marks and Names: Owner's Representative reserves the right to review and request the removal or redesign of manufacturers' trade marks and names on items of materials and equipment which will be exposed to view in the completed Work. Such removal or redesign shall be at no increase in Contract Sum.

D. Delivery of Materials: Deliver all materials in the original packages, containers or bundles bearing the name, brand, type and grade of material of the manufacturer or the supplier for whom the product is manufactured.

1.29 LAYING OUT OF THE WORK

A. Actual field conditions deviating from the Drawings shall be reported to Owner's Representative before proceeding, and Contractor shall bear the expense of corrective work necessitated by its failure to so report.

B. Contractor shall employ a California registered Civil Engineer or Land Surveyor to lay out the Work and set grades, lines, levels, and positions throughout the Project site. Before beginning the Work, locate general reference points, establish monuments, and take action as is necessary to prevent their destruction; then lay out all lines, elevations, and measurements for buildings, grading, paving, utilities, and other parts of the Work. Verify figures and dimensions shown on the Drawings and accept responsibility for any error resulting from failure to so verify, including the cost of any additional re-surveying. Establish permanent monuments on curbs, manholes, or pavements, or with concrete embedded steel pipe with lead plug and brass nail, as approved.

1.30 APPARATUS AND EQUIPMENT LOCATIONS

A. Locations of apparatus and equipment indicated on the Drawings (if any) are approximate only, and are subject to change to suit operational service as approved by Owner's Representative.

B. Furnish and install apparatus and equipment in a manner and in locations which keep openings and passageways clear. Make changes in locations of equipment and materials which may be necessary to accomplish these purposes as approved by Owner's Representative.

1.31 EXAMINATION OF EXISTING CONDITIONS

A. Verify measurements in field, as required, for work fabricated to fit job conditions. Before starting work, examine adjoining work on which installment is in any way dependent for perfect workmanship and fit. Give written description of any existing deficiencies detrimental to proper and timely installation of work.

1.32 CARE OF EXISTING FACILITIES

A. The Contractor shall be responsible for repair or replacement of existing facilities including any landscaping, paving, roads and sidewalks damaged as a result of the performance of this work. Any facilities or finishes damaged shall be repaired or replaced with materials and workmanship equivalent to that employed in executing the original work and to the satisfaction of the Owner's Representative.

B. The Contractor shall take care not to overload the existing structure by storing material, erecting shoring, placing equipment or other materials upon or against the building. Existing conditions and as-built information is available for review upon request.

C. Do not park trucks, store materials or cross over landscaped areas. Any plant materials or irrigation systems damaged as a result of the performance of this work will either be replaced with new plant materials or irrigation system components equal in size and quality to those damaged or by payment of an amount representing the value of the damaged material as determined by the Owner.

1.33 REPAIR OF EXISTING WORK

A. Whenever any cutting, removal, or alterations of existing work is required to form connections with new work or otherwise meet the requirements of the Contract Documents, perform such work so as not to damage the work that will remain in place. Perform patching and repairs occasioned thereby using materials, construction details, and finishes matching those of the existing work as closely as possible and to the approval of Owner's Representative.

1.34 ELEVATORS

A. The Contractor shall obtain special permission from the Owner in order to use new and/or existing building elevators for construction operations.

B. The Owner will specify which elevator(s) shall be used for construction purposes. The Contractor is responsible for any and all damages to the elevator(s) due to the Construction process and shall take adequate precautions to protect the elevator(s).

C. Under no circumstances shall the Contractor exceed the posted weight.

1.35 TEMPORARY FIRE PROTECTION SYSTEM

A. Where existing fire protection system of the existing building is inadequate or impaired by construction operations, provide temporary fire protection for the building during the course of construction.

B. Provide temporary fire protection for the new building during the course of construction.

C. All temporary fire protection systems must be approved by the Fire Marshal.

1.36 TEMPORARY CONSTRUCTION UTILITIES

A. The University shall provide and pay for necessary power and water required during the course of construction. The Contractor shall be responsible for providing temporary facilities required to deliver such utility services from their existing location to point of intended use, and shall install meters, and track all usage, providing that information back to the University on a monthly basis.

B. Contractor shall verify characteristics of power available. Where power of higher voltage or different phase of current is required, Contractor shall be fully responsible for providing such services and shall pay all costs required therefore. Work to be done in accordance with applicable California Administrative Codes.

C. The Contractor shall furnish, wire, install and maintain temporary electric lights wherever it is necessary to provide illumination for the proper performance and observation of the work.

D. Use backflow preventers on water lines at point of connection to Owner's water supply. Backflow preventers are to comply with requirements of the Uniform Plumbing Code.

E. No temporary utilities shall effect services to neighboring buildings or properties.

F. Owner does not guarantee amounts of water and electricity available from owner sources, nor is the owner responsible for interruption in service.

G. Comply with requirements of Section 01 5100, "Temporary Utilities."

1.37 UTILITY SHUTDOWNS AND INTERRUPTIONS

A. The Contractor is to provide 11 calendar days notification of a required shutdown. The days start counting when the Shutdown Request Form is e-mailed to the Owner's Representative prior to 11 a.m. If received after 11 a.m., counting begins the following day. Exceptions: Fridays and University holidays, counting will begin the next working day. All work required to re-establish service such as connections, line taps, cable splicing, shall be performed by the Contractor.

B. Any large deliveries or those requiring large numbers of vehicles are to be included within the 2-week look-ahead schedule.

C. Excessive scheduling of utility shut-downs or repeated requests to schedule and subsequent cancellation or re-scheduling of shut downs may be subject to back-charges to the Contractor.

1.38 TEMPORARY JOB OFFICE

A. The Contractor shall provide a lockable temporary job office for use by the Contractor, Owner and Owner's Representative with plan desk, plan rack, telephone, files, stools or chairs, and lights in a room or area to be designated at the Procedure Meeting Office. Space shall include necessary phone and data lines and power outlets.

B. In the Contractor's temporary job office, maintain complete set of Contract Documents, all reviewed shop drawings, submittals, samples, and all executed Change Orders.

1.39 PROJECT RECORD DOCUMENTS, "AS- BUILT" DRAWINGS

A. Maintain at the job site, a complete record set of up-to-date Contract Documents. The prints shall show actual installation by dimension, elevation or other reference, where changed from the original Contract bid documents.

B. The Contractor shall cross-reference all changes approved by the Owner on the record set of Contract Documents, noting the type and number of the document authorizing the change.

C. Electrical work is shown diagrammatically on the Contract Drawings. The Contractor shall make "as-built" drawings showing the exact measured location of concealed piping, duct work and major electrical conduits.

D. The University reserves the right to tie the Contractors Application for Payments to progress and completeness of “as-builts.”

1.40 CONTRACTOR'S SUBMITTALS

A. Within 10 days after receipt of the Owner’s Approval of the Fixed Price Contract – Project Buyout Proposal, submit detailed Preliminary Contract Schedule and Cost Breakdown Summary with other required documents to Owner’s Representative for approval. The Preliminary Contract Schedule may be the schedule developed during preconstruction services, if current, or an updated version.

B. Project Schedule: Submit detailed project schedule to Owner's Representative for approval as required in Specification and in the General Conditions.

C. Schedule of Values (Cost Breakdown): Submit detailed project Schedule of Values to Owner's Representative for approval as required in Specification Section 01 2973, “Schedule of Values,” and in the General Conditions.

1. Identify each line item with a number.

2. Identify site mobilization, demobilization, bonds and insurance.

3. Each subcontractor is to be broken down to reviewable parts, including materials and labor as necessary.

4. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

5. Include separately from each line item, a direct proportional amount of Contractor’s overhead and profit.

6. The Contractor shall include a separate allowance (or line item) identified as “project close out” with a corresponding value attributed to this item.

7. The Contractor shall include a separate allowance (or line item) identified as “building commissioning” or “systems commissioning” with a corresponding value attributed to this item. This line item includes Contractor cost but does not include Subcontractor costs.

8. Schedule of Values shall be reviewed and marked up as needed by the Owner’s representative for resubmission by the Contractor.

9. The Contractor shall not submit a Payment Application to the Owner’s representative prior to the Owner’s Representative’s approval of the Cost Breakdown submittal.

10. Revise schedule to list approved Change Orders, with each Application for Payment.

D. Submittal Schedule: Submit detailed Submittal Schedule to Owner's Representative for approval. Align timing of Submittals with dates materials are required on-site for construction activities.

E. Staffing Plan: Submit detailed Staffing Plan to Owner's Representative for approval as required in this Section.

F. Product Literature: Submit detailed technical literature fully describing every product or item proposed for use including manufacturer's literature and items specified. For detailed requirements, refer to individual specification sections.

G. Samples: Submit samples of materials specified to permit full evaluation of work or items proposed. For detailed requirements, refer to individual specification sections.

H. Shop Drawings: For detailed requirements refer to individual Specification Sections.

1.41 CORRESPONDENCE

A. Contractor's correspondence (any written document other than a full-size drawing) directed to Owner's Representative shall be distributed as follows:

1. Original to Owner's Representative.

2. Three copies (minimum) to Owner’s Consultant.

B. Owner's Representative's correspondence (any written document other than a full-size drawing) directed to Contractor shall be distributed as follows:

1. Original to Contractor.

2. Three copies (minimum) to Owner’s Consultant.

C. Owner’s Consultant’s correspondence (any written document other than a full-size drawing) directed to Contractor shall be distributed as follows:

1. Original to Contractor.

2. One copy (minimum) to Owner’s Representative.

1.42 PAYMENT BY OWNER

A. Summarize quantities and percentages of completion, agreed upon by Contractor and Owner's Representative, on the Cost Breakdown contained in the Application For Payment.

1. Contractor will submit billings on the Application For Payment contained in the Exhibits of the construction bidding documents.

2. Three original (i.e., ink-signed) and complete copies of the Payment Application will be submitted by Contractor to Owner (labeled "Attention Contract Administrator").

3. One copy of the complete Payment Application will be submitted by Contractor to Owner's Representative.

4. Owner's Representative will submit three original (i.e., ink-signed) and complete copies of the Certificate For Payment to Owner (labeled "Attention Contract Administrator").

B. In accordance with Article 9 of the General Conditions of the Contract, the Owner will make payments within 20 days after Owner's receipt of an original valid Application for Payment, an original valid Certificate for Payment, and all required supporting data.

C. In accordance with Article 9.3.5 of the General Conditions, the University will approve payment for materials stored offsite. All materials must be stored in a bonded warehouse or yard. Costs for a University representative to inspect materials stored outside the San Francisco Bay Area will be the Contractor’s responsibility, with the exception of structural steel which is subject to Owner’s Testing Lab inspections.

1.43 OWNER BACK-CHARGES

A. The Contractor will be cognizant of costs to the Owner caused by execution of the work of this contract. The following activities are costs to the Owner:

1. Laboratory Testing

2. Utility Shutdowns

3. Inspections

4. Clean Up

B. Excessive or repeat scheduling (2 times per item) and canceling of activities may result in backcharges to the Contractor. If excessive or repeat scheduling of Owner activities occurs, the Owner's Representative will notify the Contractor in writing, and allow 5 days for the Contractor to "cure." Failure of the Contractor to "cure" excessive or repeat scheduling of activities beyond the five day notice period may cause the Owner to back-charge the Contractor for costs of these activities. Back-charges will be deducted from amounts owing to the Contractor.

1.44 FINAL CLEAN-UP

A. Clean up the entire construction area and adjacent areas affected by the performance of work under this Contract. Remove all temporary construction, tools, equipment, excess materials and debris.

B. Staging area shall be cleaned up. All fencing, fence posts, concrete, asphalt, etc., shall be removed.

1.45 PREPARATION FOR ACCEPTANCE (PRIOR TO FINAL INSPECTION)

A. Temporary facilities and utilities shall be properly disconnected, removed and disposed of off-site.

B. All systems, equipment and devices shall be in full and proper adjustment and operation and properly labeled and identified.

C. All materials and finishes shall be neat, clean and unmarred.

D. All broken work, including glass, curbs, slabs, paving, landscape sprinklers, etc., shall be replaced or properly repaired.

E. Clean-up of the site shall be complete.

F. All guarantees, service manuals, record documents and other submittals as specified in the body of the Specifications, shall be assembled in an orderly manner and delivered to the Owner's Representative.

1.46 BUILDING COMMISSIONING OR SYSTEM(S) COMMISSIONING (PRIOR TO FINAL ACCEPTANCE)

A. Prior to final inspection, the Contractor will schedule, through the Owner's Representative, training sessions, programs, manuals and documentation as required to educate and familiarize maintenance and operations staff with equipment and system's operations. At minimum, one session per system or major piece of equipment is required. Final inspection will not be scheduled until training sessions for all building systems and major pieces of equipment have been conducted.

1.47 FINAL INSPECTION

A. Upon receipt of written notice from the Contractor that the work is ready for final inspection and acceptance, the Owner's Representative and Contractor shall promptly make a joint inspection of the work and note deficiencies, if any. When noted deficiencies have been removed and the Owner's Representative finds the work to be complete in every respect of the Contract Documents, the Owner's Representative will advise the Owner to file a Notice of Completion.

B. The Notice of Completion shall be prepared and recorded in the County Recorder's Office.

C. The Contractor shall not submit a Payment Application representing the work of the project to be 100 percent complete prior to the recordation of the Notice of Completion.

1.48 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Drawings show, if applicable, existing above and below grade structures, drainage lines, storm drains, sewers, water, gas, electrical, hot water, and other utilities which are known to Owner.

B. Locate all known existing utility installations before proceeding with construction operations which may cause damage to such installations. The existing installations shall be kept in service where shown and damage shall be repaired at no increase in Contract Sum.

C. If any other structures or utilities are encountered, request Owner's Representative to provide direction on how to proceed with the Work.

D. If any structure or utility is damaged, take immediate action to ensure the safety of persons and property. In the event that any utility is damaged, Contractor shall immediately notify Owner’s

Representative, who will in turn, notify Physical Plant-Campus Services so that damaged utility may be shut-off. Under no circumstances shall the Contractor shut-off damaged utilities, unless directed by the Owner's Representative. All costs associated with damage to known utilities and the costs from a response by Physical Plant-Campus Services, will be for the Contractor's account.

E. Shoring:

1. General Protection. Pursuant to Labor Code Sections 6705 and 6707, Contractor shall include in its base bid all costs incident to the provision of adequate sheeting, shoring, bracing or equivalent method for the protection of life and limb which shall conform to the applicable Federal and State Safety Orders.

2. Before beginning excavation five feet or more in depth, Contractor shall submit to Owner's Representative a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazards of caving ground during the excavation. The proposed plan shall comply with the State of California Construction Safety Orders and Title 24 of the California Code of Regulations (CCR). If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer whose name and registration number shall be indicated on the Drawing. If a dispute arises as to whether the plan must be prepared by a registered civil or structural engineer, Owner's Representative's determination of the matter shall be final and conclusive on Contractor. The cost of required engineering services shall be borne by Contractor and shall be deemed to have been included in the amount bid for the Work as stated in the Agreement.

3. Neither the review nor approval of any plan showing the design of shoring, bracing, sloping, or other provisions for worker protection, shall relieve Contractor from its obligation to comply with Construction Safety Orders Standards and Title 24 CCR for the design and construction of such protective Work, and Contractor shall indemnify Owner and Owner's Representative from any and all claims, liability, costs, action and causes of action arising out of or related to the failure of such protective systems. Contractor shall defend Owner, its officers, employees, and agents and Owner's Representative in any litigation of proceeding brought with respect to the failure of such protective systems.

4. Comply with State of California Construction Safety Orders, Article 6 - Excavations, Trenches, Earthwork - whether or not the excavation, trench, or earthwork is five feet or more in depth.

1.49 CM/GC CONTRACTOR'S STAFFING

A. Simultaneously with submittal of signed Agreement, Contractor shall submit a proposed Staffing Plan for review and acceptance by Owner's Representative

B. Contractor's proposed Staffing Plan shall identify individual persons proposed to fill the following positions, or their respective equivalents, for the Project, confirming compliance with University's Request for Proposals.

C. Staffing Plan shall be consistent with staff commitments included in Contractor's Prequalification submittal document, where applicable.

D. Contractor shall provide information as appropriate to document the qualifications of individual persons named in proposed Staffing Plan, for their respective positions.

E. Contractor shall revise and re-submit the proposed Staffing Plan as required for acceptance by Owner's Representative.

F. Acceptance of the Contractor's Staffing Plan by the Owner's Representative shall be a condition precedent to the making of any progress payment for work performed beyond 60 days from the date of commencement as specified in the Notice To Proceed.

G. After acceptance of the Staffing Plan, Contractor shall notify the Owner's Representative in writing of any revisions to the Staffing Plan. Changes in the level of staffing or substitutions of staff for those named in the accepted Staffing Plan shall require the acceptance of the Owner's Representative.

1.50 OWNER SUPERVISION

A. If the Project Inspector, On-Site Coordinator, and/or the Project Manager will be on site for any work which occurs outside of the specified work hours, the Contractor will be assessed at the rate of $125.00 per hour for the time. All work that occurs requires the presence of the Project Inspector or the Project Manager.

1.51 CULTURAL AND HISTORICAL RESOURCES

A. Historic archaeological deposits are not known to exist at the project site. However, unrecorded archaeological sites could be discovered during construction. In the unlikely event that currently unknown artifacts, human remains or pale ontological resources are discovered during trenching or other ground disturbing activities, the contractor shall protect the discovered items, cease work in a 35 foot radius of the find, and notify the Owner's Representative or Inspector of Record immediately. Work in this area must not proceed until approval is given to resume work. The Owner may retain an archaeological consultant to evaluate findings in accordance with standard practice and applicable regulations. Artifact recover, if deemed appropriate, will be conducted during the period when construction activities are on hold. Following completion of artifact recovery, a Change Order may be issued to adjust the contract time if required.

B. Conform with EIR (www.cp.berkeley.edu LRDP_2020.htm).

1.52 SENSITIVE AREAS

A. Governing Regulations and Standards:

1. Bay Conservation and Development Commission Act (Government Code Section 6660 et seq.)

2. Coastal Act of 1976 (Public Resources Code Sections 30000-30900)

3. California Department of Fish and Game policies

4. California Environmental Quality Act (Public Resources Code Sections 21000 et seq.)

5. Federal Endangered Species Act

6. National Historic Preservation Act of 1966 Section 106

B. Development upon identified aquifer recharge areas should be designed so as to minimize impervious surface area on the site.

C. Development should accommodate sites or areas of historical or archeological significance. Approval must be obtained before altering any archeological, historical, or cultural resource eligible for, or listed in the National Register of Historic Places.

D. Unnecessary vegetation disturbance is prohibited. This includes unnecessary stripping, removal, trampling, or other damage. Compaction, excavation, paving, or addition of soil (filling) of root zone areas within the drip line (generally the area surrounding the stem roughly equal to the diameter of the canopy) of permanent vegetation is prohibited. Vegetation that must be removed will be left on the site as long as possible.

E. Development shall not be detrimental to known endangered plant or animal species or their critical habitats or migration routes. In general, wildlife habitat should be preserved and enhanced to the extent possible.

F. Activities within 100 feet of the high tide mark of San Francisco Bay including dredging or filling, grading, or substantial change in land use require the approval of the San Francisco Bay Conservation and Development Commission.

1.53 NUISANCE ABATEMENT

A. Governing Regulation: Penal Code Section 375

B. Standard control measures will be implemented to mitigate both noise and dust created by construction activities.

C. Building designs and landscaping plans shall not attract or harbor annoying pests such as rodents, insects, pigeons, etc.

D. The development site should be free of noxious odors caused by either on-site or off-site conditions.

1.54 EXISTING AS-BUILT DRAWINGS

A. As-built drawings are available for review at UCB Capital Projects Main Office located at 1936 University Avenue, 2nd Floor, Berkeley, CA 94720 during normal working hours.

1.55 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-Division numbering system of the latest update to the 2004 Edition of CSI/CSC's "MasterFormat.".

1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

2. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words and phrased when used in particular situations. These conventions are as follows:

a. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
b. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity

to describe responsibilities that must be fulfilled indirectly be Contractor or by others when so noted.

1) The words “shall”, “shall be”, or “shall comply with” depending on the context, are implied where a colon (:) is used within a sentence or phrase.

END OF SECTION 01 1100

SECTION 01 2200
UNIT PRICES

1.01 WORK INCLUDED

A. Provide the Owner with Unit Prices specified herein.

B. Specifications for Work Requiring Unit Prices: See applicable Sections.

1.02 DESCRIPTION OF UNIT PRICES

A. Provide the following Unit Price(s) in the appropriate spaces on the Bid Form:

B. Unit Prices, if applicable, are to be determined during Phase 1.

C. Amount of unit prices includes:

1. The cost of materials billed to the Contractor, including taxes.

2. The cost of installation and,

3. Delivery to the site (or removal from site and legal disposal of materials).

4. Handling of materials at the site, including unloading and storage.

5. Other expenses required to complete the installation including, but not limited to, coordination and protection of adjacent surfaces and clean-up.

6. Contractor's and subcontractor's overhead, profit, insurance and bonds.

1.03 CONTRACTOR'S RESPONSIBILITY FOR INSTALLATION

A. On notification of selection, enter into agreement with designated subcontractor.

B. Arrange for and process product data and samples as required.

C. Install and finish products in compliance with requirements of referenced Specification Sections.

1.04 ADJUSTMENT OF COST

A. Base bid price shall be inclusive of all work shown and specified on the drawings and specifications. Unit Prices shall be the basis for determining payment to the Contractor for work, incorporated into the contract with a Change Order, over and above (or less than) that work shown on the drawings and specifications.

1. Quantities installed shall be determined by field measurements. After performing Unit Price work as directed by Owner's Representative, Contractor shall take necessary measurements in the presence of the Owner's Inspector and shall submit calculation of quantities to the Owner for approval. Contractor shall notify the Owner 1 day in advance of taking measurements.

B. At Contract closeout, reflect all approved changes in Contract Sum in the final statement of accounting.

END OF SECTION 01 2200

SECTION 01 2300
ALTERNATES

1.01 WORK INCLUDED

A. This Section identifies each Alternate and describes basic changes to the Work only when that Alternate is made a part of the Work by specific provision in the Agreement.

B. The Lump Sum Base Bid and Alternates shall include the costs of all supporting elements required, so that the combination of the Lump Sum Base Bid and any Alternates shall be complete. The scope of Work for all Alternates shall be in accordance with applicable Drawings and Specifications.

C. Except as otherwise specifically provided by Owner, the Work described in Alternates shall be completed with no increase in Contract Time.

D. This Section includes only the non-technical descriptions of the Alternates. Refer to the referenced and applicable Sections of the Specifications for technical descriptions of the Alternates.

E. Coordinate related Work and modify surrounding Work as required to properly and completely integrate the Alternates into the Work.

F. The Lump Sum Base Bid shall include all work shown except work described as Alternates.

G. The Alternates described below are intended to:

H. Allow the Owner to identify the cost of a portion of the work for funding purposes, and

I. Provide the Owner flexibility to adjust the project scope to suit funds available.

J. The Owner reserves the right to award none, any one or more selected in any order, or all of the Alternates in combination with the work covered by the Lump Sum Base Bid. Alternates will not be awarded without awarding the Lump Sum Base Bid.

K. The Owner reserves the right to determine the low bid as the Lump Sum Base Bid alone or the sum of the Lump Sum Base Bid and any combination of Alternates it chooses to award. The bid documents will identify the evaluation method to be used for choosing the alternates for purposes of identifying the low bid

L. Each Alternate is intended to cover all of the work required for a complete finished job.

M. All Alternates are either "additive" or "deductive" or “No Change” (as appropriate) to the Lump Sum Base Bid. The amounts shall be quoted in the appropriate spaces provided on the form for the Bid for Lump Sum Contracts.

N. Failure to either quote an amount; select the “No Change” option or the insertion of the words "no bid," "none" or words of similar import, will be considered as not completing the Bid for Lump Sum Contract and may constitute disqualification of the entire bid at Owner's discretion

O. The Base Bid and the Alternates are exclusive in their scope of work. There is no overlap between or among the Base Bid and Alternates. The cost of any item of work shall be included only once, in the Base Bid or in the Alternates.

1.02 DESCRIPTION OF ALTERNATES

A. Alternate 1 (Bid #2 – Exterior Skin). Delete rigid insulation and supporting "zee" grid system retaining system at exterior metal panel cladding system as shown on the Drawings.

1. Add supplemental UV stable protective covering over self-adhering waterproofing membrane where membrane will be exposed to UV light after insulation is deleted.

2. Add Hygrothermal Composite Modeling to confirm that deletion of exterior insulation does not drive dew point to inside the exterior wall cavity. Use WUFI (Wärme und Feuchte instationär (Transient Heat and Moisture Transport)) modeling tool.

B. Alternate 2 (Bid #2 – Exterior Skin): Add an interior horizontal light shelf attached to interior side of curtain wall and storefront framing where shown on the Drawings and specified in Section 10 7173, "Sun Control Devices."

C. Alternate 3 (Bid #2 – Exterior Skin): Delete free standing partial exterior building mockup as specified in Section 01 4339, "Mockups."

D. Alternate 4 (Bid #2 – Exterior Skin): Glazing at Type M and M1 Windows.

1. Delete Glass Type GL-2B where noted.

2. Add Glass Type GL-2.

E. Alternate 5 (Bid #2 – Exterior Skin): Warranty at Glazed Aluminum Curtain Walls (Section 08 4413) and Metal Wall Panels (Section 07 4243): Increase Contractor written 5-year warranty to 10-year term.

F. Alternate 5A (Bid #2 – Exterior Skin): Delete specified louver at curtain walls as specified in Section 08 9110, "Metal Louvers," and replace with an acoustically rated aluminum louver with clear anodized finish; IAC "Slimshield" Model SL-100, or equal.

~~F.~~**G.** Alternate 6 (Bid #3 – Structure/Site Utilities/Waterproofing): Delete ground concrete finish at Lobbies and provide, in lieu of ground concrete finish, trowel finish with tooled joints, sealed.

~~G.~~**H.** Alternate 7 (Bid #3 – Structure/Site Utilities/Waterproofing): Delete waterproofing transition details at basement between Etcheverry Hall and new building and provide, in lieu of transition, replacement of waterproofing at Etcheverry Hall, new waterproofing at new building, and drainage composite between membranes.

I. Alternate 8 (Bid #4 - Balance of Trades): Delete Bridge connecting Jacobs Hall to Soda Hall at First Floor Level as shown on the Drawings including demolition, structural steel and finish alterations, and repairs required at Soda Hall.

J. Alternate 9A (Bid #4 - Balance of Trades): Delete wood wall paneling at interior Lobbies and Stairs. Finish gypsum board to Level 4 finish and add finish painting of gypsum board.

K. Alternate 9B (Bid #4 - Balance of Trades): Delete suspended wood ceiling where indicated on the Drawings. Add allowance for light fixture support and management system of electrical and low voltage distribution.

L. Alternate 10 (Bid #4 - Balance of Trades): Delete all casework at Lounge at each Floor. Add specified floor finish at locations where flooring casework is removed.

M. Alternate 11 (Bid #4 - Balance of Trades): Delete Display Case at Second Floor Lobby. Add painted steel cane rail below brace frame.

N. Alternate 12 (Bid #4 - Balance of Trades): Polished Concrete Floor Finish at First and Second Floor Lobbies: Provide smooth troweled concrete finish, sealed, at these locations.

END OF SECTION 01 2300

SECTION 01 2500
CHANGE ORDER PROCEDURES

1.01 SUPPLEMENTS

A. When construction changes are proposed, they will be originated with a Supplement issued by the Owner's Representative to the Contractor.

B. Supplements will be numerically sequential and may include multiple items.

C. Supplements may be issued due to changes requested in the project by the Owner, the Owner's Representative or the Contractor.

D. Supplements are not Change Orders, however, some Supplements may become Change Orders.

E. The Contractor shall prepare a Cost Proposal (backup) in response to the Supplements as rapidly and accurately as possible.

1.02 CONTRACTOR'S COST PROPOSAL (BACKUP)

A. Following receipt of a Supplement, the Contractor shall prepare an estimate of cost and time for execution of the proposed change which, if accepted, will become the backup for a Change Order (i.e., Cost Proposal).

B. The Cost Proposal shall identify each item of work affected by the proposed change, value of the change, and a summary of overhead, profit, total cost and any time extensions required.

C. Cost Proposals shall show, as applicable, General Contractor's, Subcontractor's, and Sub-Subcontractor's work. Cost Proposals shall also show detailed breakdown of material, labor, etc., plus applicable percentages for overhead and profit as provided in the General Conditions.

D. Contractor shall provide quotations for Supplements on Exhibit 7, Cost Proposal as provided in the Contract Documents. No other form of quotation will be accepted by the Owner's Representative. The Contractor may, however, attach additional documentation to Exhibit 7.

1.03 FIELD CLARIFICATIONS AND FIELD ORDERS

A. From time to time it may become necessary to issue field clarifications to the Contractor for minor changes not affecting Contract Sum or Contract Time.

B. Where the change affects the Contract Sum or the Contract Time, and to minimize delays, a Field Order may be issued.

C. A Field Order will be superseded by a Supplement and, subsequently, an executed Change Order.

1.04 CHANGE ORDERS

A. Change Orders will be numerically sequential and may include multiple change items.

B. Change Orders will reference (at a minimum):

1. Owner's Representative's Supplement Numbers and Dates,

2. Contractor's Cost Proposal Numbers and Dates,

3. Other applicable written documentation (i.e., meeting notes, Requests For Information, etc.).

C. All Change Orders will be appended with Contractor's Backup (Supplements, Cost Proposals, or any other written documents referenced in the Change Order).

D. Change Orders will adjust Contract Sum and Contract Time as applicable.

E. Following receipt and acceptance of Contractor's Backup, Change Orders will be prepared and issued by the Owner's Representative. The Owner's Representative will transmit the Change Order (with backup) to the Contractor for signature. The Contractor will then transmit the Change Order (with backup) to the Owner (labeled "Attention Project Manager") for final execution.

F. The Owner's Representative, the Contractor, and the Owner shall sign each original part of the Change Order in ink.

G. Upon execution by the Owner's Representative, Contractor and Owner, the Change Order will become part of the Contract Documents.

H. The Contractor will not bill for a Change Order on the Application For Payment prior to its execution by the Owner. The Owner's Representative will not approve the portion of any Application For Payment which bills for a Change Order not yet executed by the Owner.

1.05 PROJECT SCHEDULE

A. Contractor shall adjust his construction schedule to reflect fully-executed Change Orders (if any), in accordance with the General Conditions.

1. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

2. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

3. Promptly enter changes in Project Record Documents.

END OF SECTION 01 2500

SECTION 01 2973
SCHEDULE OF VALUES

1.01 REQUIREMENTS INCLUDED

A. Submit to the Owner's Representative a Schedule of Values, sequenced by subcontractor, allocated to the various portion of the Work, within 10 days of Notice to Proceed. Contractor shall update and expand Schedule of Values as Bid Packages are bid and new trades brought onto the project.

B. Upon request of the Owner's Representative, support the values with data which will substantiate their correctness.

C. The Schedule of Values, unless objected to by the Owner's Representative, shall be used only as the basis for the Contractor's Applications for Payment.

D. Related Requirements in other parts of the Project Manual.

1. Conditions of the Contract.

1.02 RELATED REQUIREMENTS

A. Work Schedule: Section 01 1100, “Summary of Work.”

B. Payment Application: General Conditions.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Contractor's standard forms and automated printout will be considered for approval by Owner's Representative if requested by the Contractor. The Owner's Representative reserves the right to reject the Contractor's automated print-out and require that the form and standards set herein are explicitly met. Identify schedule with:

1. Title of Project and location.

2. Owner’s Project number

3. Design Professional.

4. Name and address of Contractor.

5. Contract designation.

6. Date of submission.

B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the Table of Contents of this Project Manual as the format for listing component items.

1. Identify each line item with the number and title of the respective major sections of the specifications.

D. For each major line item list sub-values of major products or operations under the item.

E. For the various portions of the Work:

1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.

2. For items on which progress payments will be requested for stored materials, break down the value into:

a. The cost of the materials, delivered and unloaded, with taxes paid.

F. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.04 SUB-SCHEDULE OF UNIT MATERIAL VALUES

A. Submit a sub-schedule of unit costs and quantities for:

1. Products on which progress payments will be requested for stored products.

B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.

C. The unit quantity for bulk material shall include an allowance for normal waste.

D. The unit values for the materials shall be broken down into:

1. Cost of the material, delivered and unloaded at the site, with taxes paid.

2. Installation costs, including Contractor's overhead and profit.

E. The installed unit value multiplied by the quantity listed shall equal the cost of the item in the Schedule of Values.

END OF SECTION 01 2973

SECTION 01 3113
PROJECT COORDINATION

1.01 RELATED DOCUMENTS

A. "Big Event" Days: Minimize disruptions to participants in activities at UC Berkeley, see http://www.berkeley.edu/calendar/.

1.02 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to, the following:

1. General project coordination procedures.

a. Hot Work Permit procedures for Work in existing building.

2. Conservation.

3. Coordination Drawings.

4. Project meetings.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Schedules" for preparing and submitting the Contractor's Construction Schedule.

2. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field engineering services, including establishment of benchmarks and control points.

3. Division 1 Section "Contract Closeout" for coordinating Contract closeout.

1.03 COORDINATION

A. General Requirements:

1. Coordinate the Work and do not delegate responsibility for coordination to any subcontractor.

2. Anticipate the interrelationship of all subcontractors and their relationship with the Work.

3. Resolve differences or disputes between subcontractors concerning coordination, interference or extent of the work between sections.

4. Coordinate the work of subcontractors so that portions of the work are performed in a manner that minimizes interference with the progress of the work.

5. Do not obstruct spaces and installations that are required to be clear by Applicable Code Requirements.

6. Do not cover any piping, wiring, ducts or other installations until they have been inspected and approved and required certificates of inspection issued.

7. Remove and replace all work which does not comply with the Contract Documents. Repair or replace any other work or property damaged by these operations with no adjustment of Contract Sum.

8. Coordinate all portions of the Work requiring careful coordination in order to fit in space available. Before commencing such portions of the work, prepare supplementary Drawings for review by the Owner's Representative. This includes, but is not limited to, MEP, structural and sprinkler shop drawings, access door locations and hardware.

B. Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum accessibility of required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

C. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of the Owner and other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.

2. Preparation of the Schedule of Values.

3. Installation and removal of temporary facilities and controls.

4. Hot Work Permits for Work in existing buildings.

5. Delivery and processing of submittals.

6. Progress meetings.

7. Preinstallation conferences.

8. Project closeout activities.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with considerations given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

END OF SECTION 01 3113

SECTION 01 3117
COORDINATION DRAWINGS

1.01 SECTION INCLUDES

A. Provision of coordination drawings.

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Perform work by drafters capable of producing workmanship of specified quality.

B. The Architect will provide base CAD drawings for use by the Contractor for this purpose.

1.03 REFERENCES

A. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

B. All drawings must be 1/4"=1'-0' minimum. The scale must be sufficient to show detailed required to coordinate.

C. Create a match line for plans that reside on more than one page.

1.04 COORDINATION DRAWINGS

A. The following list, in descending order, is the precedence assigned to the work items for space priority. Recessed light fixtures and space for their installation has the first priority, material conveying systems have the second priority. An exception to the listing would be gravity flow requirements for plumbing waste and roof drainage. Fire Protection/ Sprinkler Heads and Fire Alarm Systems must be coordinated and approved by the Campus Fire Marshall. Access Panel quantities, sizes and locations must be coordinated with and approved by Owner's Representative.

1. Structure
2. Lighting Fixtures
3. Plumbing waste and roof drainage
4. Fire protection/Sprinkler Heads
5. Conveying systems
6. Diffusers
7. Ductwork and appurtenances
8. Access Panels
9. Fire Alarm System
10. HVAC piping

11. Plumbing vent and supply piping

12. Data Raceways

13. Electrical conduit

14. Sleeves through rated partitions.

15. Security Cameras/Motion Detectors

16. Exit Signs and associated junction boxes

17. Wireless Devices

B. At the initial coordination meeting, a designated subcontractor will be provided by Contractor with outline drawings showing column centerlines, interior partitions locations and ceiling heights. This subcontractor with reference and consideration to the other trades will draw to scale his proposed installation showing duct sizes, equipment layouts and dimensions from column lines and from finished floors. In congested areas, this subcontractor will prepare drawings in section view. Produce the layouts in sequence as mandated by the project schedule.

C. After the initial drawings for the earliest areas have been completed, the additional subcontractors will be given background sheets for their work. The major components to be included (but not limited to)

1. Roof drain leaders

2. Large waste piping

3. Sprinkler mains

4. Heating Hot water mains

5. Chilled water mains

6. Conveying systems

7. Significant conduit runs

8. Cable trays.

9. The information delineated will be distance from column center lines or agreed upon work point origin, pipe/equipment size and distance from finished floor to bottom of pipe/equipment.

D. After all subcontractors have finished their portion of the work, hold a meeting to identify and resolve areas of conflict. Keep records of the resolutions and distribute corrected drawings and meeting notes to all participants. In the event of changes to the work, revisions will be noted on the drawings and distributed to all affected parties.

E. The General Contractor shall call as many meetings with the subcontractors as are necessary to resolve any conflicts that become apparent. He will call on the services of the Consultant Engineer or Architect where necessary. The Contractor is responsible for the coordination of the Drawing or Drawings.

F. On resolution of the conflicts, each subcontractor shall enter his own work on the coordinate set which shall become the master or integrated Drawings. The master shall be signed by each contributing subcontractor to indicate his acceptance of the arrangement of the work.

G. A reproducible copy of the master integrated Drawing will be prepared. The Contractor will make distribution.

H. Each subcontractor shall prepare his Shop Drawings in accordance with the integrated Drawings. No work will be permitted without approved Shop Drawings. It is therefore essential that this procedure be instituted as quickly as possible.

I. After each floor is poured, the structure will be field verified and the coordination drawings will be updated accordingly to reflect any changes that may have occurred.

END OF SECTION 01 3117

SECTION 01 3119
PROJECT MEETINGS

1.01 PROCEDURE MEETING

A. After execution of the construction contract and typically prior to commencement of the Work, a procedure meeting (kick-off meeting) will be conducted by Owner to discuss procedures which are to be followed during performance of the Work. The Contractor and Owner's Representative shall be prepared to review job schedules, discuss various aspects of the work, and administrative procedures for smooth job progress.

B. Location: As designated by Owner.

C. Attending shall be:

1. Owner's Representative.
2. Owner.
3. Owner's Project Inspector.
4. Owner's Consultants and Owner's Representative's Consultants, as appropriate.
5. Contractor.
6. Contractor's Superintendent.
7. Subcontractors, as appropriate.
8. Others, as appropriate.

1.02 BILLING MEETING

A. A billing meeting shall be conducted by Owner's Representative each month prior to submittal of the Application For Payment.

B. Location: As designated by Owner's Representative.

C. Attending shall be:

1. Owner's Representative.
2. Owner.
3. Owner's Project Inspector
4. Owner's Consultants and Owner's Representative's Consultants, as appropriate.
5. Contractor.
6. Contractor's Superintendent.

7. Subcontractors, as appropriate.

8. Others, as appropriate.

1.03 PROGRESS MEETING

A. During the course of construction, progress meetings will be held to review progress of the work and resolve construction problems. The minutes of these meetings will be prepared by the Contractor and issued as expeditiously as possible to all Attendees.

B. Location: As agreed upon by Contractor and Owner's Representative.

C. Attending shall be:

1. Owner's Representative.

2. Owner.

3. Owner's Project Inspector.

4. Owner's Consultants and Owner's Representative's Consultants, as appropriate.

5. Contractor.

6. Contractor's Superintendent.

7. Subcontractors, as appropriate.

8. Others, as appropriate.

D. Agenda:

1. Review minutes of previous meeting.

2. Review of Work progress.

3. Field observations, problems, and decisions.

4. Identification of problems which impede planned progress.

5. Review of submittals schedule and status of submittals.

6. Maintenance of progress schedule.

7. Corrective measures to regain projected schedules.

8. Planned progress during succeeding work period.

9. Maintenance of quality and work standards.

10. Effect of proposed changes on progress schedule and coordination.

11. Other business relating to work.

1.04 SITE MOBILIZATION MEETING

A. Owner's representative will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance required:

1. Contractor.
2. Owner.
3. Owner's Representative.
4. Contractor's Superintendent.
5. Major Subcontractors.

C. Agenda:

1. Use of premises by Owner and Contractor.
2. Owner's requirements for partial occupancy prior to completion.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Security and housekeeping procedures.
6. Procedures for testing.
7. Procedures for maintaining record documents.
8. Requirements for start-up of equipment.
9. Inspection and acceptance of equipment put into service during construction period.

D. Owner's Representative will record minutes and distribute copies after meeting to Owner, Participants, and those affected by decisions made.

1.05 GUARANTEES, BONDS, AND SERVICE AND MAINTENANCE CONTRACTS REVIEW MEETING

A. Eleven months following the date of Beneficial Occupancy, Substantial Completion, if applicable, or Final Completion, a meeting shall be conducted by Owner for the purpose of reviewing the guarantees, bonds, and service and maintenance contracts for materials and equipment.

B. Attending shall be:

1. Owner.
2. Owner's Consultants, as appropriate.
3. Contractor.

4. Subcontractors, as appropriate.

5. Others, as appropriate.

END OF SECTION 01 3119

SECTION 01 3127
PROJECT DATABASE ADMINISTRATION

1.01 SUMMARY

A. This Section specifies the administrative provisions for the organization and use of the Project database for Work that includes delegated design.

B. Related Sections:

1. Section 01 3113 - Project Coordination.

2. Section 01 3128 - Project Database Management.

3. Section 01 3325 - Delegated Design

1.02 GENERAL INSTRUCTIONS

A. Comply with Division 01 requirements and documents referred to herein.

1.03 REFERENCES

A. Abbreviations:

1. CAD: Computer aided design.

2. CADD: Computer aided design and drafting.

3. CD: Compact disc.

4. FTP: File transfer protocol.

B. Definitions:

1. 2-D Database: A set of 2-dimensional CAD files, provided in AutoCad 2010 system software format in compliance with Project CADD Standards, as well as supplemental text files such as transmittals and notes for the use of data files. 2-D database is for information only. 2-D database is not part of the Contract Documents.

2. 3-D Database: A set of 3-dimensional electronic models, provided in Digital Project V1 release 4, Service Pack 7.1 and supplemental text files such as transmittals and notes for the use of data files, or other approved software.

3. Computer Distribution Media: FTP data transfer site which may include physical distribution media.

4. Contract Documents: As defined in Instructions to Bidders, which includes the Drawings, Specifications, and the 3-D database.

5. Physical Distribution Media: Data files provided by means other than direct FTP transfer, including magnetic tapes, disks or CDs.

6. Project Database: Computer files comprised of 3-D database and 2-D database electronic files and electronic documents including the Specifications.

7. BIM Standards: Consistent with National Building Information Modeling Standard, Version 1 Part 1: Overview, Principles, and Methodologies published by the National Institute of Building Sciences.

1.04 PROJECT DATA BASE

A. Ownership of Data: Project database, Drawings, electronic media, electronic forms and other similar terms are subject to terms and conditions for use per Division 01 and as listed below.

B. The Drawings, 3-D database, Specifications and other Contract Documents are complementary and together define the scope, design intent, and other Project requirements.

C. The Project utilizes the 3-D database as defined in computer notes contained on Drawings.

D. The 3-D database for the Project is divided into a number of parts or individual models. Each part contains a specific portion of the overall 3-D database such as structure, metal surfaces, glass surfaces and metal & glass patterns.

E. The 3-D database is not a comprehensive virtual model for the Project. Portions of the Project have been selectively modeled to provide an efficient means to describe the Project and document the geometry for dimensional control. Contractor shall notify Owner's Representative of discrepancies or conflicts between the 3-D database and other portions of the Contract Documents to the extent they are identified.

F. The 3-D database is of limited completeness and intended to be used by Contractor as follows:

1. To establish scope of represented elements.

2. As the dimensional control document for represented elements.

3. As a basis for the development of field lay-out, coordination and fabrication drawings of represented elements.

4. Visualization of elements and items that required coordination.

G. By using any such Project database, Contractor agrees to following Terms and Conditions for Use of the Design Professional's documents:

1. Authorized Use of Project database: 3-D database shall be used for establishing 3-dimensional geometries of represented surfaces and elements and their relationship to work points established in other Contract Documents. Contractor, its respective Trade Subcontractors, agents, or representatives are not entitled to rely on the detail or Specifications contained in the Project database for any other purposes. Contractor acknowledges the limited completeness for the data in the 3-D database and that the data is intended to complement and supplement but not necessarily supersede other Contract Documents, and understands the 3-D database is not complete and is not for erection or fabrication purposes in the form provided. The 2-D database is provided for Contractor information only and is not a Contract Document.

2. Unauthorized Use of Project Data Base: The Project database shall not be used by Contractor, or transferred to any other party, for use in other projects, additions to the current Project, or any

other purpose for which the material is not strictly intended by the Design Professional, without Design Professional's express written permission. An unauthorized modification or reuse of material is at Contractor's sole risk, and Contractor shall cause its Trade Subcontractors having access to the Project database to agree to defend, indemnify and hold the Design Professional harmless from claims, injuries, damages, losses, expenses, and attorney's fees arising out of the unauthorized modification or use of these materials. Project database as prepared by the Design Professional is provided solely as an instrument of the Design Professional's service and is protected by applicable laws and conventions. By delivering the Project database to the Contractor, the Design Professional and Contractor shall not expand in any manner the scope of services for which each was engaged pursuant to their Agreement, or in any manner alter the division of responsibilities between the Design Professional, Owner, and Contractor, as defined in their respective Agreements.

H. Contractor's Coordination Requirements: Before using the geometry control information contained in 3-D database for development of Contractor's engineering and Shop Drawings. Contractor shall

1. Exercise professional skill, care and judgment which can reasonably be expected from other Contractors in like circumstances, review and verify existing conditions and dimension; and coordinate with information in the Contract Documents prior to development of shop fabrications which define, control and/or regulate fabrication and erection of any component of the Project.

2. Read and abide by any provisions contained in electronic files that may be issued with each version of Project database released by Design Professional.

3. Take reasonable measures to prevent unauthorized access to or loss of the Project database.

4. Maintain an independent record of modifications of this Project database which may be processed by Contractor, its Trade Subcontractors, and their employees and agents.

5. Cause its Trade Subcontractors to be solely and exclusively responsible for the accuracy and adequacy of subsequent data, computer models or other electronic media developed by such Trade Subcontractors. Design Professional is not party to and has no control over the use of such Trade Subcontractor-generated media and by parties other than Trade Subcontractors.

6. Take appropriate action, by way of instruction or otherwise, with its Trade Subcontractors, employees and agents who have access to the Project database, to insure compliance with these conditions.

7. Submit copies of Contractor or Trade Subcontractor generated data, computer models or other electronic media for review prior to beginning fabrication operations. Design Professional may review and comment on such media at its option. This information is in addition to required shop drawing submittals.

I. Contractor also agrees to following provisions:

1. Verify locations of critical elements during and after installation, such as connection points between different materials and systems. Report items that vary from the Contract Documents. Notify and coordinate other subcontractors that are affected by mislocated elements.

2. Import data for control points, surfaces and lines of fabricated and installed Work into the 3-D database and place on separate levels designated by Design Professional.

3. Copy data files to Design Professional at Substantial Completion of the Work; coordinate with Section 01 7700, "Closeout Procedures."

4. Upon Design Professional's request, return original Project database and other papers, documents, materials and other property of Design Professional held by Contractor, Trade Subcontractors, employees and their agents in connection with the Project.

5. Provide data files to Design Professional containing notes, annotations and modeled electronic elements in the 3-D database format periodically during construction and at Substantial Completion of the Work showing as-built information or field conditions for Design Professional's use in updating 3-D database for Owner's future information.

J. Because information stored in the Project database can be modified by other parties, intentionally or otherwise, without notice or indication of said modification, Design Professional reserves the right to remove all indications of its ownership and/or involvement in the Project database from each electronic medium not held in its possession. Design Professional does not convey, nor does Contractor obtain any right, title, or interest in the Project database or any computer programs, Specifications, or data furnished or developed by Design Professional.

K. Contractor to recognize that designs, plans and data stored on electronic media, such as CD, magnetic tape, electronic hard drives, and project management websites, may be subject to undetectable alterations or uncontrollable or undetectable deterioration. Contractor therefore agrees that Design Professional is not liable for the completeness or accuracy of any materials provided on electronic media as caused by undetectable alterations or uncontrollable or undetectable deterioration. Project database and other Contract Documents are intended to be complementary to each other and do not necessarily supersede information contained elsewhere in the Contract Documents.

1.05 CONTRACTOR RESPONSIBILITIES

A. Contractor is the primary user and distributor of information and data contained in the Project database. Contractor has complete responsibility for determining its needs for and dissemination of information to Trade Subcontractors and their subcontractors and vendors that may not have direct access to Project database. This responsibility may include any of the following non-traditional tasks:

1. Bidding: Providing material take-offs for quantity, dimensions, and geometry of component elements of building for Trade Subcontractors and vendors who do not have 3-D database use capability.

2. Shop Drawings: Providing extractions and translation from Project database for use by Trade Subcontractors in preparation of shop drawings.

3. Coordination: Coordinating information from Trade Subcontractors including shop drawings and product data into coordination drawings required in Section 01360, Coordination Drawings.

B. FTP: Contractor shall distribute the Project database electronic data to the Design Professional, Trade Subcontractors, and others through Contractor's FTP site, physical distribution media, or the Owner's FTP site, physical distribution media, or other acceptable means.

C. Maintaining Data: Contractor maintains electronic copies of the Project database as required for record Contract Documents.

1.06 3-D DATA BASE ORGANIZATION

A. Organization of and contents of the 3-D database is noted in Drawings, described and listed within and in files attached to the 3-D database.

END OF SECTION 01 3127

SECTION 01 3128
PROJECT DATABASE MANAGEMENT

1.01 SUMMARY

A. This section specifies the administrative provisions for the Project database exchange, translation, transmission, revisions and change tracking.

B. Related Sections:

1. Section 01 3113 - Project Coordination.

2. Section 01 3127 - Project Database Administration.

3. Section 01 3325 - Delegated Design

1.02 GENERAL INSTRUCTIONS

A. Comply with Division 01 requirements and documents referred to herein.

1.03 REFERENCES

A. Abbreviations:

1. CAD: Computer aided design.

2. CADD: Computer aided design and drafting.

3. CD: Compact disc.

4. FTP: File transfer protocol.

B. Definitions:

1. 2-D Database: A set of 2-dimensional CAD files, provided in AutoCad 2010 system software format in compliance with Project CADD Standards, as well as supplemental text files such as transmittals and notes for the use of data files. 2-D database is for information only. 2-D database is not part of the Contract Documents.

2. 3-D Database: A set of 3-dimensional electronic models, provided in Digital Project V1 release 4, Service Pack 7.1 and supplemental text files such as transmittals and notes for the use of data files, or other approved software.

3. Computer Distribution Media: FTP data transfer site which may include physical distribution media.

4. Contract Documents: As defined in Instructions to Bidders, which includes the Drawings, Specifications and the 3-D database.

5. Physical Distribution Media: Data files provided by means other than direct FTP transfer, including magnetic tapes, disks or CDs.

6. Project Database: Computer files comprised of 3-D database and 2-D database electronic files and electronic documents including the Specifications.

7. BIM Standards: Consistent with National Building Information Modeling Standard, Version 1 Part 1: Overview, Principles, and Methodologies published by the National Institute of Building Sciences.

1.04 DATA EXTRACTION

A. Extractions shall not be obtained from Design Professional.

B. Different types of data may be extracted from 3-D database on building elements where it is Defined that 3-D database is an integrated part of Contract Documents. Use of these include:

1. To establish scope of represented elements.

2. As the dimensional control document for represented elements.

3. As a basis for the development of field lay-out, coordination and fabrication drawings of represented elements.

4. Visualization of elements and items that required coordination.

C. Contractor is responsible for determining what data is needed and extracting data accordingly.

1.05 DATA TRANSMISSION AND EXCHANGE

A. Project database issued to Contractor to be distributed through Owner's Project Management Data.

B. Exchange Web Site, the Owner's FTP site or by physical distribution media, if appropriate. An Excel spreadsheet titled "3-D Database Distribution Matrix" will be issued with 3-D database file transfers. This document lists current 3-D database file revision labels. Contractor to distribute Project database and other Contract Documents to Bidders, Trade Subcontractors, and other entities as required through a Contractor FTP site or other means.

C. 3-D database information exchanged with Design Professional to be delivered to Owner' Representative in Digital Project V1 release 4, Service Pack 7.1.

D. 2-D database information exchanged with Design Professional to be delivered to Owner' Representative in AutoCad 2010 system software format Project CADD Standards

1.06 REVISION AND CHANGE TRACKING

A. 3-D database files will be tracked by date and revision numbers contained in the filename. Current revision levels are documented in "3-D Database Distribution Matrix"; if any discrepancies are found please confirm latest revision level(s) with Design Professional. Model objects that are new or have been revised since the previous issue will be indicated in electronic files.

END OF SECTION 01 3128

SECTION 01 3213
SCHEDULING REQUIREMENTS

1.01 CONTRACT SCHEDULE

A. Submission:

1. Within 10 days after receipt of Notice to Proceed with Phase 2, submit detailed Preliminary Cost Breakdown with other required documents to Owner, and to Owner's Representative for approval.

2. Submit the Contract Schedule, in a form acceptable to Owner's Representative, within ten days of the date of commencement as specified in the Notice To Proceed.

3. The Owner's Representative will determine acceptability of the Contract Schedule within 7 days after its receipt.

4. No Application for Payment will be processed nor shall any progress payment become due until the Contract Schedule is accepted by the Owner's Representative.

5. Submit Material and Safety Data Sheets (MSDS) within ten days of the date of commencement as specified in the Notice To Proceed. MSDS must be kept on the job site throughout the course of work.

B. Form:

1. The Contract Schedule shall be a bar chart showing continuous flow from left to right. Specific calendar dates shall be clearly and legibly shown for the start and finish of each work activity. Activities shall be linked and a critical path clearly delineated for the project.

2. The Contract Schedule shall be suitable for monitoring progress of the Work, in sufficient detail to demonstrate adequate planning for the Work, and represent a practical plan to complete the work within the Contract time and within the dates shown on the Notice To Proceed.

3. Identify the following milestone event on the Contract Schedule:

   a. Order all equipment and start shop fabrication after signing the Construction Contract.
   b. Substantial Completion
   c. Temporary Certificate of Occupancy
   d. Certificate of Occupancy
   e. Final Completion

4. Determine in advance and allow for special events, final examinations or other activities where Owner will not permit noisy, dusty and disruptive construction work.

5. Identify all Owner holidays and non-working days on the Contract Schedule.

C. Activities:

1. Submit list of major Contractor-furnished equipment, materials and building elements, and scheduled activities requiring Owner's Representative's prior approval. Dates shall be shown for the procurement, fabrication, delivery and installation of major equipment, materials and building

elements, and for scheduled activities designated by Owner's Representative. A minimum of 14 days shall be allotted for the Owner's Representative to review each submittal.

2. Submit system test dates.

3. Submit Contractor's requests for designated working spaces, storage areas, access and other facilities to be provided by Owner.

4. Submit Contractor's request for orders and decisions that would be required from Owner's Representative on other designated items.

5. Provide dates for penetrating existing structures.

6. The presentation of each Work activity on the Contract Schedule shall include a brief description of the work activity, the duration of the work activity in days, and a responsibility code identifying the organization or trades performing the work activity.

D. Updating:

1. Review the Contract Schedule with Owner's Representative once each week to incorporate in the Contract Schedule all changes in the progress, sequences and scope of work activities.

2. Prepare and submit to Owner's Representative an updated Contract Schedule once each month, or as mutually agreed.

   a. The updated Contract Schedule shall accurately represent the as-built condition of all completed and in-progress work activities as of the date of the updated Contract Schedule.
   b. The updated Contract Schedule shall incorporate all changes mutually agreed upon by Contractor and Owner during preceding periodic reviews, and all changes resulting from Change Orders and Field Orders.
   c. Contractor shall perform the work in accordance with the updated Contract Schedule. Contractor may change the Contract Schedule to modify the order or method of accomplishing the work only with prior agreement by Owner's Representative.

3. Contractor shall submit the updated Contract Schedule, in the form acceptable to Owner's Representative, at least 7 days prior to submitting the Application for Payment.

4. The Owner's Representative will determine acceptability of the updated Contract Schedule within 7 days after its receipt.

5. No Application for Payment will be processed nor shall any progress payments become due until updated Contract Schedules are accepted by the Owner's Representative.

6. The accepted, updated Contract Schedule shall be the Contract Schedule of record for the period it is current and shall be the basis for payment during that period.

END OF SECTION 01 3213

SECTION 01 3300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for submitting the following:

1. Shop Drawings
2. Product Data
3. Samples
4. Delegated Design
5. Coordination
6. Schedules
7. Personnel identifications
8. Requests for Information (RFI's)
9. Other miscellaneous submittals.

B. See Division 01 Section "Schedules" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.

C. See Division 01 Section "Quality Control" for submitting test and inspection reports and Delegated-Design Submittals and for erecting mockups.

D. See Division 01 Section "Contract Closeout" for submitting operation and maintenance manuals.

E. See Division 01 Section "Shop Drawings, Product Data and Samples" for submitting Shop Drawings, Product Data and Samples.

1.02 DEFINITIONS

A. Action Submittals: Written and graphic information that requires responsive action from Owner's Representative.

B. Informational Submittals: Written information that does not require approval of Owner's Representative. Submittals may be rejected for not complying with requirements.

1.03 SUBMITTAL PROCEDURES

A. General: Electronic media used in preparation of Drawings and Specifications will be provided for Contractor's convenience and use under conditions specified below; see attached "Electronic Media Agreement."

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Owner's Representative reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule:

1. Contractor shall provide a Submittal Schedule to the Owner's Representative for approval no later than 10 days after the date of commencement specified in the Notice To Proceed for Phase 2.

2. The schedule for submission of Shop Drawings, Product Data, and Samples by Contractor (the "Submittal Schedule"), and their processing and return by Owner's Representative, shall be agreed upon by both parties in order that the items covered by these submittals will be available when needed by the construction process and so that each party can plan its workload in an orderly manner.

3. Contractor shall prepare the Submittal Schedule in the format contained in the Exhibits and coordinate it with the Contract Schedule. No submittals will be processed before the Submittal Schedule has been submitted to and accepted by Owner's Representative, except in such cases where the processing of submittals is required before the acceptance of the Submittal Schedule.

4. In preparing the Submittal Schedule, Contractor shall first determine from the Contract Schedule the date the particular item is needed for the Work. Working backwards, Contractor shall add the required number of days for shipment, time for fabrication, and similar items to determine the date of the first submittal.

5. The Submittal Schedule shall be adjusted to meet the needs of the construction process and Contract Schedule. Submit 2 copies (minimum) of the Submittal Schedule after it is completed and each time it is updated by Contractor.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Owner's Representative's receipt of submittal.

1. Initial Review: Allow 15 calendar days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Owner's Representative will advise Contractor when a submittal being processed must be delayed for coordination.

2. If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Allow 15 calendar days for processing each resubmittal.

4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

5. Timing: any submittal or RFI received after 3:00 pm will be considered to have been delivered at 8 am the following working day. As an example: submittals received at 4 pm Friday will be considered to be received at 8:00 am Monday.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by the Design Professional.

3. Include the following information on label for processing and recording action taken:

4. Project name.

a. Date.
b. Name of Design Professional.
c. Name of Contractor.
d. Name and address of subcontractor.
e. Name and address of supplier.
f. Name of manufacturer.
g. Unique identifier, including revision number.
h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.
j. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Design Professional observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Owner’s Representative will return submittals, without review, received from sources other than Contractor.

1. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Design Professional in connection with construction.

1.04 ELECTRONIC SUBMISSIONS

A. The following submittals may be submitted electronically:

1. Transmittals for all communication
2. Product Data
3. Meeting Agenda & Minutes.
4. RFI (Requests for Information)
5. CCD (Construction Change Directives)
6. Punch Lists
7. Daily reports

B. Electronic submittals shall be directed to an E-mail address as directed at the Preconstruction Meeting and shall utilize E-mail format distributed to the Contractor.

C. Electronic submittals will be returned to the Contractor will be returned electronically with the exceptions of samples color charts and O&M Manuals.

D. When utilizing electronic submittal process the Contractor is only required to submit one copy and only one copy will be returned electronically for revisions or distribution.

E. Electronic Document Format:

1. Submit information in one of the following formats:
2. PDF is the preferred format.
3. Microsoft word for PC
4. Returned Items will be sent in PDF Format.
5. Size Printable to a minimum of 8-1/2" x 11" and a maximum size of 24" x 36".
6. Each document shall be printable in a clear and thorough manner.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit six copies of each submittal, unless otherwise indicated on approved "Submittal Matrix" of Submittal Schedule. Owner's Representative will return four copies. Mark up and retain one returned copy as a Project Record Document.
2. See section 01 3323 for information concerning Shop Drawings, Product Data and Samples.

2.02 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Owner's Representative will not return copies.

2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates and Licenses: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

H. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

I. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

J. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

M. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."

N. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

O. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.

P. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections.

Q. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

R. Material Safety Data Sheets (MSDSs): Maintain separate file at job site; do not submit to Owner or Owner's Representative.

1. Owner's Representative will not review submittals that include MSDSs and will return them for resubmittal.

2.03 DELEGATED DESIGN

A. See specification section 01 3325.

2.04 COORDINATION

A. General: Comply with requirements in Division 1 Section "Project Coordination."

B. Coordination Drawings: See Section 01 3117.

2.05 PERSONNEL IDENTIFICATION

A. Key Personnel Names: Within 15 calendar days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

2.06 REQUESTS FOR INFORMATION (RFIS)

A. Procedure: Immediately on discovery of the need for information regarding the Contract Documents, and if not possible to request information at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item and the following:

1. Project name.

2. Date.

3. Name of Contractor.

4. Name of the Ownery's representative.

5. RFI number, numbered sequentially.

6. Specification Section number and title and related paragraphs, as appropriate.

7. Drawing number and detail references, as appropriate.

8. Field dimensions and conditions, as appropriate.

9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

10. Contractor's signature.

11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

12. Identify each page of attachments with the RFI number and sequential page number.

C. The Owner's Representative will review each RFI, determine action required, and return it. Allow five working days for Owner's Representative's response for each prioritized RFI. Response time for non-prioritized RFIs may be up to 10 working days. RFIs received after 3:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Owner's Representative's actions on submittals.
    f. Incomplete RFIs or RFIs with numerous errors.

2. The University representative's action may include a request for additional information, in which case The University representative's time for response will start again.

3. The Owner's Representatives' action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify The Owner's Representative in writing within 10 days of receipt of the RFI response.

D. On receipt of The University representative's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify The Owner's Representative within seven days if Contractor disagrees with response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Owner's Representative.

B. Determine and Verify:

1. Field measurements.

2. Field construction criteria.

3. Catalog numbers and similar data.

4. Conformance with Contract Documents.

C. Coordinate each submittal with requirements of the Work and of the Contract Documents.

D. Notify Owner's Representative in writing, at time of submission, of any changes in the submittals from requirements of the Contract Documents.

E. Begin no fabrication or Work which requires submittals until the return of Owner's Representative's final reviewed submittals.

F. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

G. The following language will be acceptable: The undersigned, acting on behalf of the Contractor, certifies that this submittal has been reviewed and is approved; products have been verified as being as specified, field measurements and field construction criteria have been or will be coordinated, and the submittal is in compliance with Contract Documents.

3.02 THE OWNER'S REPRESENTATIVE'S ACTION

A. General: The Owner's Representative will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: The Owner's Representative will review each submittal, make marks to indicate corrections or modifications required, and return it. Design Professional will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Review of submittals is only for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. The review does not affect the Contractor's responsibility to perform all Contract requirements with no change in Contract price or time. Any actions shown by the Design Professional are subject to the requirements of the plans, specifications and other Contract Documents. The Contractor is responsible to confirm and correlate dimensions at the site, for information that pertains to the fabrication processes, for the means, methods, techniques, procedures, sequences and quantities necessary to complete the Contract and for coordination of the work of all trades and satisfactory performance of its work. The review by the Design Professional is undertaken solely to satisfy Design Professional's obligations, if any, to the Owner and shall not give rise to any claim by the Contractor or other parties against the Design Professional or Owner.

C. Informational Submittals: The Owner's Representative will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. The Owner's Representative will forward each submittal to appropriate party.

D. Submittals not required by the Contract Documents will not be reviewed and may be discarded

E. Deficient submittals will be returned with "Revise and Resubmit" to the Contractor. Additional review of the same submittal will be billed to the Contractor at the University representative's normal billing rate for time expended. Revised and resubmitted submittals will not be grounds for time or fee extension.

3.03 CONTRACTOR'S USE OF ARCHITECT'S ELECTRONIC MEDIA

A. General: At Contractor's written request, copies of Design Professional's electronic media will be provided to Contractor for Contractor's convenience and use in connection with Project.

END OF SECTION 01 3300

SECTION 01 3323
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.01 REQUIREMENTS INCLUDED

A. Shop Drawings, Product Data, and Samples, other than in connection with proposed substitutions, shall be submitted to Owner's Representative only when specifically required; and Owner's Representative will not review any other such submittals. Product Data and Samples for proposed substitutions shall be submitted to Owner's Representative in accordance with Section 01 6250. Contractor shall be responsible for obtaining such copies of Shop Drawings, Product Data, and Samples as it may require for its own use.

1.02 RELATED REQUIREMENTS

A. Related Sections:

1. 01 3300 - Submittal Procedures

2. 01 6250 - Product Options And Substitutions

B. Definitions:

1. The terms "Shop Drawings" and "Product Data" as used herein also include, but are not limited to, fabrication, erection, layout and setting drawings, manufacturers' standard drawings, descriptive literature, catalogues, brochures, performance and test data, wiring and control diagrams, all other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment, or systems and the positions thereof conform to the Contract Documents.

2. As used herein, the term "manufactured" applies to standard units usually mass-produced. The term "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements. Shop Drawings shall establish the actual detail of all manufactured or fabricated items, indicate correct relation to adjoining Work, and amplify design details of mechanical and electrical equipment in accurate relation to physical spaces in the structure.

C. Manufacturers' Instructions: Where any item of Work is required by the Contract Documents to be furnished, installed, or performed in accordance with a specified product manufacturer's instructions, Contractor shall procure and distribute the necessary copies of such instructions to Owner's Representative and all other concerned parties; and Contractor shall furnish, install, or perform the Work in strict accordance therewith.

1.03 SHOP DRAWINGS

A. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.

d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Notation of coordination requirements.
j. Notation of dimensions established by field measurement.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

1.04 PRODUCT DATA

A. Preparation: Collect information into a single submittal for each element of construction and type of product or equipment.

B. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

C. Mark each copy of each submittal to show which products and options are applicable.

D. Include the following information, as applicable:

1. Clearly mark each copy to identify pertinent products or models.

2. Manufacturer's written recommendations.

3. Manufacturer's product specifications.

4. Manufacturer's installation instructions.

5. Manufacturer's catalog cuts.

6. Wiring diagrams showing factory-installed wiring.

7. Printed performance curves.

8. Operational range diagrams.

9. Compliance with recognized trade association standards.

10. Compliance with recognized testing agency standards.

E. Modify the Drawings and other diagrams to delete information which is not applicable to the Work.

F. Supplement standard information to provide information specifically applicable to the Work.

1.05 SAMPLES

A. Samples: Submit full-size units of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, partial sections of manufactured or fabricated components; small cuts or containers of

materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

B. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

C. Field Samples and Mock-Ups: As specified in Divisions 2 through 33.

1.06 DESIGN DATA AND CALCULATIONS

A. Where required by specification sections provide basic calculations, analyses, and data to support design decisions and demonstrate compliance with specified requirements. State assumptions and define parameters. Give general formulas and references. Provide sketches as required to illustrate design method and application.

B. Arrange calculations and data in a logical manner with suitable text to explain procedures and order.

C. Indicate name, title, and telephone number of individual performing design and include professional seal of designer where applicable or required.

1.07 DELEGATED DESIGN

A. See specification section 01 3325.

1.08 CONTRACTOR'S REVIEW OF SUBMITTALS

A. See specification section 01 3300.

1.09 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with the Submittal Schedule and in such sequence as to cause no delay in the Work or in the work of any separate contractor.

B. Number of Submittals Required:

1. Shop Drawings: Submit one (1) reproducible transparency and two (2) opaque reproductions. After checking, Owner's Representative will make prints for itself, consultants, and Owner and then return the reproducible copy to Contractor. Contractor shall make prints as it requires for its use and for Subcontractors' use.

2. Product Data and Non-Reproducible Submittals: Submit the number of copies which Contractor will need, plus 4 copies (minimum) which will be retained by Owner's Representative.

3. Samples: Submit the number specified in the Section which requires them.

C. Submittals shall contain:

1. Date of submission and dates of any previous submissions.

2. Project name and number.

3. Contract identification.

4. The names of:

    a. Contractor.
    b. Subcontractor.
    c. Supplier.
    d. Manufacturer.

5. Identification of the product, with the Specification Section number.

6. Field dimensions, clearly identified as such.

7. Relation to adjacent or critical features of the Work or materials.

8. Reference standards, such as ASTM or Federal Specification numbers.

9. Identification of changes from requirements of the Contract Documents.

10. Identification of revisions on resubmittals.

11. A 4-inch x 5-inch blank space for review stamps.

12. Contractor's stamp, initialed or signed, certifying to the review of submittal; verification of materials and field measurements and conditions; and compliance of the information within the submittal with requirements of the Work and of the Contract Documents.

D. Resubmission Requirements:

1. Shop Drawings and Product Data:

    a. Revise Shop Drawings or Product Data, and resubmit as specified for the initial submittal.
    b. Identify any changes which have been made other than those requested.
    c. Note any departures from the Contract Documents or changes in previously reviewed submittals which were not commented upon by Owner's Representative.

2. Samples: Submit new samples as required for initial submittal.

E. Distribution:

1. Owner's Representative will distribute approved Shop Drawings, Product Data and Samples, (all of which carry Owner's Representative's review stamp) to the following:

    a. Owner - 2 copies minimum
    b. Contractor - 2 copies minimum
    c. Owner's Representative - 2 copies minimum

F. Owner's Representative's Review:

1. Owner's Representative will review Contractor's submittals, such as Shop Drawings, Product Data, and Samples, for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or

systems, all of which remain the responsibility of Contractor as required by the Contract Documents.

END OF SECTION 01 3323

SECTION 01 3325
DELEGATED DESIGN

1.01 SUMMARY

A. For certain components of the Work of the Contract the Contractor is required to provide professional engineering design and obtain necessary approval of regulatory agencies. The Contractor shall be responsible for the design, calculations, submittals, and permits, for these Delegated Design components. The Contractor is responsible to submit all Delegated Design documents required for approval by regulatory agencies for each Delegated Design item.

B. Review of Submittals: For compliance with design intent and shall neither lessen nor shift the responsibility from the Contractor, or their lower tier contractor, to the Owner or the Owner's consultants. The Owner shall not be responsible to neither pay for costs nor damages due to failure by the Contractor to coordinate delegated design work with the work of the Project.

C. Follow the requirements of the Authority Having Jurisdiction over the Work current at the time of submission. The Contractor is responsible to coordinate and submit all material required by the AHJ, so review and processing of submittals and permits will not adversely affect the construction schedule. Each Delegated Design item requiring review by the AHJ must be provided by the Contractor and all fees and costs associated therewith shall be the Contractor's responsibility at no additional cost to the Owner.

D. Components of the Work to which delegated design requirements apply: As required in individual technical Sections of the Specifications.

1.02 DEFINITIONS

A. Delegated Design Work: Design services and certifications provided by a Professional and or Structural Engineer registered in California related to systems, materials or equipment required for the Work to satisfy design and performance criteria established by the Contract Documents. Delegated Design does not include professional services the Contractor needs to fulfill their responsibilities under the Contract including but not limited to construction means, methods and sequence.

B. Seal: Certification that delegated design plans, computations and specifications were designed and prepared under the direct supervision of the architect or engineer whose name appears thereon.

1.03 DESIGN REQUIREMENTS

A. As required in individual technical Sections of the Specifications.

1.04 SUBMITTALS

A. Document compliance with design and performance requirements. Provide calculations, details, fabrication and assembly information, and demonstrate coordination with supporting work and other components to be integrated into Delegated Design Assemblies. Submittals required to be prepared under the control of the Delegated Design Engineer shall bear the professional stamped and signature of the responsible design professional.

B. Submittals not stamped and signed by the Delegated Design Engineer, incomplete submittals, and submittals that have not been reviewed by the Contractor will be rejected.

C. Delegated Design Summary Sheet: List entities to whom the Contractor has assigned Delegated Design responsibilities and the registered engineers' name and contact information.

D. Delegated Design Documents: Prepared under the direct supervision and control of the Delegated Design Engineer for the subject work, who shall stamp and sign drawings, calculations and other documentation as required. Provide all documentation necessary for complete and concise documentation for the Delegated Design work. Show all members, dimensions, connections, materials used. Indicate how the component or assembly is attached to the main structure, reactions associated with those connections.

1. Shop drawings and erection drawings are not acceptable as Delegated Design drawings.

2. All Delegated Design Documents shall be developed in BIM software compatible with the Building Information Model issued by the Owner's Design Professional consultant, and shall be coordinated by the Contractor with all interfacing and applicable building elements. Final Delegated Design Documents representing As-Built conditions shall be provided to the Owner as required in the General Conditions.

E. Two sets of calculations including criteria, design assumptions, substantiating computations and such additional data sufficient to show the correctness of the documentation and compliance with the applicable codes and regulations.

1.05 DELEGATED DESIGN SCHEDULE

A. The above performance and design criteria applies to, but not limited to, Work of the following:

1. Section 05 5000 - Metal Fabrications

2. Section 05 5100 - Metal Stairs

3. Section 07 4243 - Metal Wall Panels

4. Section 07 8400 - Firestopping

5. Section 08 4213 - Aluminum-Framed Entrances

6. Section 08 4313 - Aluminum-Framed Storefronts

7. Section 08 4226 - All-Glass Entrances

8. Section 08 5113 - Aluminum Windows

9. Seismic Restraint for Mechanical Equipment

10. Supporting Devices

11. Seismic Restraint for Electrical Equipment

1.06 QUALITY ASSURANCE

A. Delegated Design Submittals: Approved by Regulatory Authorities and the Owner's Representative prior to starting fabrication of the work regardless of whether a building permit has been previously issued.

B. Where the Contractor is required to provide services of a licensed design professional the Contract Documents will establish design and performance criteria the work must satisfy.

C. Except for field quality assurance testing specified to be performed by the Owner, provide laboratory and field tests to establish performance characteristics of Delegated Design work at no additional Cost to the Owner.

END OF SECTION 01 3325

SECTION 01 3527
GUIDELINES FOR OPERATIONS DURING A PROTEST

1.01 PROJECT SECURITY

A. Project security is the responsibility of the Contractor. However, there may be occasions where campus events elicit a protest response from campus and community constituencies. If protests occur at the project site, the Owner will insure a safe work environment for construction activities. If the safety of the site cannot be assured by the Owner (both for the construction personnel and for the equipment and materials), the Contractor will be directed to vacate the project site and asked not to return until the site can be secured.

1.02 PROCEDURES DURING A PROTEST

A. Known Protests (Most Common):

1. In most cases, protests will be anticipated. Information is provided in advance to the University of California Police Department (UCPD), or the assemblage can be seen from the project site. Under these conditions, UCPD will dispatch officers to the site. UCPD will notify the Project Manager who will contact the On Site Project Coordinator. Once on site, the supervising UCPD officer will introduce himself to the Contractor's Superintendent, the On Site Project Coordinator and a review of the situation will be made. The supervising UCPD officer will determine if the Contractor should cease work in certain areas, relocate his work forces, or vacate the premises. The Project Inspector and the On Site Project Coordinator will document the action in their daily report(s), and consideration may be given to the Contractor for an extension of contract time and/or cost. Any extension of contract time and/or cost will be by an executed Change Order.

B. Unknown Event:

1. In the event that protest activities occur without prior notification and consultation with UCPD, the Contractor is to cease all work activities that may directly or indirectly cause harm to a worker or protestor. The Contractor should leave the affected area, and if possible, remove tools, equipment and construction materials. The Constructor's Superintendent will notify the Project Manager and the On Site Project Coordinator of the event. The Project Inspector and the On Site Project Coordinator will record this activity in his (or "their") daily report(s) and consideration may be given to the Contractor for an extension of contract time and/or cost.

C. If the Contractor is prevented from vacating the affected area by protestors, it shall be the responsibility of UCPD to provide safe egress for the Contractor.

D. Under no circumstances is the Contractor to confront protestors, incite activity, or physically impede their intended activity.

E. The Contractor shall be aware of the work area and cognizant of any unusual visitors to the project site.

F. Due to the location of this project, jurisdiction is as follows:

1. On-Site Events:

University of California Police Department (Non-Emergency)
(510) 642-6760

2. Off-Site Events:

   City of Berkeley Police Department (Non-Emergency)
   (510) 644-6743

3. Emergency:

   911

END OF SECTION 01 3527

SECTION 01 3543
ENVIRONMENTAL CONSIDERATIONS

1.01 CODES

A. California Code of Regulations, Title 23, Waters

B. California Fish and Game Code

C. California Government Code

D. California Health and Safety Code

E. California Penal Code

F. California Public Resources Code

G. California Water Code

H. Federal Clean Water Act

I. Federal Endangered Species Act

J. Federal Rivers and Harbors Act

K. National Flood Disaster Prevention Act

L. National Flood Insurance Act

M. National Historic Preservation Act

1.02 WATER QUALITY

A. San Francisco Bay Basin Regional Water Quality Control Plan Policies:

1. Improper disposal of excess or remnant materials or chemicals is prohibited. No materials such as paint, stucco, plaster, cement slurry, oil, solvents, or other residual materials shall be disposed of directly to surface waters or wetlands or indirectly to surface waters via catch basins or any other outside storm drain. No material other than uncontaminated surface water runoff is allowed to enter the storm drain system. Residual materials or runoff from on-site cleaning of equipment, tools, brushes, etc. shall not be allowed to enter surface waters either directly or via the storm drain system.

1.03 EROSION CONTROL

A. San Francisco Bay Basin Regional Water Quality Control Plan Policies:

1. If possible, construction activities involving grading, excavation, or other severe soil disturbance shall be timed so as to coincide with dry weather. This will minimize erosion and expedite the construction process. Appropriate erosion control measures must be taken if work is to be performed during the rainy season.

2. Standard erosion control practices will be implemented to control site runoff and prevent soil erosion during the rainy season. The erosion control methods chosen will depend on the specific site. The following standard erosion control policies should be adhered to:

    a. The amount of land exposed at any time during construction should be minimized.
    b. The period of exposure for land under construction should be kept to the shortest period that is practical.
    c. Temporary vegetation or mulch should be used to stabilize critical areas where staging of construction cannot avoid a time lag prior to permanent cover for exposed lands.
    d. Reasonable measures should be taken to prevent the transport of sediment by runoff from sites under construction.
    e. Permanent final vegetation and structures should be installed as soon as practical in the construction process.
    f. Wherever feasible, natural vegetation should be retained and protected.

3. Unnecessary soil disturbance is prohibited. This includes undue exposure or stripping of bare soils, soil compaction, or unnecessary alteration of existing grades or slopes. Where grading is necessary, practices should minimize erosion potential and facilitate vegetative establishment, if appropriate. Site grading should be performed in stages if possible in order to more effectively control erosion. Slope gradients and lengths should be kept to a minimum and terraces should be installed on long slopes. A terrace should be graded back towards the slope and drain with a gentle gradient to a stable outlet. The surfaces of cut and fill slopes should be left rough or be serrated so that they hold seeds well and allow for good vegetative establishment, if appropriate.

4. Development should fit the existing topography and soils as much as possible to minimize land disturbance and erosion potential. Grading that will result in radical loss of vegetation and/or topsoil should be avoided or re-evaluated. Grading that will interrupt natural drainage patterns or result in aesthetic degradation should be avoided. Grading on steep slopes (greater than 25%) should be avoided.

1.04 CREEKS AND WETLANDS

A. San Francisco Bay Basin Regional Water Quality Control Plan policies:

1. Physical alteration of creek channels shall be avoided unless there is no practical alternative. Alteration includes culverting, channelization, channel confinement, extensive bridging or lining of the steambed or banks with concrete or other artificial materials. Diversion, realignment or other alteration of the natural path of creek channels is prohibited. Excavation or filling of any creek channel, marsh, or any wetland area is prohibited.

2. Encroachment upon creekside areas or wetlands shall be avoided. An undistributed buffer zone shall be maintained between buildings or structures and creek or wetlands areas. Vegetation disturbance or alteration shall be avoided in these natural areas.

3. An undisturbed buffer zone shall be maintained between construction site activities and creek or wetland areas. Storage or staging areas for equipment, building materials, chemicals, etc., shall be located as far away as is practical from creek or wetland areas.

4. Excavation or filling or other disturbance of streambeds, streambanks, or wetlands during construction is prohibited. Siltation or sedimentation of creek channels or wetlands as a result of site runoff or grading is prohibited.

1.05 SENSITIVE AREAS

A. Bay Conservation and Development Commission Act (Government Code Section 6660 et seq.):

1. Unnecessary vegetation disturbance is prohibited. This includes unnecessary stripping, removal, trampling, or other damage. Compaction, excavation, paving, or addition of soil (filling) of root zone areas within the drip line (generally the area surrounding the stem roughly equal to the diameter of the canopy) of permanent vegetation is prohibited. Vegetation that must be removed will be left on the site as long as possible.

2. Development shall not be detrimental to known endangered plant or animal species or their critical habitats or migration routes. In general, wildlife habitat should be preserved and enhanced to the extent possible.

3. Activities within 100 feet of the high tide mark of San Francisco Bay including dredging or filling, grading, or substantial change in land use requires the approval of the San Francisco Bay Conservation and Development Commission.

END OF SECTION 01 3543

SECTION 01 3560
SPECIAL ENVIRONMENTAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Work includes special environmental "Green" building practices related to indoor air quality and resource efficiency.

B. LEED™ Rating: This project is seeking certification in the LEED™ Rating System for New Construction and Major Renovation, sponsored by the U.S. Green Building Council.

1.02 RELATED REQUIREMENTS

A. Section 01 3543: Environmental Considerations.

B. Section 01 7300: Execution Requirements.

C. Section 01 5010: Contractor's Use of the Project Site

D. Section 01 7700: Closeout Procedures

E. Section 01 7418: Construction and Demolition Waste Management

F. Division 23: HVAC (Design-Build) and University of California Berkeley guidelines for General Commissioning Requirements.

1.03 ENVIRONMENTAL GOALS

A. General Environmental Goals:

1. Refer to specific Specifications sections for more detailed construction requirements related to specific materials and systems.

a. Energy Efficiency (Throughout Project Life): Materials and systems are intended to maximize energy efficiency for operation of Project throughout service life (substantial completion to demolition).
b. Indoor Air Quality: Materials are selected and processes specified, such as preconditioning and temporary ventilation, to maximize healthy indoor air quality.
c. Resource Efficiency (Project Construction): Materials and systems are intended to maximize environmental construction techniques, including waste recycling, reusable delivery packaging, and reusability of selected materials.

B. LEED Rating: The Owner's goal is, at minimum, a LEED Silver level rating, but Gold level rating is desired. See attached LEED checklist.

C. Contractor and Subcontractors shall provide LEED Certification administration services, including tracking and documentation in support of construction-related LEED credits.

1. Anticipated LEED credits directly related to construction includes, but is not necessarily limited to:

a. Sustainable Sites

1) Prerequisite 1: Construction Activity Pollution Prevention

b. Energy and Atmosphere

1) Prerequisite 1: Fundamental Building Commissioning (provide support to Commissioning Agent – see Section 23 08 00)

c. Materials and Resources

1) Credit 2: Construction Waste Management (Divert at least 90 percent of construction, demolition and packaging debris from landfill)
2) Credit 4: Recycled Content (Use over 20 percent Recycled Material)
3) Credit 5: Regional Materials (20 percent of materials to be extracted, processed and made within a 500 mile radius)
4) Credit 6: Rapidly Renewable Resources
5) Credit 7: Certified Wood

d. Indoor Environmental Quality

1) Credit 3.1: Construction IAQ Management Plan, during construction
2) Credit 3.2: Construction IAQ Management Plan, before occupancy
3) Credits 4.1 – 4.4: Low-emitting Materials

D. The Construction Team is encouraged to participate to the maximum degree possible to realize Owner's environmental goals.

1. Contract Documents are not intended to limit alternative means of achieving environmental goals.
   a. Suggestions from Contractor, subcontractors, suppliers, and manufacturers for implementing goals are encouraged; team approach is also encouraged.

~~**1.04 REGULATORY REQUIREMENTS**~~

~~A. Cal Green: Comply with all requirements of current edition of California Green Building Standards (CGBS Cal Green) Mandatory Requirements for Non-residential Occupancies. Requirements include, but are not limited to:~~

~~1. CGBS 5.504.4: Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, caulks and aerosol adhesives and smaller unit sizes of adhesives and sealant or caulking compounds shall comply with VOC limits indicated.~~

~~2. Architectural paints and coatings shall comply with Table 5.504.4.3.~~

~~3. CGBS 5.504.4.3.1: Aerosol paints and coatings shall meet specified requirements. Verification of compliance shall be submitted.~~

~~4. Carpet Installation: All carpet installed in the building interior shall:~~

~~a. Meet the testing and product requirements of one of the standards listed in CBS 5.504.4.4.~~

~~b. Meet the requirements of the Carpet and Rug Institute Green Label program CGBS 5.504.4.4.1.~~

~~c. All carpet adhesive shall meet the requirements of CGBS Table 5.504.4.~~

~~5. Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde per CGBS Table 5.504.4. Verification of compliance shall be provided.~~

~~6. Resilient flooring systems shall comply with the VOC emission limits per CGBS 5.504.4.6. Verification of compliance shall be provided.~~

~~1.05~~1.04 SUBMITTALS

A. LEED™ Documentation: Submit the following in compliance with LEED™ Rating System for New Construction and Major Renovation Reference Guide, 2009 Edition. The following is a summary of submittal requirements. Contractor shall be responsible to meet all LEED submittal requirements for relevant credits per the LEED Reference Guide.

1. Sustainable Sites Prerequisite 1: Construction Activity Pollution Prevention Plan: Submit LEED letter template and related documentation.

    a. Copies of project drawings to document erosion and sedimentation control measures implemented.
    b. Confirmation of compliance path taken by project.
    c. Narrative describing the Erosion and Sedimentation Control Plan implemented for the project.

2. Materials and Resources Credit 2 – Construction and Waste Management: Refer to Section 01 7419.

3. Materials and Resources Credits 4 - Recycled Content: Submit LEED letter template and related documentation indicating the sum of post-consumer recycled content, plus one-half of the pre-consumer content. Project goal: Greater than 20 percent of materials used based on material cost.

    a. Provide total project materials cost by Division.
    b. Provide tabulation of each material used, in compliance with LEED requirements.

4. Materials and Resources Credit 5 - Regional Materials: Submit LEED letter template and related documentation showing manufacturing locations and origins of materials for products manufactured within a 500 mile radius of the project site. Project goal: >20 percent of materials used based on material cost.

    a. “Manufacturing” is defined as the final assembly of components contained within a product that is furnished and installed.
    b. All manufacturers shall also state whether materials in their product are extracted, harvested, or recovered within a 500 mile radius of project site. If such is the case, indicate the location of the site and distance in miles from the project site.

5. Materials and Resources Credit 6 - Rapidly Renewable Resources: Submit LEED letter template and related documentation listing rapidly renewable materials. Project goal: > 2.5 percent of materials used based on material cost.

    a. “Rapidly renewable” is defined as materials that can be planted and harvested in less than a 10-year cycle.
    b. For assemblies, calculate the percentage of rapidly renewable materials by weight.

6. Materials and Resources Credit 7 - Certified Wood: Submit LEED letter template and related documentation that wood-based products or materials are certified in accordance with the Forest Stewardship Council (FSC) Guidelines. Project goal: Minimum 50 percent of wood based materials and products.

    a. Substitution of other certification programs will not be accepted.
    b. For assemblies, calculate the percentage of certified wood by weight.
    c. For each material or product, provide the vendor or manufacturer's FSC Chair-of-Custody certificate number.

7. Indoor Environmental Quality Credits 3.1 and 3.2 - Construction IAQ Management Plan: Submit LEED letter template and related documentation.

    a. Beginning of Construction: Within 1 week of the contract award, submit a copy of the Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases.
    b. End of Construction: Submit a documentation certifying that a Construction IAQ Management Plan has been developed and implemented, and listing each air filter used during and at the end of construction. Include the MERV value, manufacturer name and model number.

8. Indoor Environmental Quality Credit 4.1: Low-Emitting Materials - Adhesives / Sealants: Submit LEED letter template and related documentation.

    a. Submit manufacturer's catalog cut sheet and a Material Safety Data Sheet (MSDS) highlighting VOC limits for each adhesive and sealant.
    b. Submit letter for each product stating that it meets VOC limit of SCAQMD Rule #1168.

9. Indoor Environmental Quality Credit 4.2: Low-Emitting Materials - Paints: Submit LEED letter template and related documentation.

    a. Submit manufacturer's catalog cut sheet and a Material Safety Data Sheet (MSDS) highlighting VOC limits for each paint and coating.
    b. Submit letter for each product stating that it meets or is lower than current VOC and potentially harmful chemical component limits of Green Seal requirements.

10. Indoor Environmental Quality Credit 4.3: Low-Emitting Materials - Carpet: Submit LEED letter template and related documentation.

    a. Submit manufacturer's catalog cut sheet highlighting the VOC limits for each carpet product used.
    b. Submit letter stating that the carpet meets or is lower than current VOC content limits of the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program.

11. Indoor Environmental Quality Credit 4.4: Low-Emitting Materials - Composite Wood: Submit LEED letter template and related documentation.

    a. Submit manufacturer's catalog cut sheet that indicates that the bonding agent used in the product contains no added urea-formaldehyde.

~~12. Cal Green:~~

    ~~a. Submit verification of compliance with California Green Building Standards (CGBS Cal Green) Mandatory Requirements for Non-residential Occupancies.~~

~~1.06~~1.05 QUALITY ASSURANCE

A. Environmental Project Management and Coordination: Contractor to identify one person on Contractor's staff to be Environmental Compliance Coordinator responsible for environmental issues compliance and coordination.

1. Experience: Environmental Compliance Coordinator shall be a LEED Accredited Professional with at least 5 years' experience in sustainable construction practices.

2. Responsibilities: Carefully review Contract Documents for environmental issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to environmental issues; and oversee Project Environmental Goals.

3. Meetings: Review and discuss Environmental Goals at following meetings.

a. Pre-construction meeting.
b. Pre-installation meetings.
c. Regularly scheduled job-site meetings.

~~1.07~~1.06 DELIVERY, STORAGE, AND HANDLING

A. Environmental Issues: Take special care to prevent accumulation of moisture on materials and within packaging during delivery, storage, and handling to prevent development of mold and mildew on packaging and on products.

B. Use packaging that is reusable or recyclable.

~~1.08~~1.07 PROJECT CONDITIONS

A. Construction Ventilation:

1. Temporary Construction Ventilation: Maintain sufficient temporary ventilation of areas where materials having volatile organic compound (VOC) emissions for 24 hours before installation, continuously during installation, and for emissions after installation.

a. Period after installation to be sufficient to dissipate odors and volatile organic compounds.
b. Ventilate areas directly to outside; ventilation to other enclosed areas is not acceptable.

B. Protection and Packaging:

1. Protection: Take special care to prevent accumulation of moisture on materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew on packaging and on products.

a. Immediately remove from site materials showing signs of mold and signs of mildew, including materials with moisture stains.

2. Packaging: Deliver materials in recyclable or in reusable packaging such as cardboard, wood, paper, or reusable blankets, which will be reclaimed by supplier or manufacturer for recycling.

a. General: Minimize packaging materials to maximum extent possible while still ensuring protection of materials during delivery, storage, and handling.

b. Unacceptable Packaging Materials: Polyurethane, polyisocyanurate, polystyrene, polyethylene, and similar plastic materials such as "foam" plastics and "shrink-fit" plastics.
c. Reusable Blankets: Deliver and store materials in reusable blankets and mats that are reclaimed by manufacturers or suppliers for reuse where program exists or where program can be developed for such reuse.
d. Pallets: Where pallets are used, suppliers shall be responsible to ensure pallets are removed from site for reuse or for recycling.
e. Cardboard and Paper: Where paper products are used, either recycle as part of construction waste management recycling stream, or recycle for use by manufacturer or supplier where program is available for such recycling.
f. Sealant, Paint, Primers, Adhesives, and Coating Containers: Return to supplier or manufacturer for reuse where such program is available.

~~1.09~~1.08 SEQUENCING

A. Environmental Issues

1. On-Site Application: Where high volatile organic compound (VOC) emitting products and where odorous products are applied on-site, apply prior to installation of porous materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General Environmental Issues:

1. Mold and Mildew: Materials that have evidence of growth of molds or of mildew are not acceptable, including both stored and installed materials; immediately remove from site.

2. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site.

B. Ducts: Seal ducts during construction to prevent accumulation of construction dust and construction debris inside ducts.

2.02 SUBSTITUTIONS

A. Substitutions Environmental Issues: Requests for substitutions shall comply with requirements specified in Section 01 6250, "Product Options and Substitution," with following additional information required where environmental issues are specified.

1. Indicate each proposed substitution complies with requirements for volatile organic compounds, both TVOC and IVOC.

2. Owner and Architect reserve right to reject proposed substitutions where TVOC and IVOC information is not provided and where TVOC or IVOC are higher than specified materials.

3. Comply with specified recycled content and other environmental requirements.

PART 3 - EXECUTION

3.01 CLEANING

A. Final Cleaning Environmental Issues:

1. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces using solvent-free materials low volatile organic compound (VOC) emitting materials, low odor materials, and materials environmentally benign.

2. Clean equipment and fixtures to sanitary condition using materials solvent free materials, low VOC emitting materials, and low odor materials.

3. Vacuum carpeted and soft surfaces with high efficiency particulate arrestor (HEPA) vacuum.

4. Clean ducts using HEPA vacuum immediately prior to Substantial Completion and prior to using ducts to circulate air.

5. Replace filters just prior to Substantial Completion.

6. Remove and properly dispose of recyclable materials using construction waste management program described in Section 01 7419, “Construction and Demolition Waste Management.”

3.02 PROTECTION

A. Environmental Issues:

1. Protect interior materials from water damage; where interior products not intended for wet applications are exposed to moisture, immediately remove from site.

2. Protect installed products using methods that do not support growth of molds and mildews.

   a. Immediately remove from site materials with mold and materials with mildew.

3.03 BUILDING SYSTEMS COMMISSIONING

A. Environmental Issues:

1. Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended.

2. Coordinate Building Commissioning procedures with the Commissioning Authority and appropriate subcontractors.

   a. Refer to Section 01 7700: Closeout Procedures,
   b. Refer to University of California Berkeley’s General Commissioning Requirements.
   c. Refer to Section 15000: HVAC (Design Build) for Commissioning of HVAC.

3.04 LEED CHECKLIST

A. See Appendix A2 – LEED Registered Project Checklist.

END OF SECTION 01 3560

SECTION 01 3570
HAZARDOUS MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section shall not excuse the Contractor from requirements specified in Section 01 3572, "Lead-Related Construction Activity," or Section 01 3573, "Asbestos Removal."

B. This Section provides Contractor procedural requirements and a summary of known or suspected hazardous materials at the project site.

C. Prior to the start of construction in an area that historically used or stored hazardous materials, the Owner will undertake the following in locations scheduled for modification or demolition:

1. Remove all chemical containers and contaminated equipment.

2. Provide additional Hazard Communication, as appropriate where other potential hazards are known or suspected to be present by UC Berkeley EH&S.

3. Release to Contractor upon final evaluation by UC Berkeley EH&S.

D. UC Berkeley will provide the contractor with hazardous materials survey or removal reports, if any, in the project manual.

1.02 HAZARDOUS MATERIALS PROCEDURES

A. Contractor shall not cause hazardous materials to become airborne, spill to the ground or water, dispose of into drains, or cause a hazardous material to pose an exposure risk to people or the environment.

B. If any hazardous material that is not part of the scope of work is discovered in a work area, Contractor shall immediately stop work in the affected area and report the condition in writing to the Owner's Representative. Contractor shall immediately transfer his work effort to other areas of the site that are not impacted by hazardous materials. Hazardous materials removal shall be the responsibility of the Owner, unless otherwise specified in the construction manual.

C. Contractor is responsible for the health and safety of their employees and subcontractors, through hazard communication, training, and providing appropriate personal protective equipment, or engineered control of hazards.

D. Contractor shall obey all federal, state and local environmental, health and safety laws and regulations, including but not limited to, Cal-OSHA, EPA, Cal/EPA, local water district requirements, and local municipal ordinances, where applicable.

E. UC Berkeley will be responsible for disposal of hazardous wastes (as defined in the California Code of Regulations Title 22-66261) that are generated from the project. Contractor shall be responsible for hazardous waste generated from accidents, spills, or neglect by Contractor, Contractor employees, and Contractor subcontractors.

1.03 HAZARDOUS MATERIALS COMMUNICATION

A. Asbestos Containing Materials

1. Refer to Section 01 3573 for asbestos work, if any.

2. If Contractor discovers asbestos containing materials, and asbestos removal is not part of Contractor's scope, proceed with the procedures in Paragraph 1.02 B. of this Section.

B. Bio-hazardous Materials

1. UC Berkeley regulates the use of biohazardous materials on campus. Biohazard use areas are marked and labeled with a biohazard symbol.

2. EH&S requires the researcher to decontaminate their workspace once it is vacated. Biohazard labels are removed or defaced in this process. Occasionally not all labels are found. If Contractor discovers an intact biohazard warning label, follow the procedure in Paragraph 1.02 B. of this Section.

C. Chemicals:

1. Laboratories:

a. Researchers use many different hazardous chemicals, solids, liquids and gases. Chemical containers shall be removed by the owner and laboratories shall be decontaminated and cleared by EH&S before Contractor performs any construction work. If Contractor discovers abandoned chemicals, follow the procedure in Paragraph 1.02 B. of this Section.

2. Mercury (Free Liquid):

a. Mercury is used in thermometers, manometers, barometers, "bubblers", diffusion pumps, and other laboratory equipment. Mercury contamination has been found in sink traps, in sanitary sewer lines from laboratory buildings, on counter tops, floors, vacuum supply lines, behind cabinet base coving and under cabinets. Liquid mercury can have the appearance of a silvery pool of any dimension or tiny shiny beads scattered on a horizontal surface. Mercury shall be decontaminated and the laboratory cleared by EH&S before Contractor performs any construction work. If Contractor discovers mercury or mercury filled equipment, follow the procedure in Paragraph 1.02 B. of this Section.

3. Polychlorinated Biphenyls (PCBs):

a. PCBs are regulated because of their potential to cause reproductive illness to birds / fish, and the long-lived persistence to do so when released in the environment. T heir manufacture in the United States was discontinued in 1977.
b. PCBs were used in electrical oil filled equipment such as transformers, switches, and fluorescent light ballasts. PCBs in electrical transformers were removed during the campus' 12KV upgrade. Records indicate that fluorescent light ballasts were removed and upgraded with non-PCB ballasts, but some may have been missed.
c. PCBs were also used in adhesive, sealant, caulk, glazing putty, roofing material, pesticide dillusion, ink, paper, fabric dye, gaskets, and hydraulic fluid.
d. PCBs have been discovered in laboratory diffusion pump reservoirs, lab building vacuum systems and vacuum tunnel equipment.
e. Military paint formulas may contain PCBs, but interior decorative paint coatings are less likely to contain PCBs.

f. Any of the above materials are suspected of containing PCB if they were installed before 1978.
g. If Contractor discovers a PCB warning label, or fluorescent light ballasts that do not have "No PCBs" on the label, follow the procedure in Paragraph 1.02 B. of this Section.

D. Fluorescent Light Tubes:

1. Used fluorescent light tubes are considered hazardous waste in California because of their heavy metal content. Contractor shall contact the Owner for approved light tube containers. Contractor shall package the fluorescent light tubes in the approved containers. Owner will be responsible for removal of the packaged light tubes. If Contractor brakes or discovers broken fluorescent light bulbs, ventilate affected area for 15 minutes, then follow the procedures in Paragraph 1.02 B. of this Section.

E. Lead:

1. Any painted surface, unless otherwise stated, may have lead in it. Refer to Section 01 3572 for lead related construction activity.

F. Ozone Depleting Compounds:

1. Refrigerants are mainly composed of fluorinated and chlorinated compounds that if released to the environment will promote the destruction of the protective ozone layer surrounding our planet. Refrigerants are required to be recycled or disposed of properly. If Contractor discovers refrigerators, drinking fountains, or air conditioners, follow the procedures in Paragraph 1.02 B. of this Section.

G. Radioactive Materials:

1. Radioactive materials and radiation producing equipment are used on campus. UC Berkeley EH&S regulates the use of radioactive materials and equipment on campus. These areas are marked and labeled with a radioactive symbol known as a tri-foil. In addition, there are unregulated items such as tritium illuminated "EXIT" signs, smoke detectors and naturally occurring radioactive research chemicals that may require EH&S management on a case- by-case basis.

2. EH&S requires the researcher to decontaminate and obtain EH&S clearance of their workspace once it is vacated. Radioactive equipment and materials will be removed from all work locations before allowing Contractor to begin work. Tri-foils are removed or defaced in this process. Occasionally not all labels are found. If Contractor discovers an intact radioactivity warning label in its project work area, follow the procedure in Paragraph 1.02 B. of this Section.

3. Remodeling or removal of equipment may require EH&S to return to survey the area exposed by equipment removal. This will be performed on a case-by-case scenario. The Owner shall work with EH&S to ensure that all surfaces or equipment are below regulated radioactive limits before allowing Contractor to proceed with equipment removal.

H. Ductwork-Heating and Ventilation:

1. Dust in campus building air supply ductwork may contain lead, zinc, cadmium, and other metals. The Contractor shall comply with the construction standards in Title 8, California Code of Regulations, including Section 1532.1 (lead) and 1532 (cadmium).

I. Ductwork-Laboratory Fume Hood Ventilation and Roof Exhaust:

1. Many buildings on campus include laboratories that conduct work with biological, chemical and radiological materials which are vented through bio-safety cabinets and chemical fume hoods. The final discharge point of these systems is typically on the roof of the associated building through exhaust ventilation that may require EH&S management on a case- by-case basis.

2. Additional information on a specific fume hood exhaust is available upon request to UC Berkeley EH&S through the Owner's Representative.

PART 2 - CONTRACTOR ITEMS

2.01 CONTRACTOR HAZARD COMMUNICATION PROCEDURES

A. Contractor shall make a formal request, in writing, to the UC Berkeley Project Manager for any additional EH&S hazard communication.

B. Contractor is responsible for ensuring that all employees and subcontractors conducting work at the job site attend EH&S hazard communication meetings and have access to information describing potential or known hazards.

C. Contractor is responsible for isolating hazardous work environments from entry by the general public and campus citizens while working at the job site.

D. Contractor shall provide Material Safety Data Sheets to EH&S when using products that are known to cause an odor nuisance or contain chemicals listed within Proposition 65.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 3570

SECTION 01 3571

HAZARDOUS MATERIALS DISCLOSURE AND PROCEDURES

1.01 SUMMARY

A. This Section provides Contractor with procedural requirements and a summary of known or suspected hazardous materials in the project site. Prior to the start of construction, the Owner will undertake the following:

1. Decontaminate radioactive hazards, if any, and provide clearance to Contractor.

2. Decontaminate biological hazards, if any, and provide clearance to Contractor.

3. Remove all chemical containers and contaminated equipment.

4. Clean laboratory floors, bench tops and fume hood interiors with a surfactant.

5. Remove laboratory drain traps.

6. Survey for mercury contamination and clean-up if any.

7. Release to Contractor upon final evaluation by EH&S.

1.02 HAZARDOUS MATERIALS PROCEDURES

A. Contractor shall not cause hazardous materials to become airborne, spill to the ground or water, dispose of into drains, or cause a hazardous material to pose an exposure risk to people or the environment.

B. If any hazardous material is known or suspected in a work area, and Contractor cannot safely avoid disturbing the hazardous material, Contractor shall immediately stop work in the affected area and report the condition in writing to the Owner's Representative.

C. If any hazardous material is known or suspected in a work area, and Contractor cannot safely avoid disturbing the hazardous material, Contractor shall immediately transfer his work effort to other areas of the site that are not impacted by hazardous materials.

D. If any hazardous material is known or suspected in a work area, and Contractor cannot safely avoid disturbing the hazardous material, Contractor shall not be permitted to work in the affected area until the hazardous materials are removed by a properly qualified hazardous materials removal contractor. Removal of the hazardous material is the responsibility of the Owner.

E. In the event that discovery of hazardous materials causes a project delay, a Change Order will be issued by the Owner's Representative to account for the project delay, and to establish a new construction completion date, if required.

F. Contractor is responsible for the health and safety their employees, through hazard communication, training, and providing appropriate personal protective equipment, or engineered control of hazards.

G. Contractor shall obey all federal, state and local environmental, health and safety laws and regulations, including OSHA, Cal-OSHA, EPA, Cal-EPA, local water district requirements, and local municipal ordinances.

H. Owner will be responsible for disposal of hazardous wastes (as defined in the California Code of Regulations Title 22-66261) that are generated from the project. Contractor shall be responsible for hazardous waste generated from accidents or neglect by Contractor.

1.03 KNOWN OR SUSPECTED HAZARDOUS MATERIALS

A. Asbestos Containing Materials:

1. Refer to Sections 01 3573, "Asbestos Removal," containing material disclosure and abatement work by others. This subpart is a disclosure of the known inventory of ACM.

B. Bio-hazardous Materials:

1. Laboratories that were used for bio-hazardous materials will be evaluated to determine if bio-hazards may exist and cleared by EH&S prior to construction.

C. Chemicals:

1. Laboratories:

a. Researchers use many different hazardous chemicals, solids, liquids and gases. Chemical containers shall be removed by the Owner and laboratories shall be decontaminated and cleared by EH&S before Contractor performs any construction work.

2. Mercury (Free Liquid):

a. Mercury was used in thermometers, manometers, barometers, "bubblers", diffusion pumps, and other laboratory equipment. Mercury contamination has been found in sink traps, in sanitary sewer lines from laboratory buildings, on counter tops, floors, along cabinet bases and under cabinets. Liquid mercury can have the appearance of a silvery pool of any dimension or tiny shiny beads scattered on a horizontal surface. Mercury shall be decontaminated and the laboratory cleared by EH&S before Contractor performs any construction work. Should unanticipated mercury be found behind casework, follow procedures in 1.02.

3. Polychlorinated Biphenyls (PCBs):

a. PCBs are regulated because of their potential to cause illness and persistence in the environment. Their manufacture in the United States was discontinued in 1977.
b. PCBs were used in electrical oil filled equipment such as transformers, switches, and fluorescent light ballasts. PCBs in electrical transformers were removed during the campus' 12KV upgrade.

D. Fluorescent Light Tubes:

1. Used fluorescent light tubes are considered hazardous waste in California because of their heavy metal content. Contractor shall collect all tubes and place them in boxes provided by Owner for Owner's recycling or disposal.

E. Lead Paint:

1. Any painted surface, unless otherwise stated, is suspected to have lead in it. Refer to Section 01 3572, “Lead Related Construction Activities,” for lead paint required procedures. Lead paint test results conducted by the Owner are included in “Information Available to Bidders.”

2. Dispose of loose and peeling lead-based paints as a "hazardous" material as identified by Cal/EPA Title 22 regulations, as well as per Section 01 3572, “Lead Related Construction Activities.” Lead-based paints or coatings adhering to their substrates may be disposed of as "nonhazardous" waste, per CalEPA's Department of Toxic Substances Control Regulation Guidance.

F. Lead- and Cadmium-Containing Dusts:

1. Accumulated dusts in the heating, ventilation, air-conditioning (HVAC) systems and ducting are expected to contain some lead and cadmium built-up over the years of operations. The Contractor shall comply with the construction standards: Title 8, Code of California Regulations, Section 1532.1: Lead in Construction, as well as Section 1532: Cadmium.

G. Ozone Depleting Compounds

1. Refrigerants are mainly composed of fluorinated and chlorinated compounds that if released to the environment will promote the destruction of the protective ozone layer surrounding our planet. Refrigerants are required to be recycled or disposed of properly and will be done so by Owner. If Contractor discovers refrigerators, drinking fountains, or air conditioners, follow the procedures in Paragraph 1.02B. of this Section.

H. Radioactive Materials:

1. Radioactive materials and radiation producing equipment are used on campus. The University of California, Berkeley Office of Radiation Safety (ORS) regulates the use of radioactive materials and equipment on campus. These are marked and labeled with a radioactive symbol known as a tri-foil. In addition, there are unregulated items such as tritium illuminated “EXIT” signs, smoke detectors and naturally occurring radioactive research chemical that may require ORS or EH&S management on a case by case basis.

2. ORS requires the researcher to decontaminate and obtain ORS clearance of their workspace. Radioactive equipment and materials will be removed from all work locations before allowing Contractor to begin work. Tri-foils are removed or defaced in this process. Occasionally not all labels are found. If Contractor discovers an intact radioactivity warning label, follow the procedure in Paragraph 1.02B. of this Section and immediately notify ORS (643-8414).

3. Remodeling or removal of equipment may require ORS to return to survey the area exposed by equipment removal. This will be performed on a case-by-case scenario. The PM shall work with ORS to ensure that all surfaces or equipment are below regulated radioactive limits before allowing Contractor to proceed with equipment removal.

END OF SECTION 01 3571

SECTION 01 3572
LEAD-RELATED CONSTRUCTION ACTIVITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Project activities that this specification applies to include preparation of the building interior and exterior walls for painting, wall and floor demolition, structural steel welding, shear wall preparation, or any other activity that may disturb lead-containing materials.

B. In accordance with Cal/OSHA regulations, the Contractor is ultimately responsible for ensuring and documenting the health and safety of his or her employees. Therefore, Contractor shall conduct personal air monitoring or obtain objective data (paragraph 1.6 of these specifications) and maintain documentation of those air samples. Results of any air monitoring conducted by the Contractor during this project shall be made available to the Office of Environment, Health & Safety (EH&S) within 24 hours of the Contractors receipt of the results.

C. The tools, procedures, and engineering controls Contractor is using and the lead content of the paint determine the applicability of these specifications. Thus, if the lead exposure to Contractor's employees can be held below the Permissible Exposure Limit of 50 $\mu g/m^3$, then the DHS Certification mentioned in Paragraph 1.12, "Training, and Certification" is not required.

D. The work practices and procedures discussed in this specification apply to any activities that may disturb lead-containing materials.

1.02 CAL/OSHA LEAD-WORK NOTIFICATION

A. General Contractors and their Sub-Contractors shall comply with the Lead-Work Notification required by Cal/OSHA §1532.1 (p) where applicable. The notification shall include the eleven items of information listed in Cal/OSHA §1532.1 (p)(B)(2). A copy of the notification provided to Cal/OSHA shall also be provided to the Facilities Services Project Manager and the EH&S Construction Health and Safety Specialist within 24 hour of the time the Contractor or Sub-Contractor has provided it to Cal/OSHA.

B. The notification can be provided to Cal/OSHA, UC Berkeley Facilities Services and UC Berkeley EH&S by electronic mail or fax.

1.03 PROVISIONAL INDEPENDENT OVERSIGHT

A. UC Berkeley may retain the services of an independent third party oversight consultant (Consultant) to perform the following functions: review of training certificates, review of personal monitoring results, perimeter air monitoring, inspection of barriers and polyethylene sheeting, occasional site visits, review of waste handling procedures, and clearance inspections (if applicable). The Project Manager may delegate these responsibilities to EH&S at his or her discretion, subject to agreement by EH&S. The term "Consultant" shall, in these specifications, apply to an independent consultant, his or her designee, or any other party mutually acceptable to the Project Manager and EH&S to serve in this capacity.

1.04 PROVISIONAL PERIMETER AIR MONITORING

A. At UC Berkeley's discretion, the Consultant (see Article 1.03) may collect air samples approximately 20 feet downwind of the working surfaces at the temporary perimeter or barrier tape. The Consultant

shall perform continuous air monitoring during any activities that may disturb lead-containing material. The Consultant may collect additional samples as appropriate to represent site perimeter lead air concentrations. See Paragraph 3.1, Containment System.

1.05 PROVISIONAL PERSONAL AIR MONITORING

A. UC Berkeley may, at its discretion, instruct the Consultant to conduct an exposure assessment on an employee of a Contractor using the criteria mentioned in Cal/OSHA regulations (Title 8 CCR 1529 and Title 8 CCR 1532.1) as mentioned in the introduction to this Section. If this option is chosen by UC Berkeley, the Consultant shall forward all personal monitoring results to EH&S within 24 hours after the work was performed. The results should be hand-delivered or faxed to the attention of the EH&S Construction Health & Safety Specialist, fax number (510) 643-7595.

1.06 PREVIOUS EXPOSURE ASSESSMENT FOR DISTURBANCE OF LEAD-CONTAINING MATERIALS

A. If Contractors employees may be exposed to lead at or above the Cal/OSHA PEL of 50 μg/m3 Contractor shall perform personal air monitoring as an Initial Exposure Assessment, or collect objective data from general industry sources. Contractor shall have documentation of that data available to EH&S upon request within 24 hours. That documentation, from either a previous exposure assessment or from objective data, shall include the following:

1. A description of the activities on similar projects during which exposure monitoring was conducted.

2. Exposure assessment data from similar projects that includes the following:

   a. The date the samples were collected;
   b. The results of the samples expressed in both the analytical results and the eight-hour TWA;
   c. The personnel who performed the activities; and the person(s) who conducted the monitoring and their qualifications.
   d. A copy of the Written Compliance Program used for the specific project.
   e. A copy of the laboratory or X-ray fluorescent analyzer (XRF) analytical results that show the lead content of the materials that were disturbed.

1.07 CONTRACTOR NOTIFICATION REQUIREMENT

A. The Contractor shall provide notice to all other contractors and subcontractors on-site of any upcoming work that will impact lead, and may generate levels of airborne lead that could present a potential exposure to workers at or above the PEL. This notice shall provide information on the control measures being implemented and a warning to remain outside of the immediate area where such activities are occurring.

1.08 COORDINATE REMOVAL OF ITEMS ON THE BUILDING EXTERIOR OR INTERIOR PRIOR TO THE START OF WORK

A. The Contractor shall remove or protect items (if any) located within twenty (20) feet of the paint preparation areas to avoid contaminating these items with lead. These items may have to be relocated or disposed of prior to the start of work. The Contractor shall coordinate this activity with the Project Manager.

1.09 COORDINATE ACCESS/EGRESS ISSUES

A. Work that may disturb lead-containing materials and could present a potential for exposure to concentrations above the PEL should be performed after other contractors or occupants working on site have been temporarily evacuated from the immediate area. If this is not possible, the Project Manager shall arrange for a safe means of access/egress. Only qualified personnel trained to work with lead, as appropriate, shall be permitted inside controlled areas during any activities that may generate levels of lead that may present a potential for worker exposure above the PEL.

1.10 COORDINATE/ENSURE CLEARANCE INSPECTIONS

A. The Contractor shall conduct visual inspections as necessary to ensure that all loose or chipped paint has been removed from the surface and debris is not left behind as a result of the paint preparation, or other activities that disturb lead containing materials. Clearance air and wipe sampling are not required, but UC Berkeley, or its Consultant, may perform a visual inspection to ensure that the Contractor has adequately cleaned all surfaces.

1.11 FOLLOW ALL APPLICABLE REGULATIONS

A. The Contractor shall perform all work that disturbs lead-containing materials in accordance with all applicable health, safety, and environmental regulations, including the Cal-OSHA Lead Standard (Title 8 CCR 1532.1), and Bay Area Air Quality Management District (BAAQMD) regulations. The Contractor must provide a copy of their written compliance program (as required by Cal/OSHA 1532.1) to the Project Manager and EH&S for review and approval prior to commencing work.

1.12 TRAINING AND CERTIFICATION

A. If the contractor’s employees may be exposed to lead above the Cal/OSHA Action Level of 30 μg/m3, employees shall be trained according to Cal/OSHA § 1532.1 (l)(2).

B. If Contractor’s personnel may be exposed to lead above the Cal/OSHA Permissible Exposure Limit (PEL) of 50 micrograms per cubic meter of air sampled (μg/m3) then the Contractor shall provide personnel who are certified by the California Department of Health Services (DHS) as Lead Workers or Supervisors for all activities that may disturb lead-containing materials unless or until IEA monitoring shows that the work does not expose workers to concentrations of lead at or above the PEL

C. Training certificates for all Contractor employees subject to this requirement shall be supplied to the Project Manager and reviewed and approved by EH&S or the on-site Consultant prior to commencing work.

1.13 SUSPENSION OF WORK

A. The Contractor, the Consultant, the Project Manager, or EH&S may suspend lead-related work if any controls (such as barriers) fail, if excessive amounts of debris known or suspected to contain lead are detected outside the controlled area, or if the work is on the exterior and wind speeds are more than twenty miles per hour. The Consultant and EH&S shall assist the Contractor in evaluating the effectiveness of the control measures.

B. If work is suspended due to the Contractor's failure to use adequate engineering methods, maintain barriers, or implement good housekeeping, all costs associated with the suspension, including remedial actions and any additional sampling required according to this specification, shall be the Contractor's responsibility.

1.14 PROJECT DOCUMENTATION AND SUBMITTALS

A. The Contractor shall maintain on the job site copies of applicable documents (1.6 and 1.12) that show compliance with this specification, including but not limited to:

1. Cal/OSHA Lead Notification (1.02)
2. training records (1.12)
3. DHS Certifications (1.12)
4. respiratory protection program (3.06)
5. respirator fit testing records (3.06)
6. medical clearances (1.01, Cal/OSHA)
7. written lead compliance program 1.01, Cal/OSHA)
8. description of barriers and engineering controls
9. a description of personal protective equipment
10. all air monitoring results (1.01,1.06)
11. all waste disposal documentation (3.08)

B. Waste documentation and air monitoring results shall be submitted to the Project Manager and EH&S as they are received and not later than two weeks after completion of activities that may disturb lead. All other documentation should be submitted to the Project Manager and EH&S prior to performing any activities that may disturb lead-containing materials.

PART 2 - MATERIALS AND EQUIPMENT

2.01 CONTAINMENT PLASTIC SHEETING

A. Any form of ventilation containment sheeting or fabric used to control the flow of dust or fumes associated with the disturbance of lead containing materials shall be fire retardant (see Article 3.01).

2.02 VACUUM ASSISTED TOOLS

A. Wherever possible, the Contractor shall use a HEPA vacuum for manual activities that disturb lead-containing materials. All power tools and abrasive blasting used for activities that may disturb lead-containing materials must be HEPA vacuum assisted. HEPA assisted power tools must be approved by the Project Manager prior to use.

PART 3 - EXECUTION

3.01 CONTAINMENT SYSTEM FOR OCCUPIED BUILDINGS

A. The Contractor shall collect lead-contaminated dust and debris that falls to the ground by using one or more layers of fire retardant polyethylene of at least six-mil thickness (or a material of similar durability) to cover horizontal surfaces below the work area. This plastic must be secured to the building and extend horizontally at least ten feet (where practicable).

B. The Contractor shall seal all windows and doors located within twenty (20) feet of the work surfaces using at least one layer of fire retardant six-mil polyethylene or similar material. Windows scheduled to undergo external paint removal must also be sealed on the interior of the building, using at least two layers of six-mil polyethylene or similar material, with no gaps between the interior wall and the material. This shall remain in place until removal and subsequent clean up of lead-containing material from the building has been completed.

C. Perimeter air samples may be collected by Consultant or EH&S in areas adjacent to the work areas where lead-containing materials are being disturbed. If the results exceed 15 µg/m3 over an 8-hour Time Weighted Average (TWA) the Contractor shall construct a means of containment that controls ventilation or production of dust and debris in order to maintain perimeter airborne lead concentrations below 15 µg/m3. If the controls do not maintain perimeter airborne lead concentrations below 15 µg/m3 TWA during any given shift the lead-related work shall be stopped by UC Berkeley EH&S or its Consultant. Within one day of the work stoppage, UC Berkeley's Environmental Consultant shall call a meeting to review engineering controls and work practices. The meeting shall be attended by all parties affected on the job site as determined by the General Contractor and UC Berkeley EH&S. The Contractor shall perform the control measures decided upon at that meeting at no additional cost to UC Berkeley or UC Berkeley's Consultant.

3.02 CONTROLLED AREA/WORK PERIMETER

A. If the perimeter samples mentioned in Paragraph 3.1 are at or above 15 µg/m3, the Contractor shall maintain a temporary fence or barrier tape at a distance of at least twenty (20) feet from the work surfaces whenever possible. The Contractor shall post warning signs around the perimeter of the work area in accordance with Cal/OSHA requirements.

3.03 RESTRICTED ACCESS TO CONTROLLED AREA

A. The Contractor shall restrict work area access to only trained, qualified and properly protected personnel during activities that disturb lead-containing materials and may generate airborne levels of lead at or above the PEL.

3.04 WET METHODS

A. The Contractor shall use wet methods to manually remove lead containing materials. The debris generated must be maintained in a wetted state while it is being disturbed. All lead containing debris shall be collected and contained by the end of the shift and must not be left uncovered overnight. Other methods such as chemical strippers or HEPA vacuum assisted power tools do not need to be kept wet.

3.05 CLEANING

A. After surfaces have been scraped and prepared for coating and sealing, the Contractor shall use a HEPA vacuum to remove dust and debris. All loose debris must be collected and contained before the end of each working shift and not left uncovered overnight.

3.06 RESPIRATORS

A. If the lead exposure to their employees is at or above the PEL the Contractor shall use respirators and personal protective equipment as required by Cal/OSHA's task-related triggers for lead or as appropriate based on personal air monitoring results. All respirators must be NIOSH/MSHA approved. Respirator fit test records and the respiratory protection program shall be retained on site as part of the project documentation if respiratory protection is used on this project. Disposable dust/mist respirators shall not be used as personal protective equipment for lead.

3.07 AIR QUALITY

A. The Contractor shall maintain adequate engineering controls to ensure that work does not generate airborne lead concentrations in excess of 1.0 μg/m3 above background levels, as measured by the Consultant or EH&S at the perimeter of the job site.

3.08 HAZARDOUS WASTE MANAGEMENT AND DISPOSAL

A. General:

1. All lead containing materials shall be treated as hazardous waste unless the Contractor is notified otherwise by EH&S or the Consultant. The handling, transport, and disposal of all hazardous waste shall be managed in accordance with all applicable Federal, State, and local hazardous waste laws and regulations.

2. The Contractor shall provide personnel trained in hazardous waste handling in according to Title 22 CCR, Section 66262.34 to package or otherwise handle hazardous waste.

B. Containers:

1. Small containers used for storage of waste must be United States Department of Transportation (DOT) approved. EH&S will supply the Contractor with 55, 30, or 5 gallon containers. EH&S will select containers that are chemically compatible with the material to be stored in them.

2. Contractor shall supply bulk containers (bins, tanks, or tank trucks) when necessary. Contractor shall keep containers closed at all times except when material is being added.

C. Labels:

1. Containers of hazardous waste shall display hazardous waste labels. The pre-printed labels will be supplied by UC Berkeley EH&S. Before waste is accumulated, the Contractor and UC Berkeley shall identify and define waste streams. The Contractor shall not mix different waste streams in the same container. The Contractor shall mark the initial accumulation date on the hazardous waste label when waste is first placed in the container.

D. Waste Storage Area:

1. Contractor will store closed and sealed waste containers on the construction site in a locked, secure area out of the elements. The storage area, room or structure shall be identified by UC Berkeley and the Contractor on an as needed basis.

E. Inspections:

1. Contractor shall inspect the waste storage area weekly to ensure the containers are not leaking, are segregated into compatible groups, and labeled properly with appropriate dates, quantity limits are complied with, and waste descriptions. Contractor shall log this information on a weekly inspection log. The Contractor shall allow UC Berkeley representatives to review the log when requested.

F. Disposal:

1. Small Containers:

a. Once the quantity limits are reached, UC Berkeley EH&S has three days to transport the waste to the campus Hazardous Materials Facility. Contractor shall notify UC Berkeley before the quantity limits will are reached in order to facilitate quick removal by UC Berkeley EH&S. Quantity limits for waste storage areas are 55 gallons for non-acutely hazardous waste, and 1 quart for acutely hazardous waste. The PM will notify EH&S for hazardous waste pick-up.
b. If the quantity limits are not reached, then Contractor shall notify UC Berkeley at least 10 days before 270 days from the initial accumulation date are reached to facilitate timely removal by UC Berkeley EH&S.

2. Bulk Containers:

a. For bulk hazardous waste containers, Contractor shall manifest, transport and dispose of at UC Berkeley approved disposal facilities.

G. Spill Response:

1. Contractor shall maintain enough spill response supplies to contain at least 110 percent of any accumulated waste. Immediately notify UC Berkeley if there is a spill. Respond to the spill at the soonest, safest possible moment. Contractor shall clean up the spill and contain it according to the requirements of this specification. UC Berkeley EH&S will provide assistance in regulatory agency notification, and reporting (if necessary).

END OF SECTION 01 3572

SECTION 01 3573
ASBESTOS REMOVAL

1.01 ASBESTOS REMOVAL

A. The Contractor shall not include any costs associated with asbestos removal in his bid. If during the course of construction, asbestos is discovered, the removal of such asbestos will not be the responsibility of the Contractor.

B. If asbestos is suspected, the Contractor shall immediately stop his work and notify the Owner's Representative. The Owner's Representative shall notify the Berkeley Campus Office of Environmental Health and Safety (EH&S). EH&S shall make the required tests to determine if, in fact, asbestos is present.

C. If asbestos is suspected (or identified), the Contractor shall immediately transfer his work effort to other areas of the site that are not impacted by asbestos.

D. If it is determined by the Owner that asbestos is present, the Contractor will not be permitted to work in the affected area of the project until the asbestos hazard is removed, by a separate licensed asbestos abatement contractor, and the affected area is determined to be safe by the Campus Environmental Health and Safety Office (EH&S).

E. If asbestos removal by the Owner is necessary, a Change Order will be issued by the Owner's Representative to account for the project delay and to establish a new Construction Completion Date, if required.

END OF SECTION 01 3573

SECTION 01 4100
REGULATORY REQUIREMENTS

1.01 SUMMARY

A. Perform all Work in compliance with requirements of:

1. State of California Code of Regulations (CCR):

a. Title 8, Industrial Relations.
b. Title 19, Public Safety.
c. Title 21, Public Works, Chapter One, Subchapter One, Group 2, Office of Owner's Representative and Construction dealing with portions applicable to provisions for the Handicapped.
d. Title 22, Public Health.
e. Title 24, Building Standards, Parts 1-7 and Part 9.

2. Occupational Safety and Health Act (OSHA).

3. California Occupational Safety and Health Act Standards (Cal-OSHA).

4. National Electrical Code (NEC).

5. National Fire Protection Association Codes and Standards (NFPA).

6. Bay Area Air Quality Management District Regulations, including but not limited to permit requirements for portable internal combustion equipment (engines and gas turbines greater than 50 hp).

7. All other applicable health and safety requirements, codes and regulations.

B. Unless otherwise specified, specific references to codes, regulations, standards, manufacturers' instructions, or requirements of regulatory agencies, when used to specify requirements for materials or design elements, shall mean the latest edition of each in effect at the date of submission of bids, or the date of the Change Order or Field Order, as applicable.

1.02 CONFLICTS

A. If a conflict exists between referenced regulatory requirements or between referenced regulatory requirements and the Contract Documents, Contractor shall notify Owner's Representative and request that the conflict be resolved. The fact that the Contract Documents may establish higher or more costly requirements than the minimum Code or other regulatory requirements referenced above shall not constitute a "conflict."

END OF SECTION 01 4100

SECTION 01 4200
INDUSTRY STANDARD ABBREVIATIONS

1.01 ABBREVIATIONS

A. In addition to abbreviations indicated on the Drawings, references in the Project Manual to trade associations, technical societies, recognized authorities, and other institutions may include the following organizations, which are sometimes referred to by only the corresponding abbreviations. Not all abbreviations are listed, and not all listed abbreviations are used:

1.	AA	Aluminum Association (AA)
2.	AABC	Associated Air Balance Council
3.	AAMA	Architectural Aluminum Manufacturer's Association
4.	AAN	American Association of Nurserymen, Inc.
5.	AASHTO	American Association of State Highway and Transportation Officials
6.	ABPA	Acoustical and Board Products Association
7.	ACI	American Concrete Institute
8.	CIL	American Council of Independent Laboratories
9.	ACPA	American Concrete Pipe Association
10.	ADC	Air Diffusion Council
11.	AFBMA	Anti-Friction Bearing Manufacturers Association
12.	AFI	Air Filter Institute
13.	AGA	American Gas Association
14.	AGC	Associated General Contractors of America
15.	AI	The Asphalt Institute
16.	AIA	American Institute of Architects
17.	AIMA	Acoustical Insulating Material Association
18.	AISC	American Institute of Steel Construction, Inc.
19.	AISI	American Iron and Steel Institute
20.	AITC	American Institute of Timber Construction
21.	ALSC	American Lumber Standards Committee

22.	AMCA	Air Moving and Conditioning Association
23.	ANSI	American National Standards Institute
24.	AOAC	Association of Official Analytical Chemists
25.	APA	APA - The Engineered Wood Association
26.	API	American Petroleum Institute
27.	AQMD	Air Quality Management District
28.	ARI	Air-Conditioning and Refrigeration Institute
29.	ASA	American Standards Association
30.	ASAHC	American Society of Architectural Hardware Consultants
31.	ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
32.	ASME	American Society of Mechanical Engineers Association, Inc.
33.	ASTM	American Society for Testing and Materials
34.	AWS	American Welding Society, Inc.
35.	AWPA	American Wood Preservers Association
36.	AWI	Architectural Woodwork Institute
37.	AWWA	American Water Works Association, Inc.
38.	BHMA	Builder's Hardware Manufacturers Association
39.	BIA	Brick Institute of America
40.	CARB	California Air Resources Board
41.	CBC	California Building Code
42.	CBM	Certified Ballast Manufacturers Association
43.	CCR	California Code of Regulations
44.	CDA	Copper Development Association, Inc.
45.	CE	Corps of Engineers (U. S. Dept. of the Army)
46.	CEC	California Energy Commission
47.	CESO	California Elevator Safety Order
48.	CGA	Compressed Gas Association

49.	CPSC	Consumer Product Safety Commission
50.	CLFMI	Chain Link Fence Manufacturers Institute
51.	CRSI	Concrete Reinforcing Steel Institute
52.	CS	Commercial Standard of National Bureau of Standards, U.S. Department of Commerce
53.	CTI	Cooling Tower Institute
54.	DHI	Door and Hardware Institute
55.	DISS	Diameter Index Safety System
56.	EPA	Environmental Protection Agency
57.	ETL	Electrical Testing Laboratories
58.	FFDA	Federal Food and Drug Administration
59.	FGMA	Flat Glass Marketing Association
60.	FIA	Factory Insurance Association
61.	FM	Factory Mutual Engineering Corporation
62.	FS	Federal Specification of General Services Administration
63.	GA	Gypsum Association
64.	GFI	Ground Fault Interrupter
65.	HEPA	High Efficiency Particulate Air
66.	HI	Hydronics Institute
67.	HMI	Hoists Manufacturers Institute
68.	HMMA	Hollow Metal Manufacturers Association
69.	HPVA	Hardwood Plywood and Veneer Association
70.	IBEW	International Brothers of Electrical Workers
71.	IBR	Institute of Boiler and Radiator Manufacturers
72.	ICBO	International Conference of Building Officials
73.	ICEA	Insulated Cable Engineering Association
74.	IEEE	Institute of Electrical and Electronic Engineers

75.	IEC	International Electric Code
76.	IES	Illuminating Engineers Society
77.	IGCC	Insulation Glass Certification Council
78.	ISA	Instrument Society of America
79.	LIA	Lead Industries Association
80.	MIA	Marble Institute of America
81.	MIL	Military Specification of U.S. Department of Defense
82.	MOC	Ministry of Communications General
83.	MSHA	Mine Safety and Health Administration
84.	MSS	Manufacturers Standardization Society of Valve and Fittings
85.	NAAB	National Association of Air Balance
86.	NAAMM	National Association of Architectural Metal Manufacturers
87.	NACE	National Association of Corrosion Engineers
88.	NBFU	National Board of Fire Underwriters
89.	NBGQA	National Building Granite Quarries Association, Inc.
90.	NBHA	National Builders' Hardware Association
91.	NBS	National Bureau of Standards (U. S. Dept. of Commerce)
92.	NCMA	National Concrete Masonry Association
93.	NCPWB	National Certified Pipe Welding Bureau
94.	NEBB	National Environmental Balancing Bureau
95.	NEC	National Electric Code
96.	NECA	National Electrical Contractors Association
97.	NEMA	National Electrical Manufacturers Association
98.	NETA	National Electrical Testing Association
99.	NFPA	National Fire Protection Association
100.	NIST	National Institute of Standards and Technology
101.	NHLA	National Hardwood Lumber Association

102.	NIOSH	National Institute of Occupational Safety and Health
103.	NPA	National Particleboard Association
104.	NRC	Noise Reduction Coefficient
105.	NRCA	National Roofing Contractors Association
106.	NRMCA	National Ready Mixed Concrete Association
107.	NSF	National Sanitation Foundation
108.	OSHA	Office of Safety and Health Administration
109.	OSHPD	Office of Statewide Health Planning and Development
110.	PCA	Portland Cement Association
111.	PCB	Polychlorinated Biphenyl
112.	PCI	Precast Concrete Institute
113.	PDI	Plumbing and Drainage Institute
114.	PI	Perlite Institute
115.	PS	Product Standard of NBS (U.S. Dept. of Commerce)
116.	RFCI	Resilient Floor Covering Institute
117.	RIS	Redwood Inspection Service (Grading Rules)
118.	SAE	Society of Automotive Engineers
119.	SAS	Saudi Arabian Standard Organization
120.	SCAQMD	South Coast Air Quality Management District
121.	SDI	Steel Door Institute
122.	SFIA	Steel Framing Industry Association
123.	SIGMA	Sealed Insulating Glass Manufacturers Association
124.	SJI	Steel Joist Institute
125.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association, Inc.
126.	SPIB	Southern Pine Inspection Bureau (Grading Rules)
127.	SSPC	SSPC: The Society for Protective Coatings
128.	STC	Sound Transmission Coefficient

129. State of California:
    - CalTrans — Business and Transportation Agency, Department of Transportation
    - SFM — Office of State Fire Marshal
    - DSA — Division of State Architect

130. SWI — Sealant and Waterproofers Institute

131. TCNA — Tile Council of North America

132. UFAS — Uniform Federal Accessibility Standards

133. UHMW — Ultra-High Molecular Weight

134. USDA — United States Department of Agriculture

135. USSG — United States Steel Gauge

136. UL — Underwriters' Laboratories, Inc.

137. WCLIB — West Coast Lumber Inspection Bureau

138. WDMA — Window and Door Manufacturers Association

139. WI — Woodwork Institute

140. WWPA — Western Wood Products Association

B. Additional abbreviations and symbols used on the Drawings are listed thereon.

END OF SECTION 01 4200

SECTION 01 4339
MOCKUPS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for full-size, physical assemblies that are constructed on-site or off-site as specified in respective Specification Sections and as scheduled at the end of this Section.

B. Mockups will be used to verify selections made under sample submittals, to demonstrate aesthetic effects, qualities of materials, and execution. Mockups will also be tested for performance where specified.

C. Review requirements specified in other appropriate Sections for materials, methods, and additional sample submittal requirements including:

1. Cast-in-Place Concrete: Division 03
2. Structural Metal Stud Framing: Section 05 4100
3. Gypsum Sheathing: Section 06 1643
4. Metal Wall Panels: 07 4243
5. Flexible Flashing and Underlayment: Section 07 6500
6. Sheet Metal Flashing and Trim: Section 07 6200
7. Joint Sealants: Section 07 9200
8. Aluminum-Framed Entrances: Section 08 4213
9. Aluminum-Framed Storefronts: Section 08 4313
10. Glazed Aluminum Curtain Walls: Section 08 4413
11. Graffiti-Resistant Coatings: Section 09 9623
12. Sun Control Devices: Section 10 7173

D. See Section 01 2300; “Alternates,” for alternates affecting the work of this Section.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design Concept: Each mockup is intended to permit verification of workmanship and visual qualities of the final completed installation.

B. Include, as part of the mockup, required shoring and bracing to support mockup.

C. Mockup may be subjected to inspections, but is not intended for formal performance testing unless specified.

D. Make necessary additions and modifications to the details shown on the Drawings as may be required to comply with specified performance requirements while maintaining the design concept.

E. Accepted mockup shall be used as a visual standard for the final installation.

1.03 SUBMITTALS

A. General:

1. Review all Sections.

2. Submittal Procedures: In accordance with Section 01 3300, "Submittal Procedures."

B. Shop Drawings: Submit shop drawings for piratical building mockup inclusive of mockup components, footings, and bracing. Clearly identify components and materials to be integrated into the assembly.

C. Initial samples for materials to be incorporated into each mockup shall be reviewed and approved prior to providing materials for mockup and mockup construction.

1.04 QUALITY ASSURANCE

A. Mockup components shall be finished as required for completed installation including selected colors and finishes.

B. Allow time in Construction Schedule for initial review and each re-review of each mockup.

C. Obtain acceptance of mockup by Owner's Representative before starting work, fabrication, or construction represented by mockup.

D. Accepted mockups shall remain readily identifiable to serve as standard for judging the performance and appearance of completed work.

E. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Owner in writing.

PART 2 - PRODUCTS

2.01 MATERIALS.

A. General: Except as otherwise specified, materials for mockup shall be as shown and specified in the respective Specification Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine site and area to receive mockup and conditions under which mockups are to be constructed. Correct any deficiencies.

3.02 CONSTRUCTION

A. Locate mockups on site in locations coordinated with, and acceptable to, the Owner's Representative.

B. Anchorage and assembly shall conform to code requirements for seismic stability.

C. Coordinate mockup construction with delivery and assembly of related materials and components to be included in each mockup.

3.03 REVIEW AND ACCEPTANCE

A. Upon completion of each mockup construction, notify Owner's Representative and make arrangements for review. Notify the Owner's Representative not less than one week in advance of the dates and times when mockups will be available for review.

B. Modify the mockups, or construct new components if requested by the Owner's Representative, for further evaluation and until final acceptance is obtained.

C. Following acceptance, mockups shall serve as a visual standard of quality and appearance of the work it represents, including interface with adjacent materials and components.

3.04 TESTING

A. Perform tests on exterior wall assemblies where specified and in accordance with Section 01 4500, "Quality Control."

3.05 MAINTENANCE

A. Maintain each mockup in a neat, clean, and "as accepted" condition.

3.06 REMOVAL

A. Except as otherwise specified or approved by the Owner's Representative, materials used in accepted mockups shall not be incorporated into the Project.

B. Remove all mockups not approved for incorporation into the work prior to completion of Project but not before the work they are being used to judge has been accepted by the Owner's Representative.

3.07 MOCKUP SCHEDULE

A. On-Site, Free-Standing, Partial Exterior Building Mockup:

1. Provide freestanding exterior building mockup to permit review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials.

2. The required visual mockup include the area and components shown on the Drawings and shall include all visible system components of the exterior envelope systems including wall flashings, membranes, sealants, girts, and supports for a complete assembly.

3. Mockups shall be constructed out of sequence as a part of this Contract and shall not be incorporated into the Building.

4. Approval of the mockup by the Owner's Representative shall be obtained before fabrication of any components or ordering of materials for further work.

5. Mockup shall stand through the completion of the applicable Building exterior systems and serve as the standard for workmanship once it has been approved in writing by the Architect.

6. Mockup shall include and show interface of the following materials:

    a. Concrete stem wall.
    b. Aluminum-framed curtain wall, glazed as specified.
    c. Rain screen systems.
    d. Horizontal and vertical sunshades.
    e. Graffiti-resistant coatings
    f. Additional items as designated by Architect and as shown on the Drawings.
    g. Related sealants and other accessories and components as required to illustrate proposed construction and appearance.

B. Additional In-Place Mockups: As specified in the respective Specification Sections. Where appropriate, these mockups and field samples, when accepted, may remain as part of finished work.

3.08 TRIAL INSTALLATIONS

A. Prior to general installation of any given typical portion or system of the Work, the Contractor shall erect on the building a representative trial installation for approval by the Owner's Representative.

B. The Contractor shall propose the scope and location of trial installations for approval by the Owner's Representative.

C. The Contractor shall notify the Owner's Representative well in advance of each such trial installation. If approved, this portion of the work shall become part of the final installation.

D. Trial installations are to be erected in order to facilitate the timely procurement of requested approvals. No delay to the Project scheduling that result from trial installation requirements will be accepted.

E. Materials and systems requiring trial installations are noted in the respective Specification Sections.

END OF SECTION 01 4339

SECTION 01 4500
QUALITY CONTROL

1.01 GENERAL

A. Definitions:

1. The term "Owner's Testing Laboratory" means a testing laboratory retained and paid for by Owner for the purpose of reviewing material and product reports and performing other services as determined by Owner.

2. The term "Contractor's Testing Laboratory" means a testing laboratory retained and paid for by Contractor to perform the testing services required by the Contract Documents. Contractor's Testing Laboratory shall be an organization other than Owner's Testing Laboratory and shall be acceptable to Owner's Representative. It may be a commercial testing organization, the testing laboratory of a trade association, the certified laboratory of a supplier, Contractor's own forces, or other organization. Contractor's Testing Laboratory shall have performed testing of the type specified for at least 5 years.

B. Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by Applicable Code Requirements shall be made at the times needed in order not to hinder the progress of the Work. Except as otherwise provided, Contractor shall make arrangements for such tests, inspections, and approvals with Contractor's Testing Laboratory. Contractor shall give Owner's Representative timely notice of when and where tests and inspections are to be made.

C. If such procedures for testing, inspection, or approval reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for Owner's Representative's services and expenses.

D. If Owner's Representative is to observe tests, inspections, or make approvals required by the Contract Documents, Owner's Representative will do so, where practicable, at the normal place of testing.

E. Do not incorporate into the Work materials represented by samples under test without the written approval of Owner's Representative.

1.02 CONTRACTOR'S RESPONSIBILITIES REGARDING OWNER'S TESTING LABORATORY

A. Secure and deliver to Owner's Testing Laboratory specified quantities of representative samples of materials proposed for use as specified.

B. Submit to Owner's Testing Laboratory the preliminary design mixes proposed to be used for concrete and other materials which require review by Owner's Testing Laboratory.

C. Submit copies of product test reports as specified.

D. Furnish incidental labor and facilities:

1. To provide Owner's Testing Laboratory access to Work to be tested.

2. To obtain and handle samples at the Project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test samples.

E. Provide written notice to Owner's Representative and Owner's Testing Laboratory 72 hours in advance of operations to allow for assignment of personnel and scheduling of tests.

F. If Work is not performed when scheduled, Contractor shall reimburse Owner for Owner's Testing Laboratory personnel and travel expenses incurred.

1.03 TESTS AND INSPECTIONS

A. Certain portions of the Work will be tested or inspected at various stages. Nothing in any prior acceptance or satisfactory test result shall govern, if at any subsequent time the Work, or portion thereof, is found not to conform to the requirements of the Contract Documents.

B. Owner's Representative shall make periodic on-site observations of construction as it progresses and upon completion, and shall make off-site reviews of fabricated materials and equipment when such off-site reviews are specified in the Contract Documents.

C. Inspector(s) shall be selected and employed by the Owner. The Inspector(s) shall observe testing and inspection done by the Contractor as required in the Contract Documents and coordinate and observe special testing and inspection when requested by the Owner's Representative or the Owner.

D. Contractor shall personally supervise all work and inspect all materials as they arrive for compliance with the Contract Documents, and shall reject defective work and material without waiting for such rejection from others in authority. Opportunity for observation and inspection by the Owner's Representative and Inspector(s) shall be afforded throughout the construction.

1.04 ADDITIONAL TESTING AND INSPECTION

A. f initial tests or inspections made by Owner's Testing Laboratory or Owner's Geotechnical Engineer reveal that any portion of the Work does not comply with Contract Documents, or if Owner's Representative determines that any portion of the Work requires additional testing or inspection, additional tests and inspections shall be made as directed.

B. If such additional tests or inspections establish that such portion of the Work complies with the Contract Documents, all costs of such additional tests or inspections shall be paid by Owner.

C. If such additional tests or inspections establish that such portion of the Work fails to comply with the Contract Documents, all costs of such additional tests and inspections, and all other costs resulting from such failure, including compensation for Owner's Representative and Owner's consultants, shall be deducted from the Contract Sum.

1.05 TEST REPORTS

A. Owner's Testing Laboratory and Contractor's Testing Laboratory shall distribute copies of all reports as follows:

1. Owner's Representative: 1 copy.

2. Owner's Consultants: 1 copy each.

3. Owner: 3 copies.

4. The number of copies for Contractor and Subcontractor being tested will be determined upon commencement of Contract.

1.06 UNCOVERING OF WORK

A. If a portion of the Work is covered contrary to Owner's Representative's request or direction, or contrary to the requirements of the Contract Documents, it must, if required in writing by Owner's Representative, be uncovered for Owner's Representative's observation and be replaced at Contractor's expense without adjustment of the Contract Time or the Contract Sum.

B. If a portion of the Work has been covered, which is not required by the Contract Documents to be observed or inspected prior to its being covered and which Owner's Representative has not specifically requested to observe prior to its being covered, Owner's Representative may request to see such Work and it shall be uncovered and replaced by Contractor. If such Work is in accordance with the Contract Documents, the costs of uncovering and replacing the Work shall be added to the Contract Sum by Change Order; and if the uncovering and replacing of the Work extends the Contract Time, an appropriate adjustment of the Contract Time shall be made by Change Order. If such Work is not in accordance with the Contract Documents, Contractor shall pay such costs and shall not be entitled to an adjustment of the Contract Time or the Contract Sum.

1.07 GEOTECHNICAL ENGINEER

A. Owner will retain and pay the expenses of a Geotechnical Engineer to perform inspection, testing, and observation functions specified by Owner, as deemed necessary by Owner. The Geotechnical Engineer shall communicate only with Owner and Owner's Representative. Owner's Representative will then give notice to Contractor, with a copy to Owner, of any action required of Contractor.

1.08 CONTRACTOR DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of the Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written Request for Additional Information to the Owner’s Representative.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to the Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

END OF SECTION 01 4500

SECTION 01 4520
CONCRETE MOISTURE TESTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Testing for Moisture Vapor Emission Rate (MVER) and alkalinity at concrete and gypsum underlayment floors scheduled to receive an applied floor finish.

B. Related Requirements:

1. Concrete Floor Sealer: Section 09 6120.

2. Resilient Flooring: Section 09 6500.

3. Tile Carpeting: Section 09 6813.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.03 INFORMATIONAL SUBMITTALS

A. Qualifications of personnel or laboratory to perform testing.

B. Reports: Results of substrate moisture and alkalinity testing for each location and maximum allowable levels specified in respective Specification Sections for the intended floor finish.

1.04 QUALITY ASSURANCE

A. If areas of concrete are not within the floor covering manufacturer's maximum allowable emission rate and slab area fails the moisture test, do not proceed with installation and notify the Owner’s Representative.

1.05 FIELD CONDITIONS

A. Ambient Conditions:

1. Area to be tested shall match that of the finished floor covering.

2. Spaces shall be conditioned to temperature and humidity levels expected for final occupancy or as follows:

a. Interior temperature shall be 75 degrees F, plus or minus 10 degrees F.
b. Relative humidity shall be 50 percent, plus or minus 10 percent.

3. Maintain the above conditions for 48 hours prior to and throughout the duration of the tests.

PART 2 - PRODUCTS

2.01 MATERIALS FOR TEST PROCEDURES

A. MVER Tests:

1. Calcium Chloride Test Kits: Pre-packaged and of commercial consistency; American Moisture Test, Inc., Irvine, CA, Taylor Tools, or accepted equal. Kit shall include sealed dish of anhydrous calcium chloride, a metering dome with gasket, and instructions.

2. Relative humidity (RH) probe that has been verified for accuracy within the past year.

B. Alkalinity Tests: Test kit by American Moisture Test, Inc., Irvine, CA, Taylor Tools, or accepted equal pH meter.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean concrete surfaces of any residues resulting from pour of concrete which will affect the moisture vapor drive.

B. Plastic dome of test kit shall be sealed airtight to prevent ambient humidity from influencing the test results.

3.02 TESTING

A. General:

1. Perform moisture tests based on the Moisture Vapor Emission Rate (MVER) content in accordance with ASTM F1869, relative humidity tests in accordance with ASTM F2170, and alkalinity tests in accordance with ASTM F710. Results of these tests will be used to determine suitability of substrate to receive flooring materials.

2. Number of tests shall be determined by the square footage of each flooring material. Provide minimum of three tests for the first 1,000 square feet, and one test kit per each additional 1,000 square feet, with consideration to separation of test areas.

3. Unless otherwise approved in writing by Owner’s Representative, tests shall be performed by an independent testing agency.

B. MVER Test Kit:

1. Verify temperature of substrate is up to service temperature.

2. Duration of MVER test shall be 60 to 72 hours.

3. Dish shall be measured one-hour before and one-hour after testing with weight calculated within 0.1 grams.

4. Where calcium chloride test results are satisfactory but there is reason to suspect that unacceptable moisture levels below the upper two centimeters of the concrete may still exist, a relative humidity probe shall be used to test the full depth of the slab.

C. RH Probe:

1. Verify substrate is up to service temperature at least 48 hours prior to testing.

2. Depth of probes shall be 40 percent on concrete drying from the top only and 20 percent for gypsum underlayment drying from both sides.

3. Probe shall be allowed to acclimate and checked for drift less than 1 percent relative humidity over a 5 minute period.

4. Elapsed time for test shall be 48 hours.

D. Where tests are not satisfactory and substrates exceed the moisture vapor and alkalinity limits required by floor material manufacturers, do not proceed with installation. Notify Owner's Representative for review of conditions and to determine a resolution acceptable to the Owner's Representative including application of a topical barrier coat.

END OF SECTION 01 4520

SECTION 01 4550
INSPECTION OF WORK

1.01 ACCESS TO THE WORK

A. In addition to the requirements of the General Conditions, Owner, Owner's Representative and their representatives shall at all times have access to the Work wherever it is in preparation or progress and Contractor shall provide safe and proper facilities for such access and for inspection. The inspection and written acceptance of material and workmanship, unless otherwise stated in these Specifications, shall be final except as provided in the General Conditions.

1.02 TESTING AND APPROVAL

A. In addition to the requirements of the General Conditions, if any law, ordinance or public authority or the Specifications or Owner's Representative's instructions require any work to be specially tested or approved (including use of ionizing radiation for radiography), Contractor shall give Owner's Project Inspector timely notice of its readiness for inspection, and if the inspection is by another authority than Owner's Project Inspector, of the date fixed for such inspection.

B. Re-examination of questioned work may be ordered by Owner's Representative or Owner's Project Inspector.

1.03 OWNER'S INSPECTORS

A. Owner shall supply personnel who shall observe construction in progress. Project Inspectors shall have the following responsibilities and limitations on authority:

1. Observe installations and work in progress as a basis for determining conformance of the work, materials and equipment with the Construction Documents. Project Inspector will report any discrepancies observed to Owner's Representative and Contractor. Only Owner's Representative has the authority to make approvals or rejections.

2. Only Owner's Representative shall interpret the requirements of the Construction Documents. If any item is ambiguous, Owner's Representative shall make a written interpretation. If Contractor requests changes or modifications to the Construction Documents, Owner's Representative shall make a written determination on the requested changes or modifications.

3. Prepare an inspection report for each inspection performed.

4. Assist Owner's Representative in reviewing the test and inspection results of testing laboratories, if requested.

5. The Project Inspector is not authorized to permit deviations from the requirements of the Contract Documents unless such deviation has been approved by Owner's Representative in writing.

6. The Project Inspector is not authorized to advise on or issue directions to Contractor about any aspect of construction means, methods, techniques, sequences or procedures, or relating to safety programs in connection with the Project.

7. Review as-builts monthly.

B. The failure of Owner, Owner's Representative and its representatives and consultants, or Owner's Project Inspector to observe or inspect the Work, or to detect deficiencies in the Work, or to inform Contractor of any deficiencies which may be discovered, shall not relieve Contractor, its subcontractors regardless of tier, or suppliers from their responsibility for construction means, methods, techniques, sequences and procedures, construction safety, nor from their responsibilities to carry out the work in accordance with the Contract Documents and to detect and correct defective work. The term "defective work" means work that is unsatisfactory, faulty, omitted, incomplete, deficient, or does not conform to the requirements of the Contract Documents, directives of Owner's Representative, or the requirements of any inspection, reference standard, test, or approval specified in the Contract Documents, or has been damaged prior to final completion, unless responsibility for the protection of such work has been assumed by Owner through beneficial occupancy (or substantial completion, where applicable) in accordance with the General Conditions.

C. The University has developed a Code Enforcement Matrix, which identifies primary and secondary responsibilities for Inspections from either the Campus Fire Marshal or the IOR / Campus Building Official. Refer to Table available from the Owner’s Representative.

1.04 INSPECTION REQUESTS

A. Contractor shall request inspection of completed portions of the Work through Owner's Project Inspector, at least 72 hours in advance of the inspection to be performed for Campus Fire Marshal related inspections. All other inspections require 24 hours notice.

B. The Owner's Project Inspector or Owner's Project Manager will be on site for all work that takes place other than during normal work hours or that takes place on weekends or on University holidays.

C. Repeat inspection or inspections requested and subsequently canceled, may be subject to backcharges in accordance with Section 01 1100.

END OF SECTION 01 4550

SECTION 01 5010
CONTRACTOR'S USE OF PROJECT SITE

1.01 USE OF PUBLIC THOROUGHFARES AND UNIVERSITY ROADS

A. Use approved haul routes.

B. Where materials are transported in the prosecution of the Work, do not load vehicles beyond the capacity recommended by manufacturer of the vehicles or prescribed by any applicable state or local law or regulation.

C. Use only established roads on the campus; provided, however, that such temporary haul roads as may be required in the work shall be constructed and maintained by Contractor, subject to the approval of Owner's Representative.

D. Provide protection against damage whenever it is necessary to cross existing sidewalks, curbs, and gutters in entering upon the University roads. Repair and make good at the expense of Contractor all damages thereto, including damage to existing utilities and paving, arising from the operations under the Contract.

E. Truck staging is not allowed on campus or on any residential street surrounding the campus.

F. Comply with University approved Site Utilization Plan.

1.02 WATCHMAN'S SERVICES

A. Contractor should take necessary measures to safeguard materials and equipment in storage on the Project site, including Work in place or in process of fabrication, against theft, acts of malicious mischief, vandalism, and other losses or damages

B. Owner will not be liable for any loss or damage.

1.03 RUBBER-TIRED EQUIPMENT

A. Where carts, hand trucks, wheelbarrows, and similar wheeled conveyances are used on or in any portions of any structure, equip with pneumatic tires.

1.04 SERVICE CONTINUITY

A. Within the areas of the Work, investigate and uncover all drainage lines, sewers, electrical ducts, and other piping in use or forming continuations of utility systems required for other buildings or improvements upon the campus, and maintain such services in operation during performance of the Work of the Contract.

B. Maintain continuous services to all existing facilities during the period of construction except for the following conditions:

1. Perform Work that involves "shut-down" of existing facilities at such times as will cause the least inconvenience to University activities, and at the discretion of Owner's Representative. Furnish Project Inspector written notice of exact date and time of "shut-down" at least eleven (11) days in advance, unless a longer period is specified or shown on the Drawings.

2. Include in Contract sum the cost of overtime necessary for the Work. No extra payment will be allowed for overtime to meet this requirement or the Contract Schedule.

1.05 STORAGE

A. Contractor's use of the Project site for the Work and storage is restricted to the areas designated on the Drawings or as approved by Owner's Representative. Use of mechanical and electrical rooms for storage of materials or furniture is prohibited.

1.06 TEMPORARY STAIRS, SCAFFOLD AND RUNWAYS

A. Provide all scaffolds, stairs, hoist plant, runways, platforms, and similar temporary construction as may be necessary for the performance of the Contract. Such facilities shall be of the type and arrangement as required for their specific use, substantially constructed throughout and strongly supported, well secured and complying with all applicable rules and regulations and all applicable laws and ordinances. Including but not limited to 8CCR, Chapter 4, "Division of Industrial Safety", subchapter 4 "Construction Safety Orders", Article 21 "Scaffolds – General Requirements", and Article 22 "Scaffolds, various types"

B. Arrange for construction equipment access to areas which may be partly blocked by existing obstructions.

1.07 TEMPORARY HOISTS

A. Provide temporary hoist as required by job conditions for the installation of materials and equipment. Install and operate in accordance with all safety regulations of authorities having jurisdiction.

1.08 TEMPORARY SHORING AND BRACING

A. Provide temporary shoring and bracing as required for execution of the Work. All shoring and bracing shall comply with safety regulations of authorities having jurisdiction.

1.09 TEMPORARY BARRICADES

A. Provide temporary barricades as necessary. Maintain barricades in a clean and neat condition until no longer required and removal is approved or requested.

1.10 REMOVAL AND RECONDITIONING

A. Temporary facilities, barricades, utilities and other construction of temporary nature shall be removed from the Project site as soon as the progress of the work will permit in the opinion of Owner's Representative; and the portions of the Project site and building occupied by same shall be reconditioned and restored to original condition. For temporary utilities, refer to Section 01 5100.

B. Legally dispose of all debris resulting from removal and reconditioning operations.

1.11 CONTROL OF CONSTRUCTION WATER

A. Provide impermeable floor coverings and suitable dams to prevent damage by water used for the Work. Immediately clean up and remove all surplus water and water spilled in non-working areas. Do not allow water to overflow gutters or flood streets.

1.12 DUST CONTROL, AIR POLLUTION AND ODOR CONTROL

A. The Contractor shall employ measures to prevent the creation of dust, air pollution and odors.

1. Unpaved areas where vehicles are operated shall be periodically wetted down or given an equivalent form of treatment to eliminate dust formation.

2. All volatile liquids including fuels or solvents shall be stored in closed containers.

3. No open burning of debris, lumber or other scrap will be permitted.

4. Equipment shall be maintained in a manner to reduce gaseous emissions.

5. Low sulfur fuel shall be used for construction equipment.

6. Stockpiles of excavated materials shall be covered with material approved by Owner's Representative. Contractor shall provide street sweeping whenever silt from construction site is carried over to adjacent public thoroughfares.

1.13 NOISE CONTROL

A. The following noise control procedures shall be employed:

1. Maximum Noise: The Contractor shall use equipment and methods during the course of this work that are least disruptive to adjacent offices or residences. Noise levels for trenchers, graders, trucks and pile drivers shall not exceed 90 dBA at 50 feet as measured under the noisiest operating conditions. For all other equipment, noise levels shall not exceed 85 dBA at 50 feet.

2. Equipment. Jack hammers shall be equipped with exhaust mufflers and steel muffling sleeves. All diesel equipment shall have exhaust muffled. Air compressors shall be of a quiet type such as a "whisperized" compressor.

3. Operations: Machines shall not be left idling. Electric power shall be used in lieu of internal combustion engine power wherever possible. Equipment shall be maintained to reduce noise from vibration, faulty mufflers, or other sources.

4. Scheduling: Noisy operations shall be scheduled so as to minimize their disturbance to occupied adjacent areas and duration at any given location.

1.14 BARRICADE FENCING

A. Barricade chain link fencing shall be installed straight and plumb, using galvanized steel pipe and 9 gauge galvanized 2-inch diamond mesh wire fabric fastened to the posts and rails. Provide netting for screening as requested for safety.

B. Posts shall be 2.375 inch outside diameter; securely set in the ground and spaced a maximum of 10'-0" on center and 8'-0" height with a continuous top pipe rail. Posts shall not be set in or on existing concrete paving or walls to remain, but shall be located in soil, planter or brick paved areas.

C. Maintain fencing in a straight, clean and neat condition throughout construction as approved by Owner's Representative.

1.15 TEMPORARY STRUCTURES

A. Erect and maintain, for duration of operations and in locations as approved, suitable temporary office facilities as required for Contractor's, Owner's and Owner's Representative's administration of the work.

Provide necessary sheds and facilities for the storage of tools, materials, and equipment employed in the performance of the work. Temporary buildings shall be weathertight with raised solid floors, solid sheathed and composition roofs, and adequately glazed and screened windows for light and ventilation. Provide for Owner and Owner's Representative a clean 12' x 40' (minimum) trailer in good condition inside and outside electricity, heating and lighting, complete with air conditioning and a 120-208 volt/100 amp electric service and hook up for Owner's Representative and Owner with a cylinder locked door and at least 4 keys. The trailer shall have two 12' long partitions with doors located as approved by Owner's Representative. Configuration shall be as approved by Owner's Representative. Temporary buildings shall be painted using colors as approved. Contractor shall furnish daily janitorial service in the trailer. Provide stairs and handicapped ramp per code.

1.16 TRAFFIC CONTROL

A. Provide traffic control barriers and flagmen throughout the construction period.

1. Provide flagmen at pedestrian crossings of construction equipment right-of-ways one hundred percent of the time such equipment is operating. When equipment is not operating, such equipment right-of-ways shall be closed to equipment by means of a chain link gate.

2. Provide temporary traffic control barriers to ensure safety of all persons and property.

3. Provide numbers of flagmen necessary for vehicular and pedestrian traffic control. Flagmen shall be on duty at all times when the Work is in progress.

4. Refer to Section 01 5526 for additional traffic control information.

B. Provide site signage to direct pedestrians to safe and accessible routes during construction.

1.17 CONSTRUCTION SITE UTILIZATION PLAN

A. The Contractor shall follow the Site Utilization Plan that has been developed with the Campus.

1. Pedestrian Circulation Plan: Pedestrian circulation around the construction site is delineated on the Drawings.

1.18 OFF-CAMPUS SPACE USE REQUESTS

A. There may be a need for public space use by the project. The contractor shall request and pay for all necessary permits for street occupancy for the City of Berkeley’s agencies.

END OF SECTION 01 5010

SECTION 01 5100
TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide and maintain temporary utilities for construction operations and related necessary temporary structures. Remove them when they are no longer needed.

B. Pay for connections for water and electricity to Project site sources.

C. Owner does not guarantee amounts of water and electricity available from existing Owner's sources, nor will Owner be responsible for interruptions in service.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Install and use temporary utilities in accordance with Section 01 4100, “Regulatory Requirements.”

PART 2 - MATERIALS

2.01 GENERAL

A. Materials may be new or used, but shall be adequate for the required purposes. Their use and methods of installation shall not create unsafe conditions or violate requirements of applicable codes and standards.

2.02 FACILITIES

A. Install temporary toilets and washing stations and maintain facilities in a clean and sanitary condition.

1. All portable facilities shall be located within the fenced Project site.

2. Provide 1 toilet and 1 washing station per each 15 persons on the Project site at any one time, minimum. The same, yet separate provisions shall be made for female employees. At no time shall the facilities be less than required by Cal-OSHA standards.

2.03 TEMPORARY TELEPHONE

A. Telephone service will not be provided by Owner, except in case of emergency involving life and safety. Contractor shall make arrangements for temporary telephone service.

B. Contractor shall provide and maintain phones as needed for continuous field office and other phones as required.

2.04 TEMPORARY ELECTRIC SERVICE

A. Description of System:

1. Service Required: Furnish, install and maintain all necessary temporary electrical equipment, connections, etc., as necessary for the Work. Before final acceptance, all temporary equipment

and connections installed by Contractor shall be removed in a manner approved by Owner's Representative. Electric power will be provided by Owner at no cost to Contractor.

2. Electric Service:

a. Contractor shall verify characteristics of power available either directly to project site or from a surrounding building. Where power of higher voltage or different phase of current is required, Contractor shall be fully responsible for providing such service and shall pay all costs required therefore. Service connections shall be made by Contractor to the existing electrical distribution system at a point which will be made available. If a point of connection is to be made from the following:

1) The load connected to any circuit shall not exceed 25 percent of the circuit or feeder capacity as labeled in the panelboard.
2) There shall be no disturbance to building occupants and functions. Cables and conductors shall not prevent closing of fire labeled doors.

b. Temporary electric service shall be removed when no longer required. Characteristics of current furnished by Owner is limited to that existing and available; if current of other characteristics or quantity is required by Contractor, it shall supply the power as necessary at no extra cost to Owner.

3. At its own expense, Contractor shall repair and make good all damage to existing electrical facilities caused by Contractor's use, as requested and approved.

B. Requirements of Regulatory Agencies: Comply with applicable State and Federal codes, regulations and requirements.

C. Use of Permanent System: Any part of the permanent electrical system which is used for construction purposes shall be operated in a manner so as to ensure the safety of all personnel and to prevent interference with the orderly progress of the Work.

2.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watts/square feet.

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

C. Maintain lighting and provide routine repairs.

D. Permanent building lighting may be utilized during construction.

2.06 TEMPORARY HEATING

A. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

B. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

C. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

2.07 TEMPORARY COOLING

A. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

B. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

C. Owner's new cooling plant may be used.

1. Exercise measures to conserve energy.

2. Enclose building prior to activating temporary cooling.

D. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

2.08 TEMPORARY VENTILATION

A. Provide temporary fan units as required to maintain clean air for construction operations.

2.09 TEMPORARY WATER

A. Water service shall be provided at locations as approved. Contractor shall furnish, install and maintain necessary temporary supply connections, piping, fittings, etc., as necessary for the Work. Before final acceptance, all temporary connections and piping installed by Contractor shall be removed in a manner approved by Owner's Representative. Water will be provided by Owner at no cost to Contractor, however Contractor is required to install a meter to track usage.

1. Install a double check valve assembly, approved by Owner's Representative, at the point of connection to Owner's water system.

2.10 TEMPORARY WATER SERVICE

A. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

B. Connect to existing water source.

1. Exercise measures to conserve water.

C. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

2.11 TEMPORARY FIRE PROTECTION

A. Provide and maintain fire protection equipment including extinguishers, fire hoses, and other equipment as necessary for complete fire protection during the course of the Work.

1. Install a reduced pressure type backflow device, approved by Owner's Representative, at point of connection to Owner's water system.

B. Use fire protection equipment only for fighting fires.

C. A Fire Prevention Plan outlining the above (but not limited to) will be reviewed and approved by the Campus Fire Marshall within 60 days of the Notice to Proceed.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with applicable requirements specified in Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 - HVAC, and Division 26 – Electrical.

B. Maintain and operate systems to provide continuous service.

C. Modify and extend systems as required.

END OF SECTION 01 5100

SECTION 01 5526

TRAFFIC CONTROL, FIRE PROTECTION AND SITE ACCESSIBILITY

1.01 DESCRIPTION

A. General Requirement: The Contractor shall provide traffic control, fire protection provisions and site accessibility as outlined in this Specification.

1.02 TEMPORARY FIRE PROTECTION SYSTEM

A. Provide temporary fire protection for the building during the course of construction.

B. Work will be performed in an area of potential high fire danger. If a high fire danger day is declared by the local fire jurisdiction, at the Owner's Representative discretion, the Contractor will stop work until the high fire danger is over. The shutdown will be at no additional cost to the owner.

C. Fire access must be maintained to all fire hydrants, water valves, and meters, and driveways.

D. The Contractor's project superintendent shall have a cellular phone at the job site at all times. The number of this phone will be provided to the lead fire jurisdiction so that the superintendent can be contacted during work hours and advised of fire and other emergencies.

1.03 TRAFFIC AND PEDESTRIAN CONTROL

A. The Contractor shall implement effective pedestrian and vehicular traffic control during project working hours.

B. The Contractor shall provide flag persons throughout the course of the project, as required to meet construction operations.

C. The flag persons shall be under the control of the Contractor's superintendent such that they can redirect traffic as required to allow for the transit of emergency vehicles.

D. Before the end of each day's work, the Contractor shall ensure that all roads and paths disrupted by the work will not be a physical hazard during the hours when Contractor is off-site and in particular during the hours of darkness.

E. Contractor shall provide necessary beacons, guides and guard rails, project site lighting and traffic lights, temporary striping and marking and any other items needed to ensure the safe movement of vehicular and pedestrian traffic.

F. Remove promptly all signs, barriers and temporary traffic striping when no longer required.

G. Provide for the emergency passage at all times of fire trucks and ambulances through a temporary, 16' wide minimum, one-way traffic zone.

H. Prepare a traffic and pedestrian control plan. The plan shall be submitted to the Owner's Representative for approval. The plan shall include a diagram indicating the location of various traffic control personnel, structures, equipment lighting and signage. No traffic control operations will be put into effect without and approved traffic control plan.

I. All traffic and pedestrian control plans shall include provisions for disabled access around the construction site. The length of the disabled access detour shall be minimized.

J. Contractor shall provide one 16-foot wide minimum lane for vehicle access at all times. Total road closure will require the specific approval of the Owner's Representative, and will not be allowed unless adequate detour plans are presented.

K. It is the Contractor's responsibility to provide all trench plates, steel and wood, required by this work.

L. Refer to Section 01 5010 for further Traffic Control information.

1.04 SITE ACCESSIBILITY

A. All open trenches shall be covered with steel plates at the end of every work day as required so that the roadways and parking areas are left in serviceable condition

B. Steel plates shall be set in place with cut back asphalt as required to eliminate exposed edges of steel plates. Maximum discontinuity at edges shall be 1/2 inch.

C. Flag control and temporary steel plates shall be provided as required to allow operation of Addison Street, Center Street, and Oxford Street.

D. Barriers shall be placed at each end of all excavations and at such places along excavations as may be necessary to warn all pedestrian and vehicular traffic to such excavations.

E. The amount of trench to be opened or left open at any one time is limited to a single segment between communication vault to communication vault or from point of connection to communication vault. Excavation and pipe laying shall be coordinated to the end that the minimum of interference with public traffic will result. An open trench shall be defined as any trench which has not been completely backfilled, satisfactorily compacted and capped with at least 1-inch of temporary paving (cutback) in paved areas. Final surface restoration of the trench shall be completed within one weed of backfill.

F. Campus parking to remain in public use in all areas not adjacent to construction.

G. No trench or excavation shall be left open to the public at the end of any day's work. Daily traffic control measures shall continue until cleanup activities have been satisfactorily completed and all of the Contractor's equipment has been removed from the traveled way area.

H. The Contractor shall not leave open trenches in non-paved areas without a barricaded and high visibility warning tape at a height of 5 feet and 3 feet above the ground. Steel plates shall be used to cover open trenches in non-paved areas that are subject to vehicle or pedestrian traffic. Plywood sheets shall be used only where steel plates cause damage to planting or where they would render existing valves or other such utility appurtenances inaccessible as determined by the Owner's Representative.

I. The Contractor shall install temporary chain link fencing around the job sites and any trees as necessary for the protection of pedestrians and planted materials, as well as for protection of the job site from vandalism. Fence location will be reviewed with an eye to preventing short cuts by pedestrians or vehicles across landscaped areas. Contractor may have to construct temporary access for disabled pedestrians.

J. Maintain adequate exit routes for the safety of building users at all times during construction.

K. In general, two different exit routes are required from every building. Maintain at least half the width of existing passageways clear and free of obstructions but in no case shall the clear exit path be narrower than 4 feet nor remove handrails from use.

L. The Owner shall be the enforcing agency with regard to maintaining safe exits and shall have the right to order the Contractor to take remedial measure, stop work or have work done by others and deduct the cost from the Contractor, when required, to maintain safe exits.

M. No parallel parking spots will be allotted to the Contractor for storage and placement of equipment and materials unless approved by Owner Representative as a requirement for site laydown.

N. Maintain access to all adjacent roads, pathways, parking lots, buildings and public spaces at all times.

O. No work can be done on Owner Drive or any other public thorough fare adjacent to a red curb, unless approved by the Owner's Representative.

P. A traffic control, detour plan and Access Interruption is to be submitted to and approved by the Owner's Representative prior to any road closure.

1.05 CAMPUS EVENTS AND SPECIAL ACTIVITIES

A. During the course of this project, campus activities will be occurring in the area of the project. The Contractor will be required to accommodate these activities.

B. A general listing of University activities is provided in the following table. This list does not necessarily represent a full and complete listing of all events or activities.

Football Games at California Memorial Stadium	There are regularly scheduled football events
Track and Field Meet Edwards Track	There are regularly scheduled track events. Access to Edwards Track from Frank Schlessinger Way must be maintained.
Youth Summer Camps	Summer camps make use of Edwards Track, Evans Diamond and Haas Pavilion There is a great deal of traffic associated with children being delivered to and picked up from these activities. Drop off time in generally around 8:00 a.m. and pick up time around 4:00 p.m.
Tennis Matches	These are regularly scheduled events. Access to the tennis complex must be maintained.
Baseball Games	These are regularly scheduled events. Access to the Evans Diamond from both the west and east ends must be maintained. Parking space for the visiting team bus, usually near Evans Diamond main entrance, must be maintained.
Final Exams	Construction is near class rooms. Special operations may be anticipated to accommodate noise issues as directed by the Owner's Representative.
Commencements	Commencement activities bring large crowds of people and cars. They are often held outdoors. Contractor will be required to stop work or adjust work schedule on occasion to accommodate these activities.
Greek Theater Performances	These are regularly scheduled performances as well as special event performances. The Greek Theater is located along Gayley Road.

Memorial Glade	Memorial Glade is used for Campus Wide and special events, such as Calaplooza. These events will be accommodated by the Contractor.
Cal Day	Usually held the 3rd Saturday in April, it is a Campus Wide event.

END OF SECTION 01 5526

SECTION 01 5639
TREE PROTECTION AND TRIMMING

PART 1 - GENERAL

1.01 SUMMARY

A. New Work: This Section includes the protection and trimming of trees that are to remain but interfere with, or are affected by, execution of the Work, whether temporary or new construction.

B. Existing Work: Some trees on site already have been given tree protection of various types. This Section includes the maintenance of and all necessary restoration to the existing protections until such time as the Owner Representative issues written notice that protection shall be removed.

1.02 SUBMITTALS

A. Product data for each type of product specified.

B. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and the Owner Representative, and other information specified.

C. Certification by a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

D. Maintenance recommendations for care and protection of trees affected by construction after completing the Work by the Arborist.

1.03 QUALITY ASSURANCE

A. Tree Service Qualifications:

1. Contractor shall maintain an experienced, qualified arborist on the Project site on a full-time basis during execution of the Tree Protection work. This arborist shall be consulted and shall conduct a site inspection visit at any time when a change in the status of tree protection occurs, for any reason.

2. Arborist Qualifications:

a. Site Arborist: The Contractor shall utilize a registered arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where the Project is located to oversee all transplanting and trenching near existing trees, provide any pruning services required for existing and new trees. All site work shall be done under their review, in conformance with their recommendations.

B. Tree Pruning Standards: Comply with the National Arborist Association's "Pruning Standards for Shade Trees" except where more stringent requirements are indicated.

C. Pre-installation Conference:

1. Before commencing tree protection and trimming, meet with representatives of authorities having jurisdiction, The Owner Representative, consultants, and other concerned entities. Review tree protection and trimming procedures and responsibilities. Notify participants at least three (3) working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Drainage Fill: See Division 32 – Section 'Landscape Drainage."

B. Topsoil: See Division 32 – Section 'Trees, Shrubs and Ground Cover Plantings."

C. Filter Fabric: See Division 32 – Section 'Trees, Shrubs and Ground Cover Plantings."

D. Protective Fencing: Standard 6 foot metal chain link fence, with metal "T-bar" stakes. 1 1/2 inch by 1 1/2 inch by 1/8 inch or equal, sunk into the ground 2 foot minimum, with a 3-foot wide moveable opening to provide access to the tree trunk.

E. Wood Chip Mulch: See Division 32 – Section 'Trees, Shrubs and Ground Cover Plantings'.

PART 3 - EXECUTION

3.01 PREPARATION

A. Temporary Protection: Provide temporary fencing, barricades, or other suitable guards located outside the drip line (outer perimeter of branches) to protect remaining trees and other plants from damage.

B. Protect tree root systems from damage due to noxious materials caused by run-off or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

C. Place a 6-inch layer of wood chip mulch under drip line of all trees to remain.

D. Do not store construction materials, debris, or excavated material within the drip line of remaining trees.

E. Do not permit vehicles or foot traffic within the drip line, and prevent soil compaction over root systems.

F. Do not allow fires under or adjacent to remaining trees or other plants.

3.02 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Excavation within the drip line of existing trees to remain shall be prohibited without the approval of the Arborist. If approved, proceed as described below.

C. Where excavation for new construction is required within tree drip lines, hand excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

1. Relocate roots in backfill areas wherever possible. If encountering large, main lateral roots, expose beyond excavation limits as required to bend and relocate roots without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inch back from new construction.

2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition and temporarily support and protect roots from damage until they are permanently relocated and covered with earth.

D. Where utility trenches are required within tree drip lines, tunnel under or around the roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Review: The Owner Representative shall review all proposed work within root area prior to execution of the work.

2. Root Pruning: Do not cut main lateral roots or tap roots; cut only smaller roots that interfere with installation of new work. Cut roots with sharp pruning instruments; do not break or chop.

3.03 REGRADING

A. Approval: Maintain the natural existing grade around all trees, within the drip line area, unless indicated otherwise. Cut and fill shall be accomplished only upon the authority of the Arborist or Owner Representative. If approved, proceed as described below.

B. Grade Lowering:

1. Where new finish grade must be set below existing grade around trees, slope grade away from trees as recommended by Arborist. Maintain existing grades within tree drip line.

2. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or tap roots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

C. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade shown, fill with topsoil. Place topsoil in a single non-compacted layer and hand grade to required finish elevations. Do not use mechanical compaction within the drip line of existing trees to remain.

D. Moderate Fill: Where existing grade is more than 6 inches but less than 12 inches below finish grade elevation, place a layer of drainage fill, filter fabric, and a final layer of topsoil on existing grade.

1. Carefully place drainage fill against tree trunk approximately 2 inches above finish grade elevation and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill to an elevation 6 inches below grade.

2. Place filter fabric with 6 inches minimum of overlapping edges.

3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.04 TREE CANOPY ALTERATION

A. Approval: Unauthorized pruning of trees on the job site is prohibited. Pruning shall be accomplished only upon the authority of the Arborist or Owner's Representative.

B. Prune remaining trees affected by temporary and new construction. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during the Contract period as recommended by arborist.

C. Pruning Standards: Prune trees according to the ISA pruning guidelines, the ANSI-300 pruning standards, and the National Arborist Association's "Pruning Standards for Shade Trees."

1. Class I: -Fine Pruning,

2. Class II: Standard pruning.

3. Class III: Hazard pruning.

4. Class IV: Crown-reduction pruning.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Chip all branches removed from trees. Spread material where indicated or as directed by the Owner's Representative.

3.05 TREE REPAIR AND REPLACEMENT

A. Damage Assessment:

1. Damage to trees to remain shall be appraised using the "Guide to Plant Appraisal, 9th Edition." Monetary fines will be assessed according to extent of damage. Severely damaged trees shall be replaced at no cost to the Owner's Representative.

2. The Arborist shall be sole arbiter of description of damage, assessor of fines and/or determination of replacement value.

B. Repair: Promptly repair trees damaged by construction operations.

C. Replacement: Remove and replace dead and damaged trees that the Arborist determines to be incapable of restoring to a normal growth pattern.

1. Provide new trees of 6-inch caliper size and of a species selected by the Owner Representative when trees over 6 inches in caliper, measured 12 inches above grade, are required to be replaced.

3.06 DISPOSAL OF WASTE MATERIALS

A. Burning: Burning is not permitted on the Owner's property.

END OF SECTION 01 5639

SECTION 01 5642
PROTECTION OF EXISTING STRUCTURES AND UTILITIES

1.01 GENERAL

A. The Drawings show, if applicable, existing above and below grade structures, drainage lines, storm drains, sewers, water, gas, electrical, hot water, and other utilities which are known to Owner.

B. Locate all known existing utility installations before proceeding with construction operations which may cause damage to such installations. The existing installations shall be kept in service where shown and damage shall be repaired at no increase in Contract Sum.

C. If any other structures or utilities are encountered, request Owner's Representative to provide direction on how to proceed with the Work.

D. If any structure or utility is damaged, take immediate action to ensure the safety of persons and property.

E. If adjacent structures to the project site exist, these structures shall not be used to support temporary construction loads either from staging of construction material or use of construction equipment. If loading of the structure is planned for construction of the project, Contractor shall provide engineering review to ensure existing structure will not be overloaded. If adjacent structures have below grade retaining walls and walls will be surcharged due to construction activities, Contractor shall provide engineering review to ensure existing walls will not be overloaded. Engineering reports shall be provided to the Owner's Representative for review prior to start of construction.

1.02 SHORING

A. General Protection. Pursuant to Labor Code Sections 6705 and 6707, Contractor shall include in its base bid all costs incident to the provision of adequate sheeting, shoring, bracing or equivalent method for the protection of life and limb which shall conform to the applicable Federal and State Safety Orders.

B. Before beginning excavation five feet or more in depth, Contractor shall submit to Owner's Representative a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazards of caving ground during the excavation. The proposed plan shall comply with the State of California Construction Safety Orders and Title 24 of the California Code of Regulations (CCR). If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer whose name and registration number shall be indicated on the Drawing. If a dispute arises as to whether the plan must be prepared by a registered civil or structural engineer, Owner's Representative's determination of the matter shall be final and conclusive on Contractor. The cost of required engineering services shall be borne by Contractor and shall be deemed to have been included in the amount bid for the Work as stated in the Agreement.

C. Neither the review nor approval of any plan showing the design of shoring, bracing, sloping, or other provisions for worker protection, shall relieve Contractor from its obligation to comply with Construction Safety Orders Standards and Title 24 CCR for the design and construction of such protective Work, and Contractor shall indemnify Owner and Owner's Representative from any and all claims, liability, costs, action and causes of action arising out of or related to the failure of such protective systems. Contractor shall defend Owner, its officers, employees, and agents and Owner's

Representative in any litigation of proceeding brought with respect to the failure of such protective systems.

D. Comply with State of California Construction Safety Orders, Article 6 - Excavations, Trenches, Earthwork - whether or not the excavation, trench, or earthwork is five feet or more in depth.

END OF SECTION 01 5642

SECTION 01 5723
STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.01 BACKGROUND

A. Storm drains discharge directly to creeks and the Bay without treatment. Discharge of pollutants (any substance, material, or waste other than uncontaminated storm water) from this project into the storm drain system is strictly prohibited by the California Regional Water Quality Control Board's (RWQCB) Water Quality Control Plan (Basin Plan), except as provided in Article 3.08 of this Section.

1.02 GENERAL CONTRACTOR SCOPE

A. Provide all material, labor, equipment, for installation, implementation, and maintenance of all surface-water pollution prevention measures. Contractor will not be required to maintain post-construction pollution prevention structures. This work includes the following:

1. Furnishing, placing, and installing effective measures for preventing erosion and runoff of soil, silts, gravel, hazardous chemicals or other materials prohibited by the San Francisco Bay Region Water Quality Control Board from entering the stormwater drainage system.

2. Management of on-site construction materials in such a manner as to prevent said materials from contacting stormwater or wash water and running off into the storm drain system.

3. Complying with applicable standards and regulations per Article 1.3.

4. Include post-construction stormwater pollution prevention structures in the stormwater pollution prevention plan. Contractor shall use construction drawings as the reference for post-construction BMPs.

B. Specifications Included By Reference:

1. Regulatory Requirements, Section 01 4100

2. Contractor's Use of Project Site, Section 01 5010

C. In this Section, the term "storm drain system" shall include storm water conduits, storm drain inlets and other storm drain structures, street gutters, channels, watercourses, creeks, lakes, and the San Francisco Bay.

D. Sanitary sewer discharge regulations are intended to provide protection of the sanitary sewer system and East Bay Municipal Utility District's (EBMUD) water pollution control plant. In this section, "sanitary sewer" shall include any sanitary sewer manhole, clean-out, side sewer or other connection to the EBMUD wastewater treatment plant.

E. Contractor shall have storm drain pollution prevention measures in place and follow this Specification during the rainy season (October 1 through May 1) and anytime rain is predicted in the San Francisco Bay Area. It is the responsibility of the Contractor to be prepared for a rain event in the non-rainy season, and to be aware of weather predictions. The University is not responsible for informing the contractor of rain predictions.

F. Sanitary sewer blockage will likely result in a back-up and overflow to the storm drain system. The contractor shall immediately notify the project manager or the inspector of record if there is a clogged sanitary sewer.

G. Contractor shall not allow any non-stormwater to enter the storm drain system. Non-stormwater includes domestic supply water used to wash streets, painting and drywall equipment, tools, equipment, or vehicles.

1.03 REGULATIONS AND STANDARDS

A. Contractor shall comply with the following applicable regulations:

1. Clean Water Act, United States Environmental Protection Agency, and Porter-Cologne Clean Water Act, State of California.

2. "San Francisco Bay Basin (Region 2) Water Quality Control Plan" (Basin Plan), California Regional Water Quality Control Board, 1995 Edition.

3. Regional Water Quality Control Board – Construction General Permit — Stormwater Pollution Prevention.

B. Contractor shall comply with the following standards and guidelines on storm drain pollution prevention:

1. "Manual of Standards for Erosion and Sediment Control", Association of Bay Area Governments

Order From: ABAG
P.O. Box 2050
Oakland, CA 94604
(510) 464-7900

2. "Erosion and Sediment Control Field Manual" California Regional Water Quality Control Board (RWQCB)—San Francisco Bay Region, Third Edition, July 1999.

Order From: San Francisco Estuary Project
1515 Clay Street, Suite 1400
Oakland, CA 94612
(510) 622-2465

C. Stormwater Best Management Practice Handbooks, www.cabmphandbooks.com.

1.04 SUBMITTALS/DELIVERABLES

A. Submit a Storm Water Pollution Prevention Plan (SWPPP) to the Capital Projects project manager for plan approval. Contractor shall not disturb soil onsite until the University approves the plan.

1. If the project disturbs greater than 1 acre of soil, the University will send a "Notice of Intent" (NOI) to the RWQCB, with the applicable fee (Contractor shall supply Owner with the check for this fee). Upon completion of the project, the University will send a "Notice of Termination" (NOT), as required by the RWQCB. All permit-related documents shall be submitted to the RWQCB by UC Berkeley EH&S.

B. The plan shall include the following:

1. Title Page: The title page should primarily identify that the document is a SWPPP. Elements that should be included on the title page are the following:

   a. Name of the project, and project number,
   b. Owner and contractor of the project,
   c. Contact person(s)/address/daytime and emergency phone number.
   d. Waste Discharge Identification Number (WDID No.) for the project. This number is assigned by the RWQCB upon submission of the NOI. The number should be included in the plan after it is assigned.

2. Certification Page:

   a. The Contractor shall include a certification page immediately following the SWPPP title page. This page will be signed by the University and state the following:

      "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted, is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

      _____ _____
      Name, Title Date of Preparation

3. Amendments:

   a. The Contractor shall amend the SWPPP whenever there is a change in construction or operations which may affect the discharge of significant quantities of pollutants to surface waters, ground waters, or a municipal separate storm sewer system. The SWPPP should also be amended if it is in violation of any condition of the State of California General Permit or has not achieved the general objective of reducing pollutants in storm water discharges. In addition, the University may require the contractor to amend the SWPPP if the discharge is in violation of the RWQCB San Francisco Bay Region Basin Plan.

   b. The following items should be discussed in the Amendment section as appropriate:

      1) Location of proposed change should be shown on the site map, and referenced in the Amendment section of the SWPPP.
      2) Describe the existing condition and why it is being amended.
      3) Document who requested the amendment.
      4) Describe the new control measure.
      5) Attach a certification page to the beginning of the amendment.

4. Table of Contents:

   a. Include a table of contents in the SWPPP, including page numbers.

5. Introduction: The introduction shall provide the following information:

    a. Type and size of the construction project, including land area in acres).
    b. Project location, including county, and address.
    c. The beginning date of the project groundbreaking.
    d. The beginning and end dates for all phases.

6. Source Identification and Best Management Practices

    a. Identify stormwater and non-stormwater pollutant sources at the construction site. Choose an appropriate stormwater pollution prevention best management practice (BMP) to control the pollution source.
    b. Provide in the SWPPP a geographical description of potential stormwater pollution sources. Topographic and site maps shall be used for this purpose.

        1) Topography Map:

            a) The map shall extend approximately one quarter mile beyond the construction site boundary and show the following: the construction site, surface water bodies (including springs and wetlands), known wells, an outline of off-site drainage discharging into the construction site, general topography, and the stormwater discharge locations for construction site stormwater.
            b) Contractor shall use a U.S. Geological Survey quad map and shall modify it to show the required information. Include dimensions, scale, legends, flow direction of water bodies, run-on and run-off water and drainage, drainage locations, and delineation of permanent erosion and sediment control measures.

        2) Site Map:

            a) The contractor shall identify pollution sources, construct and implement stormwater and non-stormwater pollution prevention BMPs at the construction site. The contractor shall implement the SWPPP. Contractor shall include SWPPP for the post-construction pollution sources and erosion and sediment control BMPs. A separate map may be used for showing the locations of the post-construction BMPs.
            b) The site map shall be one or more detailed map(s) showing the location of pollution sources, (e.g. construction site drainage patterns, grading activities that change drainage patterns, drain inlets, hazardous materials storage, contaminated soil). The site map shall show the location of BMPs designed to prevent pollution sources from causing stormwater or non-stormwater pollution. The Contractor will choose the best available performance-based technology and methods to prevent storm water pollution for construction site activity. Many of those methods are detailed in the reference materials listed in Paragraph 1.03.
            c) The following is a list of BMPs, geographic features or pollution sources to be shown (if applicable) on the site map. Further detail on these topics is in Part 3 of this Section (Paragraph number in parentheses).

                (1) Storm water flow drainage patterns and grading activities that change drainage patterns (3.02);
                (2) Perennial, intermittent or seasonal surface water bodies, oceans, lakes, rivers, creeks or streams, ponds, springs, and wetlands (3.03)
                (3) Areas of existing vegetation (3.04)
                (4) Areas of disturbed soil (3.05)
                (5) Existing and planned paved areas and buildings (3.06)

(6) Dust suppression water management (3.07)
(7) Fire hydrant protection (3.08)
(8) De-watering and sediment settling (3.09);
(9) Erosion and sediment control measures (3.10);
(10) On-site soils movement and storage (3.11);
(11) Site ingress and egress mud tracking prevention (3.12);
(12) Storm drain inlet protection (3.13);
(13) Construction materials storage (3.14);
(14) Concrete, mortar, saw cutting (3.15);
(15) Sanitary Sewer Discharge Point Identification (3.16);
(16) Fueling, washing and equipment cleaning (3.17);
(17) Building wash or hydro-blasting water management (3.18);
(18) Inspection, monitoring and maintenance of BMP control structures (3.19);
(19) Spill Prevention and Control (3.20);
(20) Water Main Break Contingency Plan (3.21);
(21) House Keeping Practices (3.22);
(22) Post-construction stormwater run-off control (3.23);
(23) Personnel training (3.24);
(24) List of contractors and phone numbers (3.25);
(25) Or other appropriate site-specific storm drain pollution prevention methods necessary to achieve the objectives stated in subpart 1.02A.

1.05 ENVIRONMENTAL ENFORCEMENT

A. The RWQCB, East Bay Municipal Utilities District (EBMUD), and the City of Berkeley have authority to enforce, through codified regulations, any portions of this Section that if not implemented may violate applicable regulations. Agency enforcement may include but is not limited to: citations, orders to abate, bills for cleanup costs and administration, civil suits, and/or criminal charges. Contract compliance action by UC Berkeley shall not be construed to void or suspend any enforcement actions by these or other regulatory agencies.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide materials as required for execution of the work.

PART 3 - EXECUTION

3.01 GENERAL

A. For each applicable sub-part below, the Contractor shall delineate on the site map BMP locations and provide a detailed description in the plan for pollution prevention structures or methods that will be constructed, implemented and maintained on site.

3.02 STORMWATER DRAINAGE PATTERNS AND GRADED SLOPES

A. Drainage patterns shall be shown on the site map. Drainage patterns that are modified during the construction of the project should be clearly shown on the site map. All slopes should indicate grading ratio and flow direction.

B. The size of the construction site (in acres).

C. The run-off coefficient of the site before and after construction

D. The percentage of the area of construction that is impervious before and after construction.

3.03 SURFACE WATER LOCATIONS

A. All surface water locations shall be clearly delineated on the site map. Surface water bodies include: oceans, lakes, rivers, creeks or streams, ponds, springs and wet lands. Include intermittent or seasonal surface water bodies. Estimate the storm water flow onto the site, assuming a 10 year 6-hour rain event. Estimate the volume of water the site would contain in trenches, excavations, pier holes, or pits for the different phases of work.

3.04 AREAS OF EXISTING VEGETATION

A. Contractor shall protect existing vegetation that is to be preserved on the site from mechanical or other injury during the project. Areas of existing vegetation shall be clearly delineated on the site map.

3.05 AREAS OF DISTURBED SOIL

A. Contractor shall clearly identify on the site map all areas of soil disturbance. These areas shall include soil removal or augmentation, such as holes, pits, excavations, trenches, berms, slopes, fill, and imported top soil.

3.06 EXISTING AND PLANNED PAVED AREAS AND BUILDINGS

A. Areas that are covered by concrete, asphalt, or other permanent coverage of the soil shall be clearly delineated on the site map. Imprints of buildings shall also be indicated whether they are permanent or temporary.

3.07 DUST-SUPPRESSION-WATER MANAGEMENT

A. Contractor shall use best available dust suppression equipment and methods to control dust so that the dust does not cause discomfort or nuisance to occupants of the project site neighboring property. Contractor shall control dust suppression water so that it is effective in controlling dust, but does not enter the storm drain system. Contractor shall describe their dust suppression water management methods in this plan.

3.08 FIRE HYDRANT PROTECTION

A. Contractor shall protect fire hydrants on and near the project site from mechanical damage. If the project personnel cause damage that results in a release of fire suppression water, the Contractor shall implement the procedures described in Article 3.20.

3.09 DE-WATERING AND SEDIMENT MANAGEMENT

A. If stormwater or groundwater in site excavations or drilled holes, (e.g., trenches, pits, pier holes, footings), needs to be removed, it shall be made clean by filtering, settling, or other method capable of removing solids and suspended particles from this water prior to discharge to the storm drain system. The Contractor shall ensure that this discharge complies with all applicable provisions of the Basin Plan (see Article 1.01 of this Section).

B. If excavation water is domestic supply water, or the water is contaminated with a hazardous substance, then the contractor shall dispose of according to guidance from the PM. For disposal authorization, the

contractor shall contact the PM to determine the discharge requirement. The PM will work with UC Berkeley Office of Environment, Health & Safety (EH&S) who will establish the discharge requirements.

1. If the Contractor suspects the presence of contaminated groundwater, or domestic supply water, the Contractor shall immediately notify Owner representative or EH&S at (510) 642-3073. The Contractor shall not attempt to pump out or treat any material suspected of containing a hazardous material or petroleum product.

3.010 DESCRIPTION OF EROSION AND SEDIMENT CONTROL MEASURES

A. Provide a description of erosion and sediment control measures that will be used on the site, and correlate the description with the site map (may be listed on the map in a comments section). Areas requiring erosion control measures are exposed soil, such as soil piles, bare soil, sloped soil, and any area of disturbed soil. Erosion control measures include paving, tarp placement, soil blankets, mulching, seeding, hydro-mulching, the use of straw wattles, and spreading straw. Sediment control measures include drain inlet protection, filter fabric, geo-textile silt fencing, gravel placement, gravel or sandbag placement, sediment settling tanks, and straw wattle placement. This list is not all inclusive and the contractor should refer to the resources listed in Article 1.03 of this Section. Both erosion and sediment control practices are designed to be implemented as an integrated system of pollution control. Without erosion controls, sediment controls are easily overwhelmed and will not prevent pollution.

3.11 ON-SITE SOILS MOVEMENT AND STORAGE

A. The Contractor shall describe and implement proven methods to prevent erosion from soils stored on site.

3.12 SITE INGRESS AND EGRESS MANAGEMENT MUD TRACKING PREVENTION

A. The Contractor shall ensure that mud is not tracked from the site onto public or campus roads. Contractor shall select the most appropriate BMP to accomplish this requirement.

3.13 STORM DRAIN INLET PROTECTION

A. The Contractor shall protect storm drain inlets from receiving sediment, hazardous chemicals, gasoline, diesel, oil or grease, trash, debris or other pollutants from the construction site.

3.14 CONSTRUCTION MATERIALS STORAGE

A. Storage and exposure of raw materials, byproducts, finished products, and hazardous materials containers shall be controlled as described below:

1. All construction materials shall be stored at least ten feet away from storm drain system inlets, catch basins, and curb returns.

2. The Contractor shall not allow any material to enter the storm drain system.

3. At the end of each working day, the Contractor shall collect and prepare for disposal all scrap, debris, and waste material generated by project activities.

4. During wet weather or when rain is in the forecast, the Contractor shall store materials, (that can flow or be transported by storm water), inside a building or under a secured waterproof covering

to prevent accidental release to the storm drain system. Examples: use sealed debris bins in rainy weather; store fuel containers out of the weather; cover soil, sand, or debris piles with tarps.

5. The Contractor is responsible for ensuring that storage and disposal of all hazardous materials brought on site for this project (e.g., coatings, thinners, solvents, and fuels), and all hazardous waste generated during project activities (e.g., waste oil) is in compliance with all applicable federal, state, and local standards and requirements.

6. Liquid materials shall be stored in secondary containment. The containment shall be designed to hold at least 110% of the volume of the largest stored container.

3.15 CONCRETE, MORTAR, SAWCUTTING

A. For concrete or mortar application to be performed on site (if any), the Contractor shall comply with the following provisions:

1. Washing sweepings of exposed aggregate concrete into the street or storm drain system, as defined in paragraph 1.02C., is prohibited. Collect and return sweepings to aggregate base stockpile, or dispose of as construction debris.

2. Do not wash out concrete trucks and equipment into the storm drain system. Whenever possible, perform washout of concrete trucks (if any) and equipment off-site where discharge is controlled.

3. If on-site washout of trucks and equipment is necessary, then the Contractor shall comply with the following procedures:

   a. Locate washout area at least 50 feet from storm drains, open ditches or water bodies, preferably in a dirt area.
   b. Do not allow storm water run-off from the washout area.
   c. Construct a temporary pit or bermed area large enough to contain the wash-water and surplus concrete waste.
   d. Wash out concrete waste into the temporary pit where the concrete can set, be broken up, and then disposed of as construction debris. If the volume of water is greater than what will allow concrete to set, allow the wash water to concentrate and/or evaporate, if possible. Otherwise, allow water to settle before filtering it, and then pump to the sanitary sewer (as long as the pH is less than hazardous waste limit of 12.5).

4. Wash-water from tools used for mixing mortar, in sheet rock work, plaster, drywall, mortar work or similar work shall be settled before disposal to the sanitary sewer. Solids shall be disposed to the debris bin. This wash-water is prohibited from stormwater discharge.

5. Concrete sawing or drill cutting lubricating/cooling water or shall be collected using a wet-vacuum. The lubricating/cooling water shall be settled before disposal to the sanitary sewer. Solids shall be disposed to the debris bin. This lubricant/cooling water is prohibited from stormwater discharge.

3.16 SANITARY SEWER DISCHARGE POINT IDENTIFICATION

A. If the Contractor will be disposing of water from a settling operation, or any other water approved by EH&S for sanitary sewer disposal, the Contractor will verify with the Physical Plant-Campus Services (PP-CS) utilities department that the manhole used for disposal is a sanitary sewer and not a storm drain. (Note: Do not assume that a manhole is a sanitary sewer, even if the words “sanitary sewer” are embossed on it. Sometimes utility maps and manhole cover designations are incorrect.) The Contractor shall be given PP-CS contact information by the PM.

3.17 FUELING, WASHING AND EQUIPMENT CLEANING

A. The Contractor shall not perform vehicle cleaning on site, unless a properly designed wash area prevents run-off from entering the storm drain system. Domestic water supply is prohibited from entering the storm drain because it contains chloramines. It can go to the sanitary sewer if the sediment is allowed to settle before discharge and it meets the standards of the EBMUD Wastewater Discharge Permit pollutant strength limits.

B. If fueling must occur on-site, use designated areas away from drainage. Locate on-site fuel storage tanks within a bermed area designed to hold the tank volume. The area should be covered so that rain water will not get into the bermed area. The bermed area shall be lined so that leaks, spills or drips will not contaminate the soil. Use secondary containment while fueling or changing fluids to catch drips or small spills.

C. The Contractor shall dispose of wash water from the cleaning of non-hazardous water-based coating equipment (such as latex paints or drywall compounds) and tools to the sanitary sewer. Unused latex paint, oil based paint, used or new paint thinner and solvents are prohibited from disposal to the sanitary sewer and the storm drain system. The Contractor shall dispose of these wastes in accordance with federal, state, and local hazardous waste and solid waste regulations.

3.18 BUILDING WASH OR HYDRO-BLASTING WATER MANAGEMENT

A. Contractors are required to follow the attached "Procedure for Wastewater Management from UC Berkeley Building Washing and Maintenance Operations" if performing this work. These procedures are in Attachment 1 of this Section.

3.19 INSPECTION, MONITORING AND MAINTANCE OF POLLUTION CONTROL SYSTEMS

A. Inspect the site before, after, storm events, or during a 24-hour storm event. Inspections shall be done during the storm water observation period (October 1 through April 1) to ensure that storm drain pollution prevention controls are in place. Provide documentation of these inspections, and improvements or modifications of the control systems. Contractor shall designate an inspector and list the name of the inspector in the list of contacts page as described in subparagraph 1.04A.1.c. Contractor shall maintain structural controls and updates/amendments to the SWPPP. Representatives from UC Berkeley will conduct periodic inspections of the site to verify adequacy of storm drain pollution prevention controls and compliance with applicable regulations and standards as stated in paragraph 1.03A.

B. UC Berkeley will disclose historic site activities that may have included the use of hazardous materials (e.g., gas station, dry cleaner, underground storage tank, manufacturing) and that have or are suspected to have caused pollution at the site. The University will write and implement a plan to monitor, sample and analyze stormwater discharges for pollutants related to the construction activity. If applicable to site conditions, Contractor shall include this hazardous materials monitoring plan in the SWPPP.

3.20 SPILL PREVENTION AND CONTROL

A. The Contractor shall take precautions to prevent accidental spills of pollutants, including hazardous materials brought onsite by the Contractor. However, in the event of a spill, the Contractor shall be held responsible for the following:

1. Immediately contain and prevent leaks and spills of prohibited pollutants from entering the storm drain system. Clean up the spill and label the container. Store the container in a safe place and contact the PM to arrange disposal of the waste. The Contractor shall keep a spill kit on site at all times for this purpose.

2. Contractor shall comply with all federal, state, and local hazardous waste requirements and ensure that no spilled materials are washed into the stormwater or non-stormwater systems.

3. Report any hazardous or unknown material spills immediately to the EH&S at 510-642-3073. If a spill occurs after hours or on a weekend, call 9-911 from campus phones (911 from off-campus phones, or 642-3333 from cellular phones) to contact the UC Berkeley Police Department.

B. The Contractor is responsible for ensuring that its employees and subcontractors (if any) working on site are aware of the location of the campus phone nearest the project site.

3.21 WATER MAIN AND SANITARY SEWER LINE BREAK CONTINGENCY PLAN

A. If working on or near a water main line or sanitary sewer line, the Contractor shall have a written emergency response plan that states procedures for responding to a break and release of supply water to the storm drain system. The Contractor shall meet the following requirements:

1. Water Main Work

a. Determine the direction of water flow if the main were to break.
b. Build a containment berm between the work area and the storm drain inlet(s) that the water would flow into. Make the containment structure large enough to hold the water so that it can be pumped to a sanitary sewer.
c. Build this containment structure before digging.
d. If there is a water main break, pump the water that collects in the containment structure to a sanitary sewer.
e. If the containment fails, prevent chlorinated water from entering the storm drain system by placing dechlorination sodium sulfite tablets in the sewage according to Attachment 2 of this Section.
f. Put in place, before digging, sediment control structures upstream of drain inlets and at drain inlets.
g. If a break occurs contact the PM or inspector of record immediately. Include in the plan the phone numbers of the PM and EH&S contacts.

2. Sanitary Sewer Line Work: This sub-part applies only to Contractors that are hired to work on sanitary sewer lines and are trained to work near sewage.

a. Determine where the sewage will flow if the work could cause a blockage.
b. Build a containment structure between the work area and the storm drain inlet(s) that the sewage water would flow into. Make the containment structure large enough to hold the sewage flow so that it can be pumped to a sanitary sewer.
c. Build the containment before working on the sewer line. Put in place, before digging, solids (toilet paper, etc.) control structures upstream of drain inlets and at drain inlets.
d. If a sewage blockage occurs, pump it to a sanitary sewer, and do not allow it to flow into the storm drain system.
e. If the containment fails, prevent chlorinated water from entering the storm drain system by placing dechlorination sodium sulfite tablets in the sewage according to Attachment 2 of this Section).
f. If a sewage blockage or spill occurs contact the PM or inspector of record immediately. The PM will immediately notify EH&S. Include in the plan the phone numbers of the PM and EH&S contacts.

3. Excavation Work: This Paragraph applies to Contractors that excavate in the vicinity of sanitary sewer lines and cause or discover a sewage spill, leak or blockage.

a. Immediately notify the PM. The PM will immediately notify EH&S. Include in the plan the phone numbers of the PM and EH&S contacts.

3.22 HOUSE KEEPING PRACTICE

A. The Contractor shall implement the following applicable good housekeeping practices:

1. Store materials that have the potential to be transported to the storm drain system by storm runoff or spillage away from areas of heavy traffic and under cover in a contained area or in sealed waterproof containers.

2. Use tarps on the ground to collect fallen debris or splatters that could contribute to storm water pollution.

3. Secure opened bags of powdered materials (if any) that could contribute to storm water pollution and visible dust emissions.

4. Pick up litter, construction debris, and other waste generated by project activities daily from adjacent areas, including the sidewalk area, gutter, street pavement, and storm drains impacted by the project. All wastes shall be stored in covered containers, disposed of, or recycled immediately.

5. Clean sidewalks, driveways, or other paved areas within the construction site to eliminate or prevent mud-tracking conditions. Vacuuming, power sweeping, or manual sweeping is acceptable. Dispose of sweepings in a place that will not pollute the storm drain system. Domestic water may be used but it shall be contained and directed to landscapes or the sanitary sewer. The discharge of wash-water to the storm drain system is prohibited.

6. Inspect vehicles and equipment arriving on-site for leaking fluids, and promptly repair leaking vehicles and equipment. Use drip pans to catch leaks until repairs are made.

7. Avoid spills by handling materials carefully. Keep a stockpile of appropriate spill clean-up materials, such as rags or absorbent materials, readily accessible on site. Clean up all spills of materials brought on site for project activities according to Article 3.19.

8. Train employees regularly on good housekeeping practices and procedures. Assign responsibility to specific employees for inspecting good housekeeping, and responding to spills.

3.23 POST-CONSTRUCTION STORMWATER RUN-OFF CONTROL MEASURES

A. All permanent structural and nonstructural control measures that are planned for the project to control pollutants in stormwater discharges after construction is completed shall be delineated on a site map. These controls shall be part of the design of the project and included in the architectural drawings. Post-construction BMPs include, but are not limited to:

1. Minimization of land disturbance

2. Minimization of impervious surfaces

3. Treatment of stormwater run-off using infiltration

4. Water detention/retention

5. Bio-filter BMPs

6. Efficient irrigation systems

7. Ensuring that interior building drains and trash enclosures are tied to the sanitary sewer system, and not the stormdrain system

8. Appropriately designed and constructed energy dissipation devices

B. Post construction BMPs must be consistent with all local post-construction stormwater management requirements, policies and guidelines.

C. Contractor shall provide operation and maintenance manuals for post-construction stormwater management controls installed as part of this project. Funding for the operation and maintenance of the BMPs will be identified by the PM, and included in the manuals by the contractor.

D. Contractor shall refer to construction drawings for post-construction BMPs and include them in the SWPPP.

E. Develop a maintenance plan for the permanent BMPs installed at the site.

3.24 PERSONNEL TRAINING

A. The Contractor shall train its employees working on the site on the requirements contained in this Section. The Contractor shall document this training in writing. University representatives for the site will request to see the training materials and records at the onset of work.

B. The Contractor shall inform all subcontractors (if any) of the water pollution prevention requirements contained in this Specification and include appropriate subcontract provisions to ensure that these requirements are met.

3.25 LIST OF CONTRACTORS DESIGNATED SWPPP CONTACTS AND PHONE NUMBERS

A. Provide a list of employees that will be responsible for writing, implementing and updating the SWPPP.

SECTION 01 5723
ATTACHMENT 1

Procedure For Wastewater Management From
UC Berkeley Building Washing and Maintenance Operations

This procedure describes wastewater management for UC Berkeley building washing operations and is to be used in conjunction with all operations where building exterior surface cleaning generates wash-water. Wastewater from washing operations is prohibited from discharge to storm drains because it may contain chloramines, cleaning compounds, or materials dislodged from the building surfaces during cleaning (such as leaded paint). Wastewater may be disposed to landscaped areas or the sanitary sewer on the condition that contaminant concentrations will not harm the landscape or the sewage treatment facility's operations.

Offsite disposal through the Office of Environment, Health & Safety (EH&S) may be necessary if contaminants in the wash-water exceed sewer discharge contaminant limits. If cleaning compounds containing surfactants, detergents or other chemicals are used in the cleaning process and there are sludges or residues that need to be disposed of, contact EH&S, 642-3073, for disposal guidance.

Building Washing Wastewater Management Procedures

Unpainted Buildings

- Construct a containment system to eliminate wash-water discharge to the storm drain.
- Divert wash-water onto landscaping (preferable) or into the sanitary sewer.
- If high pressure water is used (e.g., hydro-blasting to remove spalled concrete) then settle out the solids using a containment tank, or filter out the solids using filter fabric or other solids removal method.

Painted Buildings

- Construct a containment system to eliminate wash-water from draining to the storm drain or the sanitary sewer system.
- Pour, pump or drain the wash-water into a containment tank.
- Use a filter system (e.g., cartridge filters) to remove suspended paint solids. Use settling methods to minimize the amount of solids entering the filter system. This will prevent filter saturation.
- Sample the filtered water before it is discharge to the sanitary sewer. Have the sample analyzed for the 13 priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, zinc) and any other chemicals of concern that could be present to determine whether or not the water is suitable for sanitary sewer discharge. Send a copy of the analytical results to EH&S for disposal method determination.
- If the analytical results exceed the EBMUD discharge limits, consider options for using a finer pore size filter, or dispose of the water through EH&S. EH&S will arrange to ship the water to a properly permitted disposal facility.

SECTION 01 5723
ATTACHMENT 2

Procedure for Preventing Chlorinated Water From Entering The Storm Drain System Using Sodium Sulfite Tablets

Purpose

These procedures describe how to manually dechlorinate discharges of domestic water using sodium thiosulfate solution prior to release into storm sewer systems or receiving waters in accordance with Regional Water Quality Control Board requirements.

This procedure is limited to domestic water discharges with a chlorine residual of 2 mg/L or less. Dechlorinating superchlorinated water (chlorine residual of 50-200 mg/L) is not addressed in this procedure. Contact EH&S, 642-3073, for guidance on discharging superchlorinated water.

Dechlorination Procedure Overview

Dechlorination of chlorinated water discharges is accomplished by the addition of tablets comprised of 90% sodium sulfite to the discharge flow. For discharges from trenches during main breaks, the tablets are placed inside synthetic mesh fabric pockets sewn together in a grid or line (called a "dechlor mat" or "dechlor strip" respectively). The dechlor mat or strip is laid across the flow path or over the storm drain and either weighted down or nailed to the street to keep it in place.

In all cases, as the discharged water flows over and around the tablets, chemical is released as the water contacts the tablets, reacting with and destroying the chlorination. The key to the success of this procedure requires effective contact between the flow and the tablets. This is accomplished by ensuring the tablets are well-distributed across the flow path. The tablets must be spaced no more than 4" apart for gravity discharges at ambient pressure. For discharges under pressure (such as pumping), the tablets should be spaced as close together as possible without constricting the flow. The various tablet holder designs are fabricated to ensure that this specification is met.

Selection Criteria For Dechlor Mat or Dechlor Strip For Use In Gravity Discharges

This decision is ultimately up to the preferences of the user as long as the tablets are well distributed across the flow path. The mats can cover a larger area so if the discharge flow is large and spread out, mats may be easier to use than multiple strips. Mats are also sized to cover storm drain inlets so if the flow is not well channelized, it may be easier to locate mats over the storm drain(s) the flow is ultimately discharging into rather than laying out strips or mats upstream of this point. Strips are smaller, take up less space in vehicles and multiple strips can be used to cover larger flows so their convenience and flexibility make them the appropriate choice unless some of the conditions described above are encountered.

Dechlorination Equipment

The following equipment is needed for dechlorination when following this procedure:

Dechlor mat (3' x 4') -or-
Dechlor strip (3' x 6") -or-
Diffuser with tablet chamber -or-
Diffuser with mesh tablet holder -and-
Dechlor tablets (45 lb bucket) -and-
DPD Powder-Pop Dispenser -and-
Attachment 2 continued

WARNING!

Don't use sodium sulfite with calcium hypochlorite (HTH) or sodium hypochlorite (used to disinfect water distribution system mains or appurtenances). These two chemicals can react when mixed in the presence of water. The reaction can produce heat and both hydrogen and chlorine gas, creating both a potentially toxic and explosive/flammable atmosphere. These chemicals and associated mixing and dispensing equipment must be kept segregated from each other at all times. Should the chemicals become mixed, call EH&S 642-3073.

Procedure 1—Dechlorination For Releases From Trenches During Water Main Breaks

Fill Pockets With Tablets

Put one tablet in each pocket of the dechlor mat or strip. If the pocket contains a partially-used tablet, add another tablet only if there is room.

Place Dechlor Mat Or Strip In flow Path

Place the dechlor mat or strip across (perpendicular to) the flow path downstream of sediment control devices (e.g., pea gravel bags). Nail the mat or strip to the street using street nails (through the grommets in either end of the mat) or weigh the mat or strip down to ensure that it stays in place. If the flow path is more than 4' wide (width of dechlor mat) when using a dechlor mat or 3' wide (width of dechlor strip) when using a dechlor strip or there is more than one flow path (flow is spreading out in more than one direction), use additional mats to ensure all water from the source is crossing a mat. If the flow is deep (more than 1" above the top of the dechlor mat) and/or the flowrate is very high (>300 GPM), a second mat should be placed downstream of the first mat to ensure adequate dechlorination.

Monitor Mat or Strip

Check the dechlor mat periodically to ensure some tablet remains in each pocket and that all flow is crossing at least one mat.

Clean-up

When the discharge is complete, move the dechlor mat(s) or strip(s) to the storm drain(s) where the discharge was entering, placing it on the upstream side of the grate. Hose the flow path to remove any tablet residual, ensuring that the flow enters the storm drain(s) upon which the dechlor mat(s) or strip(s) is installed. If the flow path separates and some flow travels to a different storm drain, a dechlor mat or strip should be installed at that location as well.

Tablet Disposal

Tablets Shelf Life

Tablets have a relatively long shelf life unless exposed to high temperatures (>85°F). At higher temperatures, tablets may crumble. During the summer months, crews may need to place enough tablets for daily use in coolers for storage on trucks at the beginning of each workday. Supply buckets must be kept in a cool storage location.

Powdered Tablet Waste Disposal

As long as tablets are in large enough pieces to be retained within the mesh dechlor, diffuser chamber or diffuser mesh pockets, they can be used for dechlorination per the procedures contained herein. Small amounts of powdery or granular tablet waste from tablet supply buckets or secondary containers should be mixed with water and discharged to the sanitary sewer.

END OF SECTION 01 5723

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.02 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.

2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. See Section 01 6250, “Product Options and Substitutions.”

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.03 SUBMITTALS

A. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 3300, "Submittal Procedures." Show compliance with requirements.

1.04 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

5. Store products to allow for inspection and measurement of quantity or counting of units.

6. Store materials in a manner that will not endanger Project structure.

7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

9. Protect stored products from damage.

B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate size and location with Owner.

PART 2 - PRODUCTS

2.01 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Design Professional will make selection.

5. Where products are accompanied by the term "match sample," sample to be matched is Design Professional's.

6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

7. Or Equal: Where products are specified by name and accompanied by the term "or equal," comply with provisions in 01 6250, “Product Options and Substitutions.”

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 6000

SECTION 01 6250
PRODUCT OPTIONS AND SUBSTITUTIONS

1.01 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. Catalog numbers and specific brands of trade names followed by the designation "or equal" are used in conjunction with the material and equipment required by the Specification to establish the standards of quality, utility and appearance required. Substitutions which are equal in quality, utility and appearance to those specified may be accepted subject to the following provisions:

1. All substitutions must be approved by the Owner's Representative in writing.

2. Contractor shall submit to the Owner's Representative, within 70 calendar days after the date of commencement specified in the Notice to Proceed, a typewritten list containing a description of each proposed substitute item or material, along with the documents required by Paragraph 1.01C.

3. The Owner's Representative will accept, in writing, such proposed substitutions as are, in the Owner's Representative's opinion, equal in quality, utility and appearance to the items or materials specified.

4. Such approval shall not relieve the Contractor from complying with the requirements of the drawings and specifications.

5. Contractor shall be responsible at the Contractor's own expense for any changes resulting from the Contractor's proposed substitution which affect other parts of the Contractor's own work or the work of others.

6. The decision of the Owner's Representative shall be final.

B. If a request for substitution occurs after the 70 calendar day period, the substitution may be reviewed at the discretion of the Owner's Representative; and the costs of such review, as approved by Owner, shall be borne by Contractor and will be deducted from the Contract Sum.

C. Requests for substitutions will only be considered if Contractor submits the following supporting data:

1. Complete technical data including drawings, performance specifications, samples and test reports of the article proposed for substitution; all submittal items required in the Specification for the proposed article including design and engineering calculations; and any additional information required by the Owner's Representative.

2. Data described in Subparagraph C-1 for the specified item for which substitution is proposed.

3. List similar projects using product, dates of installation, and names of Owner and Owner’s Representative

4. Statement by Contractor that the proposed substitution is in full compliance with the requirements of the Contract Documents and Applicable Code Requirements.

5. Itemized comparison of proposed substitution with specified product, listing variations, and reference to Specifications section name and number, article and paragraph numbers.

6. List availability of maintenance services and replacement materials.

7. List of Subcontractors, if any, that may be affected by the substitution.

8. If the proposed substitution requires that portions of the work be redesigned or removed in order to accommodate the substituted item, submit design and engineering calculations prepared by a properly licensed design professional.

D. The Owner's Representative may reject any substitutions not proposed in the manner and within the time prescribed above.

E. For products specified by naming only one product and manufacturer, without the qualifying phrase “or equal” there is no option, and no substitution will be allowed. Such is the case with products, materials, equipment or systems which are specified for the purpose of matching a specific function or economy of maintenance of other products, materials, equipment or systems already in use in existing portions of University’s installations. Where matching with an existing item is required, the final decision whether a product proposed matches the item satisfactorily is Owner’s Representative’s judgement.

F. The 70-day submittal period does not excuse the Contractor from completing the project within the performance time stipulated in the agreement or excuse the Contractor from the payment of liquidated damages if final completion is delayed.

G. Wherever more than one manufacturer's product is specified, any of the specified products are acceptable and a substitution request is not required; however, the first-named product is the basis for the design used in the work and the use of alternative-named manufacturer's products or substitutes may require dimensional modification in the project design and construction and resulting adjustments in location of related work. If such alternatives are proposed by Contractor in accordance with submittal requirements and are favorably reviewed by the Owner's Representative, Contractor shall assume costs required to make necessary dimensional revisions and modifications. Such approval will not be unreasonably withheld.

H. If the Owner's Representative, in review of the list of materials and equipment, requires revisions or corrections to be made or shop drawings and/or supplemental data to be submitted, Contractor shall promptly do so. If any proposed substitute is judged by the Owner's Representative to be unacceptable, the specified item shall be provided; further submissions will not be allowed, unless directed by the Owner's Representative.

I. Samples may be required. Tests required by the Owner's Representative for the determination of the quality and utility shall be made by Contractor's Testing Laboratory, and at the expense of Contractor, with acceptance of the test procedure first given by the Owner's Representative.

J. In review of the data submitted in support of substitutes, the Owner's Representative will use for purposes of comparison all the characteristics of the specified item as they appear in the manufacturer's published data even though all the characteristics of the specified item may not have been particularly mentioned in the specification. If more than two submissions of data are required, the cost of reviewing these additional submissions shall be charged directly against Contractor; and the Owner will withhold the funds necessary to cover these costs.

END OF SECTION 01 6250

SECTION 01 6600
MATERIAL AND EQUIPMENT

1.01 GENERAL

A. Unless otherwise specifically provided elsewhere in the Contract Documents, all materials, equipment, and articles incorporated in the Work shall be first grade, new and delivered (where practicable) to the job in original containers or cartons. Each article or equipment specified shall be the latest product as listed in printed catalog data of latest date, and shall be the standard product of a single manufacturer.

B. All material and equipment incorporated in the Work shall be:

1. In condition acceptable to the Owner's Representative.

2. Suitable for intended use.

C. Keep materials clean, dry and undamaged.

1.02 TRANSPORTATION AND HANDLING

A. All products shall be delivered, stored and handled in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Contractor shall control delivery schedules to minimize long-term storage at the Project site and to prevent overcrowding of construction spaces. In particular, Contractor shall coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

B. Products shall be delivered to the Project site in the manufacturer's sealed original container or other packaging system, clearly labeled manufacturer's name brand, grade seal or model number, and instructions for handling, storing, unpacking, protecting and installing.

C. Promptly remove damaged or defective products from the Project site and replace with no adjustment of Contract sum.

1.03 STORAGE AND PROTECTION

A. When delivered and before installation, all materials shall be provided with protection as required to prevent damage. All surfaces shall be kept clean and free from dirt and stains. Deliveries to the Project site shall be made only during the hours indicated herein.

B. Products shall be stored at the Project site in a manner that will facilitate and measurement of quantity or counting of units.

C. Heavy materials shall be stored away from the Project structure in a manner that will not endanger the supporting construction.

D. Store manufactured products in accordance with manufacturers' instructions and with seals and labels intact and legible.

1. Store products and equipment subject to damage by the elements in weather-tight enclosures or other means.

2. Maintain temperature and humidity in accordance with manufacturer's recommendations.

E. Exterior Storage:

1. Store materials and equipment above ground on blocking or skids to prevent soiling, staining and damage.

2. Cover products that are subject to damage by the elements with impervious protective sheet coverings. Provide adequate ventilation to prevent condensation.

3. Store sand, rock, or aggregate material in a well-drained area on solid surfaces to prevent mixing with foreign matter.

F. Periodically inspect stored products to assure that products are maintained under specified conditions and are free from damage and deterioration.

G. Protection after Installation:

1. Prevent damage to materials and equipment.

2. Use whatever protective materials or methods are necessary to prevent damage to installed products from traffic, construction operations, and weather. Remove protection when no longer required.

3. Maintain temperature and humidity conditions in interior spaces for the work in accordance with manufacturers' instructions for the materials and equipment being protected.

1.04 STANDARD PRODUCTS

A. Unless otherwise indicated in these Specifications, or favorably reviewed by the Owner's Representative, materials and equipment for the construction work shall be essentially the standard product of a manufacturer regularly engaged in the production of such materials and equipment or materials and equipment of comparable character.

1.05 UL LABEL

A. Materials and equipment, for which Underwriters' Laboratories, Inc. standards have been established and their label service is available, shall bear the appropriate UL Label.

1.06 MANUFACTURERS' TRADE MARKS AND NAMES

A. The Owner's Representative reserves the right to review and request the removal or redesign of manufacturers' trade marks and names on items of materials and equipment which will be exposed to view in the completed Work. Such removal or redesign shall be with no adjustment of Contract Sum.

END OF SECTION 01 6600

SECTION 01 7110
EXISTING CONDITIONS

PART 1 - GENERAL

1.01 SUBMITTALS

A. When conditions encountered differ from that shown, submit proposed remedial methods for approval.

B. Cross-reference to Contract Documents includes shop drawings, samples, and product data as appropriate.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials, Manufacturers and Fabrication: Comply with the requirements established by the Contract Documents.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect existing conditions and surfaces that will become substrates for, or contiguous surfaces with, the work under this contract. Should deviations from tolerances established by the Contract Documents interfere with lines, levels or the tolerances established for the work under this Contract, correct prior to commencement of adjacent new work.

B. Submit a written list of conflicts and remedial requirements within 10 days of the Notice to Proceed. Any conflicts not identified at that time will be remedied at the Contractor's expense.

C. Where photographic or video media is utilized to record condition prior to the start of construction, submit 2 sets of media to the Owner for its records.

3.02 WORKMANSHIP

A. Work shall be done in accordance with tolerances established by the Contract Documents. It is the expectation of the University that the Contractor and subcontractors will endeavor to ensure the utmost quality and pride of workmanship in all aspects of the Work.

END OF SECTION 01 7110

SECTION 01 7123
FIELD ENGINEERING

1.01 FIELD MEASUREMENTS AND EXISTING CONDITIONS

A. Contractor Responsibility: Exact field measurements are responsibility of the Contractor. Any required off-sets, additional fittings, rerouting of existing or new work to provide serviceable system with location shown, and to maintain head room and clearances to match existing construction, are responsibility of the Contractor.

B. Layout of the Work: The Contractor shall employ, at the Contractor's own expense, Registered Civil Engineer or Licensed Land Surveyor approved by the Owner's Representative to survey existing conditions and lay out new work. Existing building plans have been created based on the original construction documents. Existing dimensions and elevations shall be field-verified prior to the proceeding with new work.

1.02 GRADES, LINES AND LEVELS

A. Datum: The Contractor shall provide all survey work necessary for accurate location, both horizontal and vertical, of the work from Project references shown on the Drawings. Coordinate University building datum with Civil Drawings and ensure that all survey information provided clearly indicates which datum is used.

B. Review: The Contractor's layout, i.e., location and alignment, of structures and facilities shall be reviewed by the Owner's Representative prior to any demolition, construction, or installation by the Contractor.

C. Conflict: The Contractor will be held responsible for correctness of layout, for establishing location of existing concealed utility lines, and for notifying the Owner's Representative in writing in event of conflict with the Drawings. In such case, the Contractor shall not proceed until directed by the Owner's Representative.

D. Preservation: All stakes, boundary lines, bench marks or survey marks, etc., which have been or may be established in any part of the Project site or adjacent thereto shall be carefully preserved and respected by the Contractor and shall be restored at the Contractor's expense if lost or destroyed as result of the Contractor's operations.

END OF SECTION 01 7123

SECTION 01 7300
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Surveying for laying out the work.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

G. Closeout procedures, except payment procedures.

1.02 QUALIFICATIONS

A. For survey work, employ a land surveyor registered in California and acceptable to Owner's Representative. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located.

1.03 FIELD CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1. Minimize amount of bare soil exposed at one time.

2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Pest Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

G. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.04 COORDINATION

A. Notify affected utility companies and comply with their requirements.

B. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas excluding the exposed to structures and as otherwise noted, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of work of separate sections.

F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific Section.

C. Notify Owner's Representative four days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of installation, preparation and installation procedures.

2. Review coordination with related work.

3.04 LAYING OUT THE WORK - SEE SECTION 01 1100

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Owner's Representative of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Owner's Representative the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Owner's Representative.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

J. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual Sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, cutting oils, lubricants, chemicals, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.07 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.08 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 01 4500 and Division 23.

3.10 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

1. Provide copies to Owner's Representative.

B. Notify Owner's Representative when work is considered ready for Substantial Completion.

C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Owner's Representative's review.

D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

E. Notify Owner's Representative when work is considered finally complete.

F. Complete items of work determined by Owner's Representative's final inspection.

3.11 MAINTENANCE SERVICE

A. Furnish service and maintenance of components if indicated in specification sections for 1 year from date of Substantial Completion.

B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Owner.

END OF SECTION 01 7300

SECTION 01 7325
ANCHORS AND FASTENERS

1.01 GENERAL

A. Submit manufacturer's literature and calculations for anchoring and fastening devices to Owner's Representative for approval.

B. For concrete, except as listed below, use two-piece expansion anchors or drilled-in fasteners as shown. Concrete nails are not permitted.

1.02 POWDER DRIVEN FASTENERS

A. The use of low velocity powder-activated tools is permitted only for the conditions described below. The use of medium and high velocity powder-activated fasteners as defined by ANSI A10.3 is prohibited.

1. Permitted Uses of Low Velocity Powder-Actuated Fasteners:

a. Anchoring metal track for interior non-load bearing walls. Note: Door frames shall be fastened with two-piece expansion anchors.
b. Fastening of furring strips to concrete walls.
c. Temporary fastening and concrete forming.
d. Installation of incidental straps and wires used to suspend the following:

1) Metal duct work of 25 pounds per linear foot or less;
2) Piping of 1" diameter or less;
3) Electrical conduit of 2" diameter or less.

e. Fastening of plaster accessories, flashing and similar items with negligible loading.

2. Requirements for Low Velocity Powder Actuated Fasteners.

a. Minimum shank: .143 inch diameter; minimum penetration: 1.25 inches for 3000 psi concrete; minimum rated tensile strength: 310 lbs; minimum rated shear strength: 420 lbs. Contractor shall submit calculations to substantiate selection.
b. Weight suspended from each connection shall not exceed 200 lbs.
c. Where designated by Owner's Representative, anchors, fasteners and ties installed utilizing low velocity powder-actuated tools will be tested by an independent testing laboratory to resist two times the design load. Any such anchor, fastener or tie which fails such a test shall be replaced by Contractor at no cost to Owner.

3. Procedures for use of low velocity powder actuated tools:

a. The use of low velocity powder actuated tools shall comply with Federal OSHA safety requirements and California Code of Regulations Title 24, including the requirement that the operator of the tool be trained and certified. Submit certification to Owner's Representative.
b. Submittal of manufacturer's literature and calculations for anchoring and fastening devices shall include load calculations and minimum spacing for fasteners for each specific use. Design for a factor of safety of two times allowable load. Calculations shall be signed by Contractor's structural engineer. Structural engineer shall be registered in California.
c. Conform to SMACNA low velocity shotpin installation requirements.

1.03 TEST PROCEDURE

A. Contractor shall test a minimum of 10 percent of the fasteners installed to ensure compliance with the construction documents. If the 10 percent test fails, the Contractor is responsible to test the balance of the fasteners. The testing is to be done by a testing laboratory acceptable to Owner's Representative. The 10 percent test applies to each trade performing the work. The cost of required testing services shall be borne by the Contractor and shall be deemed to have been included in the amount of bid for the work as stated in the Agreement.

END OF SECTION 01 7325

SECTION 01 7329
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SUMMARY

A. Contractor shall be responsible for all cutting, fitting and patching required to complete the work and to:

1. Make its several parts fit together properly.

2. Uncover portions of the work to provide for installation of ill-timed work.

3. Remove and replace work not conforming to requirements of Contract Documents.

4. Provide routine penetrations of nonstructural surfaces for installation of electrical conduit, plumbing and ductwork.

1.02 SUBMITTALS

A. Submit a written request to Owner's Representative well in advance of executing any cutting or alteration which affects:

1. The work of the Owner or any separate contractor.

2. The structural value or integrity of any element of the completed building.

3. The integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.

4. The efficiency, operational life, maintenance or safety of operational elements.

5. The visual qualities of sight-exposed elements.

B. The request shall include:

1. Identification of the project.

2. Description of the affected work.

3. The necessity for cutting alteration.

4. The effect of the work on the Owner or any separate Contractor and on the structural or weatherproof integrity of the existing building.

5. Description of the proposed work:

a. The scope of cutting, patching or alteration,
b. The trades who will execute the work,
c. Products proposed to be used,
d. The extent of refinishing to be done.

6. Alternatives to cutting and patching.

7. Cost proposal, when applicable.

8. Written permission of any separate contractor whose work will be affected.

C. Should conditions of the work or the schedule indicate a change of products, submit a request for substitution.

D. Submit a written notice to Owner's Representative designating the date and the time the work will be uncovered.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Comply with Contract Documents for each specific product involved.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of the Project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect the conditions affecting the installation of products or performance of the work.

C. Report unsatisfactory or questionable conditions to the Owner's Representative in writing; do not proceed with the work until the Owner's Representative has provided further instructions.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work.

B. Provide devices and methods to protect other portions of the project from damage.

C. Provide protection from the elements for that portion of the project which may be exposed by cutting and patching work

3.03 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of reports.

B. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

C. Restore work which has been cut or removed; install new products to provide completed work in accordance with requirements of Contract Documents.

D. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

E. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

1. For continuous surfaces, refinish to nearest intersection.

2. For an assembly, refinish the entire unit.

END OF SECTION 01 7329

SECTION 01 7410
CLEAN UP AND DISPOSAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Clean up and disposal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTINUOUS CLEAN UP

A. Under no circumstances shall rubbish, debris, waste, dust, dirt, or surplus materials be allowed to accumulate in the building, or on the Project site, and all such shall be removed continually as the Work progresses and by the end of each day's Work.

1. Materials: In occupied building areas, only sufficient materials and flammable or toxic substances necessary for the Work being performed that day or shift shall be brought into the building and work areas. In no case shall flammable or toxic substances be stored in the building, and these substances shall be immediately removed from the building when not needed and not later than the end of the day's Work.

2. Splattering or spilling of material shall be promptly cleaned up at time of occurrence.

B. Contractor shall provide street sweeping whenever silt from construction site is carried over to adjacent public thoroughfares.

C. Failure to maintain a clean and orderly project site may necessitate action by the Owner. In the event that the Contractor fails to clean up and maintain the project in a clean and orderly manner, the Owner may clean the job-site and back-charge the Contractor for costs in accordance with Section 01 1100.

D. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

E. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

F. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

G. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

H. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

I. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

J. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

3.02 FINAL CLEAN UP

A. Owner's Representative's Inspection: Give Owner's Representative at least 24 hours advance notice of readiness for inspection. Any deficient cleaning operations, as determined by Owner's Representative, shall be immediately corrected as approved at Contractor's expense.

B. Interior surfaces and areas where Work is performed shall be left in vacuum clean condition with all dust, dirt, stains, hand marks, paint spots, plaster droppings, and other blemishes and defects completely removed. To the extent of Contractor's operations, use or materials, the following requirements apply to all areas where Work is performed:

1. Walls: Bare and painted surfaces shall be cleaned and free of dust, lint, streaks, or stains.

2. Hardware and metal surfaces shall be cleaned and polished using non-corrosive and non-abrasive materials.

3. Glass: New glass and soiled existing glass shall be washed and polished both sides and left free of dirt and spots. Labels shall be removed.

4. Ceilings and floors shall be clean and free of stains, handmarks, and defacing.

5. Fixtures and Equipment: New mechanical, plumbing and electrical fixtures and like items shall be cleaned and polished. Lighting fixtures shall be free of dust, dirt, stains, or waste material. Equipment and machinery shall be cleaned, serviced, and ready for use. Existing items shall be cleaned as required including ventilating supply and return equipment in walls and ceilings.

6. Surfaces not mentioned shall be cleaned according to the intent of this Section and as required for Owner's Representative's approval.

3.03 DISPOSAL

A. Under no circumstances shall debris, rubbish, or waste material be disposed of on Owner's property by burying or otherwise, and all shall be removed from Owner's property to a legal disposal area. Contractor shall bear all dumping charges.

B. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

C. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

D. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.04 CORRECTIVE WORK

A. Where existing Work has been dirtied, stained, defaced, or otherwise made defective and cleaning operations are not satisfactory, as determined by Owner's Representative, Contractor shall remove the Defective Work and install new Work as requested and approved, at no extra cost to Owner.

3.05 CLEAN UP SPECIFIED IN OTHER SECTIONS

A. Any clean up specified in other Sections of these Specifications shall be in addition to, and not in lieu of, these requirements.

END OF SECTION 01 7410

SECTION 01 7419
CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

1.01 SUMMARY

A. Section Includes: Requirements for diversion of non-hazardous construction and demolition waste from landfill including:

1. Waste Management Goals
2. Waste Management Plan
3. Progress Reports
4. Project Meetings
5. Management Plan Implementation

B. Related Requirements:

1. Summary of Work: Section 01 1100.
2. Submittal Procedures: Section 01 3300; general requirements for submittals.
3. **Special Environmental Requirements: Section 01 3560; LEED requirements.**
4. ~~3.~~ Hazardous Materials: Section 01 3570
5. ~~4.~~ Environmental Considerations: Section 01 5110.
6. ~~5.~~ Clean Up and Disposal: Section 01 7410.
7. ~~6.~~ Selective Demolition: Section 02 4119.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk or similar products.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash debris and rubble resulting from construction, remodeling repair and demolition operations. Hazardous materials are not included.

C. Diversion from Landfill: To remove, or have removed, from the site for recycling, reuse or salvage material that might otherwise be sent to a landfill. Diversion from Landfill does not include using the material as alternative daily cover at a landfill site, nor does it include burning, incinerating, transformation processing or thermally destroying waste.

D. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product.

E. Recycle (Recycling): To sort, separate, process, treat or reconstitute solid waste and other discarded materials for the purpose of redirecting such materials into the manufacture of useful products. Recycling does not include burning, incinerating, transforming or thermally destroying waste.

F. Return: To give back reusable items or unused products to vendors.

G. Reuse: To reuse excess of discarded construction material in some manner on the Project site.

H. Salvage: To remove a waste material from the Project site for resale or reuse.

I. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable and reusable material.

J. Waste Management Plan: A project-related plan for the collection, transportation and disposal of waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material going to landfill.

1.03 WASTE MANAGEMENT REQUIREMENTS

A. All projects shall generate the least amount of waste possible and the process shall ensure the generation of as little waste as possible due to error, inaccurate planning, breakage, mishandling, contamination, or other factors.

B. Of the inevitable waste that is generated, as many of the waste materials as feasible, and as stated here, shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

C. A minimum of ~~50~~ **90** percent of total project demolition and construction waste (by weight) shall be diverted from the landfill~~ and projects shall attempt to divert 75 percent~~. Volume reporting is only permitted by exception. The following waste categories are likely candidates to be included in the diversion plan.

1. Inerts (and clearing debris, rock and dirt)
2. Concrete
3. Bricks
4. Concrete masonry units (CMU)
5. Asphalt
6. Metals (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, brass, bronze)
7. Cardboard, packaging
8. Clean dimensional wood
9. Asphalt shingles or roofing
10. Drywall
11. Carpet and pad

12. Ceiling tiles

13. Glass

14. Shrink/stretch wrap from furniture/palletized deliveries

15. Greenwaste and organic landscaping materials (brush, chips, trees, stumps)

16. Reuse items indicated on the Drawings and/or elsewhere in the Specification

D. All fluorescent lamps, HID lamps and mercury-containing thermostats removed from the site shall be recycled and disposed of through the campus procedures.

1. See http://physicalplant.berkeley.edu/files/fluorescent.pdf

1.04 SUBMITTALS

A. The General Contractor shall be responsible for the development and implementation of a Waste Management Plan for the Project. The Plan must be approved by the Owners Representative.

B. Waste Management Plan: Before any work begins, the General Contractor shall submit to the Owner's Representative a Waste Management Plan containing the following:

1. Estimate of the total proposed jobsite waste to be generated, including types and quantities (by weight).

2. Proposed Alternatives to Landfilling: A list of each material proposed to be salvaged, reused, or recycled during the course of the Project, the proposed destination for each material and the projected amount (by weight).

3. Material Handling Procedures: A description of the means by which any waste materials identified in paragraph 1.03C. above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with the requirements for acceptance by recycling processors to be utilized.

4. List of documentation to be provided in Progress Reports.

1.05 PROGRESS REPORTS

A. The General Contractor shall submit Waste Management Progress Report(s) at a regular time interval specified by the Owner's Representative. The Progress Report shall contain the following information:

1. Project title, name of company completing report, and dates of period covered by the report.

2. Report on the disposal of all jobsite waste, including:

a. Recycled materials. For each material, provide the following:

1) Amount (in tons)
2) Dates removed from the jobsite
3) Receiving Party

b. Reused or salvaged materials. For each material, provide the following:

1) Amount (in tons)
2) Description of intended or actual use

c. Landfilled materials. Provide the following:

1) Amount (in tons)
2) Dates removed from the jobsite
3) Identity of the transfer station or landfill

3. Include legible copies of on-site logs, weight tickets and receipts. Receipts shall be from recycling and/or disposal site operators who can legally accept the materials for the purpose of reuse, recycling or disposal. If mixed construction and demolition waste is sorted off-site, provide a letter from the processor stating the average percentage of mixed construction and demolition waste they recycle. Contractor shall save original documents and provide certified weight tags for the duration of the contract.

4. This plan and all reports will be submitted to the solid waste/recycling manager on campus, for inclusion in campus waste generation and diversion reports.

1.06 PROJECT MEETINGS

A. Waste management plans and implementation shall be discussed at the following meetings:

1. Pre-demolition meeting

2. Pre-construction meeting

3. Regular job-site meetings

END OF SECTION 01 7419

SECTION 01 7700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.

2. Operation and maintenance manuals.

3. Warranties.

4. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section "Execution Requirements" for progress cleaning of Project site.

2. Division 1 Section "As-built Documents" for submitting As-Built Drawings, As-Built Specifications, and Record Product Data.

3. Divisions 2 through 32 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.02 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list).

2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

3. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.

4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

5. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

6. Complete startup testing of systems.

7. Submit test/adjust/balance records.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

9. Advise Owner of changeover in heat and other utilities.

10. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

11. Complete final cleaning requirements, including touchup painting.

12. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

13. Complete the Cx Action Items to the satisfaction of the Owner

14. Provide Building and Equipment training as required by individual specification sections. Note: All training may be required to be video taped.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner's Representative will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Owner's Representative, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Results of completed inspection will form the basis of requirements for Final Completion.

1.03 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."

2. Submit certified copy of Owner's Representative's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner's Representative. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner's Representative will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.04 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Design Professional.
d. Name of Contractor.
e. Page number.

1.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7823, “Operations and Maintenance Data.”

1.06 WARRANTIES

A. Submittal Time: Submit written warranties on request of Owner’s Representative for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 14 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Provide a minimum of 4 copies. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Remove tools, construction equipment, machinery, and surplus material from Project site.
d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
f. Sweep concrete floors broom clean in unoccupied spaces.
g. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
i. Remove labels that are not permanent.
j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

k. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils if units were operated without filters during construction.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
p. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 7700

SECTION 01 7823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.

2. Emergency manuals

3. Operation manuals for systems, subsystems, and equipment.

4. Maintenance manuals for the care and maintenance of products, materials, and finishes and systems and equipment.

B. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.

3. Division 1 Section "As-Built Documents" for preparing Record Drawings for operation and maintenance manuals.

4. Divisions 2 through 33 Sections for specific operation and maintenance manual requirements for products in those Sections.

1.02 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.03 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual per approved submittal schedule. Include a complete operation and maintenance directory. Owner’s Representative will return 1 copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 1 copy of each manual in final form within 3 months after receipt of approved submittal. Owner’s Representative will return copy with comments within 15 days.

1. Correct or modify each manual to comply with Owner’s Representative's comments. Submit 4 copies of each corrected manual within 15 days of receipt of Owner’s Representative's comments.

2. Manuals must be fully approved 1 month prior to Building and Equipment training.

1.04 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.

2. List of systems.

3. List of equipment.

4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.

2. Table of contents.

3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.

2. Name and address of Project, including UCB's Project Number and UCB's Building CAAN Number.

3. Name and address of Owner.

4. Date of submittal.

5. Name, address, and telephone number of Contractor.

6. Name and address of Owner's Representative.

7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   c. Binders shall not exceed 3" in diameter.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper.

5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.03 EMERGENCY MANUALS

A. Content:

1. Organize manual into a separate section for each of the following:

   a. Type of emergency.
   b. Emergency instructions.
   c. Emergency procedures.

2. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

   a. Fire.
   b. Flood.
   c. Gas leak.
   d. Water leak.
   e. Power failure.
   f. Water outage.
   g. System, subsystem, or equipment failure.
   h. Chemical release or spill.

B. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

C. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.

2. Shutdown instructions for each type of emergency.

3. Operating instructions for conditions outside normal operating limits.

4. Required sequences for electric or electronic systems.

5. Special operating instructions and procedures.

2.04 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.

2. Performance and design criteria if Contractor is delegated design responsibility.

3. Operating standards.

4. Operating procedures.

5. Operating logs.

6. Wiring diagrams.

7. Control diagrams.

8. Piped system diagrams.

9. Precautions against improper use.

10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.

2. Manufacturer's name.

3. Equipment identification with serial number of each component.

4. Equipment function.

5. Operating characteristics.

6. Limiting conditions.

7. Performance curves.

8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.

2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.05 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.

2. Manufacturer's name.

3. Color, pattern, and texture.

4. Material and chemical composition.

5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.

2. Types of cleaning agents to be used and methods of cleaning.

3. List of cleaning agents and methods of cleaning detrimental to product.

4. Schedule for routine cleaning and maintenance.

5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.

2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.

2. Comply with requirements of newly prepared Record Drawings in Section 01 7839, "As-Built Documents."

G. Comply with Section 01 7700, "Closeout Procedures," for the schedule for submitting operation and maintenance documentation.

END OF SECTION 01 7823

SECTION 01 7836
GUARANTEES

1.01 GENERAL

A. The General Conditions requires all items to be guaranteed for a period of one (1) year.

B. Guarantees for more than one (1) year required by individual Specification Sections require a written guarantee by Contractor.

1.02 FORM OF GUARANTEE

A. Use form contained on the following page.

(Remainder of this Page is Blank)

GUARANTEE

Project Name: _____ Date: _____

Project Location: _____

Project Number: _____

Guarantee For: _____
(Specification Section and Contract No.)

(the "Contract"), between The Regents of the University of California ("Owner") and _____ ("Contractor").

_____
(Name of Contractor, Subcontractor, or Supplier as Applicable)

hereby guarantees to Owner that the portion of the Work described as follows:

_____

_____

_____

which it has provided for the above referenced Project, is of good quality; free from defects; free from any liens, claims, and security interests; and has been completed in accordance with Specification Section _____ and the other requirements of the Contract.

The undersigned further agrees that, if at any time within _____ months after the date of the guarantee the undersigned receives notice from Owner that the aforesaid portion of the Work is unsatisfactory, faulty, deficient, incomplete, or not in conformance with the requirements of the Contract, the undersigned will, within ten (10) calendar days after receipt of such notice, correct, repair, or replace such portion of the Work, together with any other parts of the Work and any other property which is damaged or destroyed as a result of such defective portion of the Work or the correction, repair, or replacement thereof; and that it shall diligently and continuously prosecute such correction, repair, or replacement to completion.

In the event the undersigned fails to commence such correction, repair, or replacement within ten (10) calendar days after such notice, or to diligently and continuously prosecute the same to completion, the undersigned, collectively and separately, do hereby authorize Owner to undertake such correction, repair, or replacement at the expense of the undersigned; and Contractor will pay to Owner promptly upon demand all costs and expenses incurred by Owner in connection therewith.

SUBCONTRACTOR OR SUPPLIER (If Applicable)

Signed: _____ Title: _____

Typed Name: _____

Name of Firm: _____

Contractor License Classification and License Number:

_____

Address: _____

_____

Telephone Number: _____

CONTRACTOR

Signed: _____ Title: _____

Typed Name: _____

Name of Firm: _____

1.03 SUBMITTAL REQUIREMENTS

A. Submit prior to the date of final completion and prior to final application for payment.

B. Provide 3 original copies.

C. Provide on the letterhead of Contractor, subcontractor, or supplier doing the work or supplying the item guaranteed.

END OF SECTION 01 7836

SECTION 01 7839
AS-BUILT DOCUMENTS

1.01 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store Project as-built documents and Samples in Contractor's field office separate from documents used for construction.

B. Maintain as-built documents in order and in a clean, dry, legible condition.

C. Do not use as-built documents for construction.

1.02 AS-BUILT DOCUMENTS

A. Owner's Representative will, at no cost, provide Contractor with a set of the Drawings of the original Contract Documents, which shall be used for recording the "As Built" condition of the Work.

B. As-Built Drawings: Record the following kinds of information on the As-Built Drawings:

1. Locations of Work buried under or outside the building, such as plumbing and electrical lines and conduits. Provide horizontal and vertical dimensions from fixed points.

2. Actual numbering of each electrical circuit.

3. Locations of all HVAC, plumbing and electrical Work concealed inside the building; and other work that is changed by Contractor from that shown on the Drawings.

4. Locations of all items, not necessarily concealed, which vary from the locations shown on the Drawings.

C. The following requirements for As-Built Drawings are in addition to those specified elsewhere:

1. They shall be done carefully and neatly by a competent drafter, familiar with the Work involved, using methods acceptable to Owner's Representative.

2. They shall be kept up to date during the entire progress of the Work and made available to Owner's Representative at any time.

3. Additional Drawings shall be provided as required to accurately describe changes.

4. Record all changes in size, location, and other features of installation shown on the Drawings.

5. Record all locations of underground Work, points of connection, valves, manholes, catch basins, capped stubouts, invert elevations, etc.

6. Record sufficient information such that Work concealed in the building may be located with ease and accuracy. This may be accomplished by dimensioning or by stating the relationship to the spaces in the building near which the Work was installed. Owner's Representative's decision on what constitutes sufficient information shall be final.

7. Provide electronic “As-Built” drawings using AutoCAD, in addition to one full-size set of reproducible documents.

D. Shop Drawings: Provide final Shop Drawings which have been updated to show actual conditions, for Work specified in the individual Sections.

E. Specifications and Addenda:

1. Record the following:

a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
b. Changes made by Addenda, Change Order, or Field Order, and clarifications and interpretations made by Letter of Instruction.
c. Provide electronic file in Microsoft Word format and one hard copy in 3-ring binder.

END OF SECTION 01 7839

SECTION 02 4113
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of a building or structure.

2. Demolition and removal of selected site elements.

B. Related Sections include the following:

1. Division 1 Section "Summary of Work" for use of the premises and phasing requirements.

2. Division 1 Section "Contractor's Use of the Project Site" for restrictions on use of the premises due to Owner or tenant occupancy.

3. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.

4. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

5. Division 23 Sections for demolishing, cutting, patching, or relocating mechanical items.

6. Division 26 Sections for demolishing, cutting, patching, or relocating electrical items.

1.02 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.03 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.04 SUBMITTALS

A. Qualification Data: Firms have been prequalified.

B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.

2. Interruption of utility services.

3. Coordination for shutoff, capping, and continuation of utility services.

4. Use of elevator and stairs.

5. Locations of temporary partitions and means of egress, including for other tenants affected by selective demolition operations.

6. Coordination of Owner's continuing occupancy of portions of existing adjacent building and walkways and of Owner's partial occupancy of completed Work.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Firms have been prequalified for this work.

B. Professional Engineer Qualifications: Comply with Division 1 Section "Quality Requirements."

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section 01 3113, "Project Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.06 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for condition of areas to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: Hazardous materials have been selectively demolished. A report on the removal of hazardous materials is on file for review and use.

1. Hazardous material procedures are specified elsewhere in the Contract Documents.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

E. Storage or sale of removed items or materials on-site will not be permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Owner's Representative.

D. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1. Provide at least 11 days' notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements: Refer to Divisions 22, 23, and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

A. Dangerous Materials: Have been removed.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

3. Protect existing site improvements, appurtenances, and landscaping to remain.

C. Temporary Shoring: Provide and maintain exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.04 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.05 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.

6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly.

10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner's Representative, items may be removed to a suitable,

protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

D. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

E. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

END OF SECTION 02 4113

SECTION 03 1000
CONCRETE FORMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, mock-ups, services, tests and inspections, necessary for the installation, shoring, bracing, and removal of standard and architectural concrete formwork. Refer to Architectural Drawings for locations of architectural concrete.

B. Engineering: Provide engineering services for the design and implementation of standard and architectural concrete formwork, including required shoring and bracing.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Reinforcing – 03 2000

2. Cast-In-Place Concrete – 03 3000

3. Shotcrete – 03 3713

4. Concrete Finishing – 03 3500

5. Concrete Curing – 03 3900

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.

2. AAMA - American Architectural Manufacturer's Association, product specifications referenced herein.

3. ACI - American Concrete Institute,

a. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials".
b. ACI 301, "Specifications for Structural Concrete".
c. ACI 303.1, "Standard Specification for Cast-In-Place Architectural Concrete".
d. ACI 347, "Guide to Formwork for Concrete".

4. ASTM - American Society for Testing and Materials, designations referenced herein.

1.04 SUBMITTALS

A. General: Submittals shall be submitted as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Shop Drawings for Architectural Concrete Formwork: Submit detailed drawings to the Owner's Representative for review prior to fabrication of formwork showing forming material; location and method of sealing form joints; form-tie layout; and chamfer, drip, groove and reveal strips.

C. Samples for Architectural Concrete Formwork: Submit samples of formwork materials to the Owner's Representative for approval including the following:

1. Form facing and/or overlay.

2. Form ties.

3. Form liners.

4. Chamfer, drip, groove, and reveal strips.

1.05 CONTRACTOR'S ENGINEERING SERVICES

A. General: Where engineering services are required herein, the Contractor shall retain either a Civil or Structural Engineer registered in the State of California, referred to herein as the Contractor's Engineer.

1. Documents prepared by the Contractor's Engineer shall be stamped and signed.

B. Formwork: The Contractor's Engineer shall perform or supervise the design, inspection, and creation of scheduled procedures for concrete formwork, including, but not limited to, shoring, bracing, reshoring, and form removal in accordance with ACI 347 and, for architectural concrete, ACI 303.1.

PART 2 - PRODUCTS

2.01 CONCRETE FORM MATERIALS AT CONCELAED SURFACES

A. Smooth Form Finish: Form-facing panels that will provide continuous, straight, uniform textured, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize the number of joints.

1. Wood Forms: Unless otherwise specified, wood forms shall be Douglas fir plywood, 5 ply, 3/4 inch, B-B Plyform, Class I, exterior type, edges sealed. Mill-oiled plywood shall not be permitted. Plywood sheets shall bear APA trademark stamp indicating plywood grade and thickness.

2. Steel and Fiberglass Forms: Suitable for concrete construction.

B. Round Column Forms: Metal, fiberglass, or spiral wound fiber tubes suitable for concrete construction.

C. Lost Forms:

1. Expanded polystyrene manufactured in accordance with ASTM C 578.

2. Metal or cardboard specifically designed for use as concrete formwork.

3. Expanded metal forms: Amico's "Stay-form", or equal.

4. Wood shall not be used as lost forms without written permission from the Owner's Representative.

D. Chamfer, drip, groove, and reveal strips: FRP, PVC, or smooth milled wood, fully sealed on all sides with two coats of form sealer.

E. Form Ties: Factory fabricated, adjustable length removable or snap-off metal ties with 1" maximum diameter plastic cones inserts designed to prevent form movement and prevent concrete spalling upon removal. No part of form ties left in concrete members shall be closer than 1½" to concrete surfaces. Form ties used for structural members located below grade shall not be hollow and shall provide a water-stop washer placed at the center of the tie.

F. Form Spreaders: Metal with plastic-covered tips at each end.

G. Form Joint Caulking: Closed-cell PVC foam tape with pressure-sensitive adhesive on one side.

H. Form Joint Sealer: Silicone or urethane sealant.

I. Form Release Agent: Colorless, non-staining, non-toxic agent intended for this use that shall not impair the bonding of paint or other coatings. Manufactured by Noxcrete or equal.

2.02 ARCHITECTURAL CONCRETE FORM MATERIALS

A. Treated Wood Forms: Wood forms shall be APA Douglas fir plywood, 5 ply, 3/4 inch, B-B or better, Class I, unless otherwise noted, with overlay on one side only, specifically designed for concrete forming. All plywood shall bear APA grade mark.

1. Overlay shall be non-vapor-transmitting form face with high density overlay (HDO), impregnated with minimum of 65% phenolic resin.

B. Untreated Natural Wood Grain Forms: Seasoned with cement or lime slurry consistent with the specified appearance of the architectural concrete.

C. Chamfer, Drip, Groove, and Reveal Strips: FRP, PVC, metal, or smooth milled wood, fully sealed on all sides with two coats of form sealer. Provide kerf on backside (form facing) of wood strips. Metal strips shall match form face metal type.

D. Form Ties: Factory fabricated, adjustable length removable or snap-off metal ties with 1" maximum diameter plastic cones inserts designed to prevent form movement and prevent concrete spalling upon removal. No part of form ties left in concrete members shall be closer than 1½" to concrete surfaces. Form ties used for structural members located below grade shall not be hollow and shall provide a water-stop washer placed at the center of the tie.

E. Form Spreaders: Metal with plastic-covered tips at each end.

F. Form Joint Caulking: Compressible Tape meeting AAMA 810.1-92, Type I requirements.

G. Form Joint Sealer: Sealant for form joints shall conform to ASTM C 920, Type S, Grade NS, Class 50 or ASTM C 834.

H. Form Sealer: Chemstop Manufacturing Company's "Chemstop", Burke's "form Sealer" W.R. Grace Company's "Formfilm", or equal.

I. Form Release Agent: Colorless, non-staining, non-toxic agent intended for this use that shall not impair the bonding of paint or other coatings. Manufactured by Noxcrete or equal.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.02 TOLERANCES

A. Formwork for standard and architectural concrete shall be constructed such that the shapes, sizes, lines, and dimensions of cast-in-place concrete shown on the Drawings conform to the tolerances listed in the Section entitled "Cast-In-Place Concrete".

B. Offsets between adjacent formwork facing materials for rough finish, concealed surface concrete formwork shall conform to ACI 117 Class C requirements.

C. Offsets between adjacent formwork facing materials for smooth finish, exposed surface concrete formwork shall conform to ACI 117 Class B requirements.

D. Offsets between adjacent formwork facing materials for architectural concrete formwork shall conform to ACI 117 Class A requirements.

E. Form face deflection shall be limited to 1/400 of its span for architectural concrete.

3.03 COORDINATION

A. The Contractor shall coordinate, locate, and provide sleeves and penetrations in formwork for electrical, plumbing, heating, ventilating, and other work.

B. The Contractor shall locate, coordinate, provide, and verify openings, offsets, reveals, recesses, nailing blocks, channel cases, anchors, ties, and inserts in the formwork before concrete is placed.

3.04 CONCRETE FORMWORK CONSTRUCTION

A. The construction and maintenance of concrete formwork shall be as directed by the Contractor's Engineer and in accordance with ACI 347.

B. Formwork shall be new at the start of the job. Forms may be reused, provided they are thoroughly cleaned of dirt, mortar, oil, rust, and foreign materials, and are undamaged at edges and contact faces. Reuse of forms shall be subject to approval by the Owner's Representative.

C. Formwork shall not stain the concrete.

D. Oiling of forms shall not be permitted.

E. The arrangement of formwork shall be uniform and neat.

F. Formwork shall be built to support the weight of concrete within deformation limits, formed to the shapes, sizes, lines, and dimensions shown on the Drawings. Footings and grade beams do not require formwork unless otherwise indicated.

G. Form ties shall provide accurate spreading and positive tying. Layout of ties shall be uniform, aligned, and symmetrical. Wire ties shall not be used.

H. Provide chamfer strips at all exposed, protruding concrete corners, unless otherwise noted on Drawings.

I. Form horizontal joints shall be level and continuous. Formwork vertical joints shall be plumb.

J. Seal form joints with foam tape or form joint sealer. Forms shall be sealed sufficiently tight to prevent leakage of mortar.

K. Provisions shall be made for openings, offsets, inserts, embedments, blocking, and other features of the work as shown or indicated. Penetrations, notches, and blockouts in concrete elements not shown on the Drawings shall not be installed without written approval from the Owner's Representative.

L. Attach chamfers, drip, groove, and reveal strips securely to prevent displacement and dislodgement during concrete placement and form removal.

M. Provide temporary openings at the base of wall and column forms to facilitate inspection of concrete reinforcement and to allow cleaning of forms. Do not locate temporary openings at exposed concrete surfaces.

N. Apply form release agent to form surfaces prior to placement of reinforcement.

O. Immediately prior to concrete placement, clean forms, wet forms, remove freestanding water, and seal temporary openings.

3.05 ARCHITECTURAL CONCRETE FORMWORK

A. Provide architectural concrete formwork at all interior and exterior concrete locations shown exposed to view on architectural drawings.

B. The requirements for architectural concrete formwork shall be in addition to the requirements for standard concrete formwork described above.

C. Architectural concrete formwork shall be executed in accordance with ACI 303.1.

D. Reuse of architectural concrete formwork shall be limited such that the specified architectural concrete appearance is consistent.

E. Attach form liners as recommended by the form liner manufacturer.

F. Porous formwork materials for architectural shall be sealed with form sealer.

G. Formwork joints shall be minimized and their arrangement shall be as shown on the Drawings and as subject to approval by the Owner's Representative.

H. Formwork joints shall be sealed, taped, and gasketed as necessary to properly seal forms.

I. The arrangement of form tie hole locations shall be drilled, located as shown by cone locations on the Drawings, and as subject to approval by the Owner's Representative.

J. At the Contractor's option, some cones may be provided without spreaders or ties.

K. Form tie cone holes shall be removed without damage to concrete surfaces and shall be filled, partially filled, or left as cast, as indicated on the Drawings.

3.06 FORMWORK REMOVAL

A. Formwork shall be removed according to the schedule and sequence prepared by the Contractor's Engineer and in accordance with ACI 347.

1. Formwork shall not be removed until the concrete has hardened sufficiently to permit formwork removal with safety, and until the concrete members have attained sufficient strength and stiffness to safely support the imposed loads. The minimum times for removal of formwork after concrete has been placed shall be as shown below.

a. Footings (where required): 2 days
b. Columns: 3 days
c. Walls and Pilasters: 3 days; 7 days for Architectural Concrete
d. Side Forms for Joists, Beams, and Girders: 3 days
e. Soffit Forms for Joists, Beams, Girders, and One-Way Slabs: 7 days for form facing material; shore until concrete achieves design compressive strength, 7 days minimum.
f. Soffit Forms for Two-Way Slabs: 7 days for form facing material; shore until concrete achieves design compressive strength, 21 days minimum.
g. Soffit Forms for Post-Tensioned Beams, Girders, and Slabs: As soon as full post-tensioning force has been applied.

2. Formwork removal shall be coordinated with the requirements in the section titled "Concrete Curing".

B. Formwork shall be removed without damaging the concrete exposed surfaces, chamfers, and inserts.

3.07 RESHORING

A. Reshoring shall be as directed by the Contractor's Engineer and in accordance with ACI 347.

B. Reshoring shall be designed and implemented in a manner that does not subject the concrete to excessive loads. The minimum time to begin reshoring is 14 days after the concrete has been placed, and not until the full compressive design strength of the concrete has been achieved.

1. Reshore locations shall not alter design stress patterns. Reshoring shall equal at least 50 percent of in-place shores and shall be placed immediately after shore removal.

2. Reshoring in multi-story construction shall remain in place in at least two stories beneath the level under construction.

3. Previously placed concrete elements shall not support reshoring until their full design compressive strength has been achieved and not until at least 14 days after casting.

3.08 CONSTRUCTION LOADS

A. Construction loads on concrete elements supported by concrete formwork shall be as directed by the Contractor's Engineer. Construction loads shall not exceed design loads indicated on the Drawings.

3.09 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.10 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 1000

SECTION 03 2000
CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, mock-ups, tests and inspections necessary for the installation of concrete reinforcement.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming – 03 1000
2. Cast-In-Place Concrete – 03 3000
3. Concrete Finishing – 03 3500
4. Shotcrete – 03 3713
5. Concrete Curing – 03 3900

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.
2. ACI - American Concrete Institute,
    a. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials”.
    b. ACI 301, “Specification for Structural Concrete for Buildings”.
    c. ACI 315, “Details and Detailing of Concrete Reinforcement”.
3. ASTM - American Society for Testing and Materials, designations referenced herein.
4. AWS - American Welding Society,
    a. AWS D1.1, “Structural Welding Code - Steel”.
    b. AWS D1.4, “Structural Welding Code - Reinforcing Steel”.
5. CRSI - Concrete Reinforcing Steel Institute,
    a. CRSI MSP-1, “Manual of Standard Practice”.
    b. CRSI, “Placing Reinforcing Bars”.

6. ICC-ES - International Code Council Evaluation Services, Evaluation Reports referenced herein.

1.04 SUBMITTALS

A. General: Submittals shall be sent to the Owner's Representative, or Owner's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Shop Drawings: The Contractor shall submit concrete reinforcement shop drawings prepared in accordance with ACI 315 to the Owner's Representative for review. Fabrication or delivery of material to the building site shall not begin until the Owner's Representative's review is complete.

1. Shop drawings shall include plan, elevation, and detail views with project grids accurately indicating bar material type, size, lengths, locations, bends, lap splice lengths and locations, welded splice locations, mechanical coupler locations, and headed bar locations.

2. Layering and sequencing information for intersections shall be identified.

3. Shop drawings shall not include copies of Contract Document details. References to Contract Document details in lieu of details prepared as part of placing drawing submittals will not be accepted.

4. Shop drawings shall list the structural materials included in the submittal. Reinforcement shown on placing drawings illustrating sequencing, layering, or intersections, but not included in the placing drawing bar lists, shall be identified as "previously submitted" or "to be submitted".

C. Mill Certificates: The Contractor shall submit mill certificates in accordance with ASTM designations referenced herein for each heat of reinforcement, mechanical couplers, and headed bars to the Owner's Testing Agency for review.

D. Welding Documents: The Contractor shall submit Welding Procedure Specifications (WPSs), Procedure Qualification Records (PQRs), and Welder Qualification Test Records (WQTRs) prepared in accordance with AWS D1.4 for each type of weld and position to be performed to the Owner's Testing Agency for review.

E. Manufacturer's Data: The Contractor shall submit manufacturer ICC-ES reports for mechanical couplers and headed bars to the Owner's Representative for review.

F. Samples: The Contractor shall submit samples of mechanical couplers and headed bars to the Owner's Testing Agency for testing as required herein and on the Drawings.

G. Contractor's quality control test reports: The Contractor shall submit quality control test reports to the Owner's Representative and Owner's Testing Agency for review.

H. LEED Submittals:

1. Recycled content: Submit product data indicating percentage by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for each product having recycled content.

1.05 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. The Owner's Testing Agency shall inspect material, size, spacing, arrangement, placement, and cover of reinforcement.

3. The Owner's Testing Agency shall conduct tension load tests on Type II and Type III mechanical couplers at the frequency indicated on the Drawings, but not less than 1 test for each 100 mechanical couplers or fraction thereof. Perform tests on no less than 2 couplers of each type. Test specimens shall be selected at random. Tension tests shall be conducted to failure of the coupler or rupture of the bar in accordance with ASTM A 370. Alternatively, where the supplier conducts tension load tests in conformance with ASTM A 370 at a frequency that meets or exceeds that stated above, the Owner's Testing Agency may observe tension load tests performed by the supplier in lieu of performing tension load tests.

4. The Owner's Testing Agency shall verify compliance with the manufacturer's recommended installation procedures on in-place mechanical couplers, and headed bars that utilize threaded connections, at the frequency indicated on the Drawings, but not less than 10%.

5. The Owner's Testing Agency shall observe tension tests performed on Type II and Type III headed reinforcement at the frequency indicated on the Drawings, but not less than 1 test for each 100 headed bars or fraction thereof. Perform tests on no less than 2 headed bars. Test specimens shall be selected at random. Tension tests shall be conducted to failure of the head or rupture of the bar in accordance with ASTM A 970.

6. Welding of reinforcement shall be inspected by the Owner's Testing Agency in accordance with AWS D1.4, and, where indicated, AWS D1.1.

   a. Review the WPSs, PQRs, WQTRs, and suitability of welding equipment.
   b. Inspect welding work, including surface preparation, preheat, welder technique and performance, equipment, weld lengths, and weld sizes for conformance with the WPSs.
   c. Perform visual inspection of fillet, flare-v-groove, and flare-bevel-groove welds of reinforcement bars to structural steel.
   d. Perform visual inspection and nondestructive testing of complete joint penetration (CJP) groove welds. Nondestructive testing shall be magnetic particle testing performed in accordance with ASTM E 709.
   e. For reinforcement bars welded to structural steel, verify surface preparation, required preheat, and filler metal type for the structural steel conforms to AWS D1.1 requirements.

C. Contractor's Quality Control Tests and Inspections:

1. General:

a. Quality control tests and inspections shall be the responsibility of the Contractor.
b. Where required herein, the Contractor shall demonstrate that quality control conforms to the requirements of the Contract Documents.
c. Quality Control Test and Inspection Reports shall be prepared and submitted for review.

2. Tension tests of reinforcement bar not accompanied by certified mill analysis reports: The Contractor shall conduct one tension test and one bend test in accordance with ASTM A 370 for each 2-1/2 tons or fraction thereof of each material type and size of reinforcement bar not accompanied by certified mill analysis reports. Test reports shall be reviewed by the Owner's Testing Agency before placement of reinforcement.

1.06 ENVIRONMENTAL QUALITY ASSURANCE

A. Provide materials with minimum percentage of recycled content as specified under Part 2 Materials article.

B. The following work is to occur within 500 miles of the project location:

1. Fabrication of reinforcing steel, studrails and anchor rods.

2. Installation of headed bars, deformed bar anchors and mechanical couplers.

C. Applicable LEED Credits:

1. Category – Materials and Resources:
a. Credits 4.1 and 4.2, Recycled Content.
b. Credits 5.1 and 5.2, Regional Materials.

PART 2 - PRODUCTS

2.01 REINFORCEMENT MATERIALS

A. Reinforcement:

1. Typical Bars: Deformed, material type as indicated on the Drawings.

a. ASTM A 706, Grade 60.
b. ASTM A 615, Grade 60.

2. Special Bars: Bars end-fitted with friction-welded components shall be ASTM A 706, deformed.

3. Bars Welded to Structural Steel: ASTM A 706, deformed.

B. Deformed Bar Anchors (DBA): See Section titled "Structural Steel".

C. Spiral Wire Reinforcement: ASTM A 82.

D. Welded Wire Fabric: Sheets conforming to ASTM A 185.

E. Recycled Content: 50 percent minimum.

2.02 TIE WIRE AND BAR SUPPORTS

A. Tie Wire: #16 gauge (AWG) or heavier, black annealed wire.

B. Tie Wire for Architectural Concrete: #16 gauge (AWG) or heavier, ASTM A 492 stainless steel.

C. Bar supports in shall be provided as follows.

1. Typical Supports in Contact with Formwork, Unless Otherwise Noted: CRSI Class 2 - Type A, or all-plastic supports.

2. Supports in Contact with Ground: Precast concrete blocks ("dobies") with embedded wires.

3. Supports Not in Contact with Formwork or Ground: Lengths of reinforcement bar, or metal or plastic spreaders and separator specifically intended for support of concrete reinforcement.

4. Supports for Architectural Concrete: CRSI Class I plastic-protected stainless steel.

2.03 MECHANICAL COUPLERS AND HEADED BARS

A. Mechanical Couplers: Standard, transition, position, and half-couplers (form savers) for reinforcement bars shall be as follows. Swaged and wedged couplers shall not be used. Type II or Type III couplers may be used in lieu of Type I at the Contractor's option, provided that these couplers can be dimensionally accommodated in the reinforcing cage.

1. Type I couplers shall meet the requirements of the CBC.

a. BarSplice Products' "ZAP Screwlok 'SL' series".
b. Dayton Superior's "Barlock S/CA-series coupler".

2. Type II couplers shall meet the requirements of the CBC. Couplers shown on the drawings shall be Type II, unless otherwise shown or indicated.

a. BarSplice Products' "ZAP Screwlok" series.
b. Erico Lenton's "A2" series.
c. Dayton Superior's "Barlock L-series" (A 615 reinforcement only).
d. Dextra's "Bartec" Series.

3. Type III couplers shall meet the requirements of the CBC for Type II couplers. In addition, Type III couplers shall be capable of developing the full rupture strength of the reinforcement bar without failure of the coupler following a minimum ductile elongation of 10% of the sample length, or 175% of the specified reinforcement yield strength, whichever is greater. Type III couplers shall conform to the dimensional tolerances shown on the Drawings such that special ties or hoops are not required at the coupler, required concrete cover requirements are not violated, and location of longitudinal bars is not altered.

a. Headed Reinforcement Corporation's "HRC 400" (A 706 reinforcement only) or "HRC 500" series.
b. Erico Lenton's "A12 Plus & P14 Plus" series, or approved equal.

B. Headed Bars:

1. Type I headed bars shall be used where indicated on the drawings and in lieu of hooked bar ends at the Contractor's option except where Type II or Type III headed bars are indicated. Terminations shall be capable of developing the specified yield strength of the reinforcing bar.

   a. Erico Lenton's "Terminator D6" series headed bars.
   b. Dextra's "Bartec" Series.

2. Type II headed bars shall be used where indicated on the drawings. Terminations shall be capable of developing 160% of the specified yield strength of the reinforcing bar. Headed bars shown on the drawings shall be Type II, unless otherwise shown or indicated.

   a. Erico Lenton's "Terminator D6" series headed bars.
   b. Dextra's "Bartec" Series.

3. Type III headed bars shall be used where indicated on the drawings. Terminations shall be capable of developing the full rupture strength of the reinforcement outside the termination following a minimum ductile elongation of 10% of the sample length, or 175% of the specified reinforcement yield strength, whichever is greater. Type III headed bars shall conform to the dimensional tolerances shown on the Drawings such that the required concrete cover requirements are not violated.

   a. Headed Reinforcement Corporation's "HRC 100" and "HRC 200" series T-Headed Bars (A 706 reinforcement only).
   b. Erico Lenton's "Terminator D16 Plus" series headed bars.

2.04 WELDING ACCESSORIES

A. Welding Filler Metals: Use AWS D1.4 matching type filler metals.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.02 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in concrete members and verify conformance to structural requirement shown on the Drawings. Additional reinforcement at penetration and opening locations shall be as indicated on the Drawings.

3.03 FABRICATION

A. Tolerances for reinforcement fabrication shall conform to the requirements of ACI 315.

B. Reinforcement shall be shop fabricated to the lengths and bends shown on the Drawings, by experienced shops using methods that do not damage the reinforcement.

C. Bars shall be cold bent.

D. Concrete cover, measured to edge of reinforcement, mechanical couplers, and headed bars, shall be as shown and scheduled on the Drawings.

E. Bars shall be placed, spaced, and aligned as indicated on the Drawings.

F. Stagger splices of adjacent bars, unless otherwise shown on the Drawings.

G. Where the Contractor utilizes reinforcement splices not shown on the Drawings, the splice locations shall be included in the reinforcement placing drawing submittals for review by the Owner's Representative. Splices of reinforcement shall not be made at points of maximum stress.

H. Lap splices and dowel lengths shall be as indicated on the Drawings, but not less than 40 bar diameters, or 24 inches, whichever is more.

I. Locate mechanical couplers and headed bars as shown on the Drawings. Where the Contractor utilizes mechanical couplers not shown on the Drawings, the coupler types and locations shall be included in the reinforcement placing drawing submittals for review by the Owner's Representative.

J. Stagger mechanical coupler locations at adjacent reinforcement bars as indicated on the Drawings, but not less than 24 inches.

K. Reinforcement bundles shall be tagged with suitable identification to facilitate sorting and placing.

3.04 PLACING

A. Tolerances for placement of reinforcement shall conform to ACI 117.

B. Prior to placing reinforcement, the contractor shall clean reinforcement free of scale, dirt, grease, or other foreign substances detrimental to bonding. Maintain cleanliness of reinforcement until it has been completely encased in concrete.

C. Placement of reinforcement shall be in accordance with CRSI - Placing Reinforcing Bars.

D. Concrete reinforcement shall be supported in conformance with the CRSI Manual of Standard Practice, and shall not be unsupported for lengths exceeding 4'-0". Use spreaders between curtains of vertical reinforcement to maintain bar alignment in the forms.

E. Reinforcement shall be placed to meet the concrete cover, bar spacing, and bar alignment requirements indicated on the Drawings.

F. Tie intersecting reinforcement bars with tie wire in accordance with the CRSI - Placing Reinforcing Bars to prevent displacement during casting of concrete. Tack welding of intersecting bars shall not be allowed.

3.05 MECHANICAL COUPLERS AND HEADED BARS

A. Threaded mechanical couplers and headed bars shall be tightened with a torque wrench according to the manufacturer's recommendations.

3.06 WELDING

A. Welding of reinforcement bars to structural steel shall be in accordance the requirements of AWS D1.4 for the reinforcement bar and AWS D1.1 for the structural steel surface preparation, filler metal type, and preheat.

B. Welders shall be qualified for processes, positions, and weld thicknesses to be used by that welder.

C. Shop welders, field welders, and welding foremen shall possess a copy of the approved WPSs.

3.07 REQUIREMENTS FOR ARCHITECTURAL CONCRETE

A. At exposed faces of architectural concrete, bar chairs, supports, bolsters, and other devices shall not be attached to the form face material.

B. Turn tie wires after cutting toward the inside of concrete members and bend in such a manner that concrete placement will not displace the wires toward exposed concrete surfaces.

C. Welding of reinforcement shall be performed prior to placing reinforcement in formwork.

3.08 FIELD MODIFICATIONS

A. Reinforcement shall not be field bent except where specifically indicated as such on the Drawings, or with written permission from the Owner's Representative. Bars kinked or bent during construction shall be considered defective work.

3.09 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.10 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 2000

SECTION 03 2520
ANCHORS AND DOWELS IN RESIN

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of post-installed anchors and dowels in resin.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, and all other Specification Sections apply to this Section.

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.

2. ACI 355.2 American Concrete Institute, "Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary"

3. ASTM - American Society for Testing and Materials, designations referenced herein.

4. ICC-ES, International Code Council Evaluation Services; Evaluation Service Reports (ESRs)referenced herein.

5. IAPMO-UES, International Association of Plumbing and Mechanical Officials, Uniform Evaluation Service; alternate Evaluation Reports (ERs) referenced herein

1.04 SUBMITTALS

A. General: Submittals shall be sent to the Owner's Representative, or Owner's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Manufacturer's Data: The Contractor shall submit the manufacturer's ICC-ES or IAPMO-UES report to the Owner's Representative for review.

1.05 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. The Owner's Testing Agency shall provide special inspection to verify compliance with the specifications and the product's ICC-ES or IAPMO-UES report the for following items:

a. Drill type, bit, bit diameter and setting.
b. Hole diameter, depth, and accuracy of location.
c. Cleanliness and surface preparation of holes.
d. Anchor and dowel type, material, diameter, and length.
e. Mixing and placing of resin.
f. Expiration date of resin
g. Placement of anchors and dowels in the resin-filled holes.

3. The Owner's Testing Agency shall conduct static tension load tests on installed anchor and dowel. Test 10% of each diameter of anchors and dowels, or test as scheduled on the Drawings. Tests shall be in accordance with ASTM E 488, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements".

a. Tension load tests shall not begin prior to manufacturer's recommended full cure time after installation based on temperature/cure time guidelines by manufacturer.
b. Scheduled test loads shall be applied 15seconds with no allowable slip.
c. If an anchor or dowel fails a tension load test, additional dowels or anchors shall be tested until 20 consecutively successful tests have been performed.
d. Provide tension load tests for replacement anchors and dowels.
e. The Owner's Testing Agency shall develop and utilize an effective method of field marking locations and results of tension load tests.

1) Field marking for test locations shall not affect exposed concrete appearance.
2) A detailed drawing record of test locations and results shall be acceptable.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Resin adhesives for anchors and dowels in normal weight and lightweight concrete:

1. Hilti Corporation's "HIT-RE 500-SD" (ICC-ES Report No. ESR-2322).

2. Simpson Strong-Tie's "SET-XP Adhesive" (ICC-ES Report No. ESR-2508).

B. Resin adhesives for anchors in fully grouted CMU:

1. Hilti Corporation's "HIT HY-150 MAX" (ICC-ES Report No. ESR-1967).

2. Simpson Strong-Tie's "SET Adhesive" (ICC-ES Report No. ESR-1772) or "SET-XP" Adhesive (IAPMO-UES Report No. ER 265).

C. Dowel reinforcement bars (dowels) shall be as specified in Section titled "Concrete Reinforcement".

D. Threaded rod (anchors), washers, and nuts shall be as specified in Section titled "Structural Steel".

E. Patching Mortar: BASF's "EMACO S66 CI", Sika Corporation's "SikaRepair 223", Simpson Strong-Tie's FX-263 or equal.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.02 LAYOUT

A. Inspect areas to be drilled to verify conditions of access, interferences, and existing materials.

1. Verify location of reinforcement in areas to be drilled using non-destructive methods. Contractor shall use care and caution to avoid cutting or damaging reinforcement. Maintain a minimum clearance of one inch between reinforcement and anchors or dowels, unless otherwise shown on the Drawings.

2. Locate post-tensioned tendon locations in areas to be drilled using non-destructive methods. Contractor shall use care and caution to avoid cutting or damaging tendons and tendon sheaths. Maintain a minimum clearance of one inch between tendon sheaths and anchors or dowels, unless otherwise shown on the Drawings.

3. Verify locations of grouted cells in CMU.

3.03 TOLERANCES

A. Anchor hole locations shall conform to tolerances for the material being attached.

3.04 DRILLING AND PREPARATION OF HOLES

A. Holes shall not be drilled in concrete that has not achieved its specified compressive strength and not until a minimum of seven days after concrete has been cast.

B. Holes shall not be drilled into grouted CMU until the CMU grout has attained its design compressive strength and not until a minimum of seven days after CMU grout has been placed.

C. Holes shall be drilled using the manufacturer's recommended drill type, diameter, bit, and setting, unless otherwise noted on the drawings.

D. Hole diameter shall be as indicated by the manufacturer. Depth of hole shall be as indicated on the Drawings; however, in no case shall the embedment of anchors or dowels be less than the minimum depth required by the manufacturer.

E. Where drilling causes the concrete or CMU to spall or crack, the holes shall be considered defective work.

F. Dust and other contaminants shall be completely removed from holes by blowing with compressed air in accordance with manufacturer's specified hole cleaning instructions

3.05 ANCHOR AND DOWEL INSTALLATION

A. Anchor and dowel installation shall be according to the resin manufacturer's recommendations, including filling holes with resin appropriately and installing the anchor or dowel in the hole.

B. Resin shall completely enshroud installed anchors and dowels without entrapping air in the hole and shall be finished flush with surface of concrete or CMU.

3.06 PROTECTION DURING RESIN CURE TIME

A. Protect dowels and anchors from displacement or disturbance during entire resin curing period. Consider the ambient temperature in determination of minimum cure time.

B. Minimum temperature requirements of the concrete or CMU shall be maintained for full cure time of adhesive as specified by the manufacturer.

3.07 REPLACEMENT ANCHORS AND DOWELS AT FAILED TEST LOCATIONS

A. At failed tension load test locations:

1. Abandon anchor, cut 1 inch below concrete, and patch with mortar.

2. Contact Engineer-of-Record for direction.

3.08 DAMAGED REINFORCEMENT

A. Damage to existing reinforcement shall be considered defective work.

3.09 SURFACE REPAIRS AND FILLING OF ABANDONED HOLES

A. Clean and repair surfaces damaged by drilling or installation. Cleaning and repairing requirements shall be as directed by the Owner's Representative.

B. Abandoned holes shall be filled with patching mortar in accordance with the manufacturer's recommendations.

3.10 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the

defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.11 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 2520

SECTION 03 2530
EXPANSION ANCHORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of post-installed expansion anchors.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, and all other Specification Sections apply to this Section.

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.

2. ACI 355.2, American Concrete Institute, "Qualification of Post-installed Mechanical Anchors in Concrete.

3. ASTM - American Society for Testing and Materials, designations referenced herein.

4. Federal Specifications - United States General Services Agency Federal Specifications and Commercial Item Description reports as referenced herein.

5. International Code Council Evaluation Services (ICC-ES) or the International Association of Plumbing and Mechanical Officials (IAPMO-UES), Evaluation Service Reports referenced herein.

1.04 SUBMITTALS

A. General: Submittals shall be sent to the Owner's Representative, or Owner's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Manufacturer's Data: The Contractor shall submit the manufacturer's ICC-ES or IAPMO-UES report to the Owner's Representative for review.

1.05 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. The Owner's Testing Agency shall provide special inspection to verify compliance with the specifications and the product's ICC-ES or IAPMO-UES report the for following items:

a. Drill type, diameter, bit type, and setting.
b. Hole diameter, depth, and accuracy of location.
c. Cleanliness and surface preparation of holes.
d. Expansion anchor type and size.
e. Installation of expansion anchors.
f. Torque tightening.

3. The Owner's Testing Agency shall conduct static tension load tests on installed anchors. Test 10% of each diameter of anchor, or test as scheduled on the Drawings. Tests shall be in accordance with ASTM E 488, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements".

a. Tests shall not begin until one full day after anchor installation.
b. Scheduled test load shall be applied for 15 seconds during which the maximum allowable slip shall be 1/8 inch.
c. If an anchor fails the tension load test, additional expansion anchors shall be tension load tested until 20 consecutively successful tests have been performed.
d. Provide tension load tests for replacement expansion anchors.
e. The Owner's Testing Agency shall develop and utilize an effective method of field marking locations and results of expansion anchor tests.

1) Field marking for test locations shall not affect exposed concrete appearance.
2) A detailed drawing record of test locations and results shall be acceptable.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Expansion Anchors:

1. Anchors shall be wedge-type anchors made from carbon steel or stainless steel as indicated on the drawings, and tested in accordance with AC 193 Cracked Concrete (seismic) requirements of carbon steel or stainless steel as indicated on the Drawings.

2. Expansion anchors for use in normal weight concrete:

a. Hilti Corporation's "Kwik Bolt TZ" (ICC-ES Report ESR-1917).
b. Simpson Strong-Tie's "Strong-Bolt 2" (ICC-ES Report No. ESR-3037).

3. Expansion anchors for use in lightweight concrete (installed directly to concrete or through bottom of light gage metal deck):

    a. Hilti Corporation's "Kwik Bolt TZ" (ICC-ES Report ESR-1917).
    b. Simpson Strong-Tie's "Strong-Bolt 2" (ICC-ES Report No. ESR-3037).

B. Patching Mortar: BASF's "EMACO S66 CI", Sika Corporation's "SikaRepair 223", Simpson Strong-Tie's FX 263 or equal.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, corrosion, and weather conditions as designated by the manufacturer, and contaminants such as grease, oil, and dirt.

3.02 LAYOUT

A. Inspect areas to be drilled to verify conditions of access, interferences, and existing materials.

1. Verify location of reinforcement in areas to be drilled using non-destructive methods. Contractor shall use care and caution to avoid cutting or damaging reinforcement. Maintain a minimum clearance of one inch between reinforcement and anchors or dowels, unless otherwise shown on the Drawings.

2. Locate post-tensioned tendon locations in areas to be drilled using non-destructive methods. Contractor shall use care and caution to avoid cutting or damaging tendons and tendon sheaths. Maintain a minimum clearance of one inch between tendon sheaths and anchors or dowels, unless otherwise shown on the Drawings.

3.03 TOLERANCES

A. Anchor hole locations shall conform to tolerances for the material being attached.

3.04 DRILLING AND PREPARATION OF HOLES

A. Holes shall be drilled in concrete that has achieved the minimum specified compressive strength. Holes cannot be drilled until a minimum of seven days after concrete case been poured.

B. Holes shall be drilled using the manufacturer's recommended drill type, bit, and setting, unless otherwise noted on the drawings.

C. Hole diameter shall be as indicated by the manufacturer. Depth of hole shall be as indicated on the Drawings; however, in no case shall the embedment of expansion anchors be less than the minimum required by the manufacturer.

D. Where drilling causes the concrete to spall or crack, the holes shall be considered defective work.

E. Dust and other contaminants shall be completely removed from holes by blowing with compressed air or other effective means.

3.05 ANCHOR INSTALLATION

A. Installation of anchors in the holes shall be in accordance with manufacturer's recommendations.

B. Anchors shall be tightened to the required installation torque values as determined by the manufacturer.

3.06 REPLACEMENT ANCHORS AT FAILED TEST LOCATIONS

A. At failed tension load test locations:

1. Remove anchor if possible with out damaging concrete or abandon anchor in place.

2. Install replacement anchors in new holes at location approved by the Engineer of Record or the Owner's Testing Agency.

3. Existing holes not approved by the Owner's Testing Agency shall be considered defective work.

4. Contact Engineer for anchor recommendations into existing holes if necessary.

3.07 DAMAGED REINFORCEMENT

A. Damage to existing reinforcement shall be considered defective work.

3.08 SURFACE REPAIRS AND FILLING OF ABANDONED HOLES

A. Clean and repair surfaces damaged by drilling or installation. Cleaning and repairing requirements shall be as directed by the Owner's Representative.

B. Where expansion anchors have been removed, abandoned holes shall be filled with patching mortar in accordance with the manufacturer's recommendations.

3.09 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.10 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 2530

SECTION 03 3000
CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, sample panels, mock-ups, trial batches, tests and inspections necessary for the installation of cast-in-place concrete. The work also includes the following:

1. Furnishing and installation of rock base, vapor barrier and sand cover where shown under slabs-on-grade.

2. Installation of inserts, sleeves, dowels, anchor bolts and other items embedded in concrete, but furnished under other sections.

3. Grouting of column bases.

B. Engineering: Provide engineering services for the design and implementation of cast-in-place concrete mix designs.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming – 03 1000

2. Concrete Reinforcing – 03 2000

3. Concrete Curing – 03 3900

4. Concrete Finishing – 03 3500

5. Polished Concrete Floor Finish – 03 3543

6. Shotcrete – 03 3713

7. Structural Steel – 05 1200

8. Special Environmental Requirements (LEED) – 01 3560

9. Below Grade Vapor Barrier – 07 2616

10. Pre-Applied Integrally Bonded Membrane Waterproofing – 07 1355

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.

2. ACI - American Concrete Institute, Manual of Concrete Practice, including, but not limited to, the following sections:

   a. ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials”.
   b. ACI 211.1 “Recommended Practice for Selecting Proportions for Normal and Heavy Weight Concrete”.
   c. ACI 211.2 “Standard Practice for Selecting Proportions for Structural Lightweight Concrete”.
   d. ACI 301 "Specification for Structural Concrete for Buildings".
   e. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.
   f. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete".
   g. ACI 304R "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete”.
   h. ACI 304.2R “Placing Concrete by Pumping Methods”.
   i. ACI 305R "Hot Weather Concreting".
   j. ACI 306R "Cold Weather Concreting".
   k. ACI 308R “Guide to Curing Concrete”.
   l. ACI 309R “Guide for Consolidation of Concrete”.
   m. ACI 318 “Building Code Requirements for Structural Concrete”.

3. ASTM, American Society for Testing and Materials, designations referenced herein.

4. Caltrans - California Department of Transportation, “Standard Specifications”.

5. NRMCA - National Ready-Mix Concrete Association, Quality Control Manual – Section 3: Certification of Ready Mixed Concrete Production Facilities

6. TransLab - Caltrans Transportation Laboratory, “California Test Methods” as listed herein. Note: documentation of these test methods is available on the Internet.

7. State of California, Construction Safety Orders (CAL/OSHA).

1.04 SUBMITTALS

A. General: Submittals shall be sent to the Owner’s Representative, or Owner’s Testing Agency, or both, as required herein for review prior to producing project concrete. Review of submittals covers the general character of the details, material properties of the concrete ingredients, and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Shop Drawings: The Contractor shall prepare and submit shop drawings to the Owner’s Representative showing:

1. Joints: Indicate details and locations of construction, control, and expansion joints.

2. Penetrations and Openings: Indicate locations and sizes of penetrations in concrete members.

3. Casting Sequence: The Contractor shall submit a proposed casting sequence for placing concrete to the Owner's Representative for review before commencing with the work. The sequence shall include the locations, extents, and structural members included in each pour.

C. NRMCA Certificate of Conformance: Submit a copy of the NRMCA Certificate of Conformance to the Owner's Testing Agency for the ready-mix plant, equipment, and mix trucks that will supply the concrete for the project.

D. Product Data for Concrete Accessories: The Contractor shall submit manufacturer's data for each product to the Owner's Representative for review.

E. Samples: When specifically requested by the Owner's Representative, provide samples of cementitious materials, aggregates, or both to the Owner's Testing Agency in adequate quantity to facilitate testing of these materials for conformance with the Specifications. Aggregate samples shall be taken in conformance with the requirements listed in ASTM C 33.

F. Mix Design: The Contractor shall submit concrete mix designs for review by the Owner's Representative and Owner's Testing Agency at least seven days before placing concrete. Review of mix designs covers general conformance with the specifications, but does not constitute an approval of the mix proportions. Submit one mix design for each class of concrete. Each mix design shall include the following information:

1. Concrete class,

2. Member types and specific placement locations,

3. Material quantities per cubic yard,

4. Material ingredient certificates of compliance,

5. Coarse and fine aggregate sources, types, sizes, and gradation,

6. Admixture product data and dosage,

7. Design compressive strength, age (in days) required to reach design compressive strength, and compressive strength historic data,

8. Maximum water to cementitious materials ratio,

9. Design slump (or target slump range for self-consolidating mixes) at point of discharge from transit mix truck,

10. Unit weight of freshly mixed and oven-dry concrete,

11. Calculated percent water-soluble chloride ions (Cl^-) by weight of cement, considering the chloride ion content of all concrete ingredients,

12. Water-soluble chloride ion content historic data or trial batch test data, when required herein,

13. Shrinkage historic data or trial batch test sample data, when required herein,

14. Contractor's Engineer's stamp and signature certifying that the concrete mix has been designed under the supervision of the Contractor's Engineer.

G. Historic data: When concrete mix design historic data is required herein to demonstrate conformance with the specification, the collected data shall satisfy the requirements stipulated for concrete mix trial batching requirements found under the "Contractor's Quality Control Tests and Inspections" section of this specification.

H. Architectural sample panels: Two 2'-0" x 2'-0 x 2" minimum thick sample panels, cast vertically, shall be submitted to the Owner's Representative for each type of architectural concrete element, including but not limited to walls and floor topping slabs, for review of color and texture of concrete surfaces prior to casting Architectural Concrete. The acceptable sample panels shall serve as the standard for color and texture.

I. Architectural mock-up: Provide one concrete mock-up at the job site, as a demonstration for the Owner's Representative's review of materials, color, quality of workmanship, and finish, for each type of architectural concrete element, including but not limited to walls and floor topping slabs. Refer to the Drawings for the representative area of the mock-up. The mock-up shall be constructed using the materials and proportions of the proposed mix design, the thicknesses, contours, surface features, reveals, formwork and reinforcement of the indicated location, and shall utilize the specified curing and finishing measures for the concrete class. In addition, at least one construction joint shutoff with keyways shall be included in both the horizontal and vertical directions. The completed mock-up shall match color, texture, workmanship, and finish of the approved sample panels. Mock-ups found to be deficient shall be repaired or new mock-ups shall be constructed until the Owner's Representative approves a satisfactory panel. The approved mock-up shall serve as the standard of quality for architectural concrete.

J. Form Tie Hole Filling and Finishing Procedure: The Contractor shall submit a procedure for the filling and finishing of form tie holes in architecturally exposed areas.

K. Batch Ticket Information: The Contractor shall submit a copy of each delivery ticket to the Owner's Testing Agency for their record.

L. Contractor's quality control test and inspection reports: The Contractor shall submit quality control test and inspection reports to the Owner's Representative and Owner's Testing Agency for review.

M. LEED Submittals:

1. Furnish product data indicating that all adhesives and sealants used inside the building and applied on site comply with LEED VOC Requirements outlined in the Environmental Quality Assurance article.

2. Recycled Content: Submit product data indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for product having recycled content.

3. Regional Materials: Submit product data indicating that all aggregate was extracted within 500 miles of project location.

1.05 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

3. The Contractor shall notify the Owner's Representative 48 hours prior to placing concrete to facilitate structural observation.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. Sample tests: When the Owner's Representative requires the Contactor to submit samples for cementitious materials, aggregates, or both, the Owner's Testing Agency shall test the samples for conformance with the specifications.

3. Mix design and materials review: The Owner's Testing Agency shall review the Contractor's proposed mix designs and material certificates of compliance.

4. Batch Plant Inspections: The Owner's Testing Agency shall provide inspections at the Contractor's concrete batch plant as detailed in CBC 1704A.4.3 or 1704A4.4.

5. Job Site Special Inspections: The Owner's Testing Agency shall provide the following special inspections during the project construction:
   a. Special inspection of location of embedded items and anchor bolts and anchor rods.
   b. Special inspection of concrete placement.

6. Job-site monitoring: Where a Thermal Control Plan has been established, the Owner's Testing Agency shall monitor and record temperature measurements of the Contractor's thermal monitoring devices.

7. Job site samples: The Owner's Testing Agency shall take job site samples of fresh concrete in accordance with ASTM C 172. The volume of each sample shall be adequate to facilitate the required on-site and laboratory tests. Samples for each class of concrete shall be taken not less than once a day, or not less than once for every 150 cubic yards of concrete, or not less than once for every 5,000 square feet of surface area for slabs and walls.

   a. If the total volume of concrete for the project is such that less than five samples would be collected for a given class of concrete, samples shall be made from at least 5 randomly selected batches, or from each batch if fewer than 5 batches are used.
   b. Record the air temperature at the time of taking concrete samples.

8. Job site tests: From each sample taken, the following job-site tests shall be performed:

   a. Slump: ASTM C 143,
   b. Density and Air Content: ASTM C 138,
   c. Temperature: ASTM C 1064.

9. Collection and curing of test specimens: From each concrete sample taken, collect and cure sets of test specimens as follows:

    a. Compression cylinder test specimens: ASTM C 31. Collect a set of standard 6 by 12-inch cylinder test specimens. A set shall consist of four cylinder test specimens for concrete with compressive strength specified at 28 days or five cylinder test specimens for concrete with compressive strength specified at greater than 28 days. Test specimens shall be standard cured.
    b. Shrinkage test specimens: ASTM C 157. When concrete classes require shrinkage tests, collect a set of shrinkage test specimens. A set shall consist of three test specimens. Specimens shall be standard cured and air stored.

10. Laboratory tests: Test specimens shall be laboratory tested after collection and curing as follows:

    a. Perform compressive strength tests on compression cylinder test specimen sets in accordance with ASTM C 39.

        1) For concrete with compressive strength specified at 28 days, one specimen from each set shall be tested at 7 days after casting, two specimens from each set shall be tested at 28 days after casting, and the remaining cylinder in each set shall be kept for further testing, if required.
        2) For concrete with compressive strength specified at greater than 28 days, one 6x12 cylinder specimen from each set shall be tested at 7 days after casting, one specimen from each set shall be tested at 28 days after casting, and two specimens from each set shall be tested at the age designated for determination of specified compressive strength, as indicated on the concrete mix design. The remaining cylinder in each set shall be kept for further testing, if required. Owner's Testing Agency may opt to use 4x8 cylinder specimen on the condition that a minimum of three specimens are tested at the age designated for determination of specified compressive strength, as indicated on the concrete mix design.

    b. Perform shrinkage tests on shrinkage test specimen sets in accordance with ASTM C 157. Length measurements for each specimen shall be recorded at 14, 28, and 35 days after casting. Specimens shall be kept for further testing, if required.

11. Grout Sampling and Testing: Take one set of three 2-inch mortar cubes for compressive strength tests per ASTM C 109 each day grout is placed. Test one cube 7 days after molding and two cubes at 28 days after molding.

C. Contractor's Quality Control Tests and Inspections:

1. General:

    a. Quality control tests and inspections shall be the responsibility of the Contractor.
    b. Where required herein, the Contractor shall demonstrate that quality control conforms to the requirements of the Contract Documents.
    c. Quality Control Test and Inspection Reports shall be prepared and submitted for review.

2. Concrete Mix Trial Batching: Where required herein, the Contractor's Testing Agency shall prepare concrete trial batches in accordance with ASTM C 192 as needed for preparation of test specimens. The number of batches and quantity of each batch shall be at least adequate to prepare the required number of test specimens for each of the required tests as follows. Test specimens for different tests may be taken from a single batch.

a. Compressive test specimens: Trial batch and test specimen quantity shall be in conformance with the requirements for the governing building code.
b. Water-soluble chloride ion test specimens: Prepare one trial batch. Prepare one test specimen from the trial batch and test after a minimum of 28-days after casting in conformance with ASTM C 1218.
c. Shrinkage test specimens: Prepare two trial batches. From each batch prepare and test two sets of three specimens in conformance with ASTM C 157.

1.06 CONTRACTOR'S ENGINEERING SERVICES

A. General: Where engineering services are required herein, the Contractor shall retain either a Civil or Structural Engineer registered in the State of California, referred to herein as the Contractor's Engineer.

1. Documents prepared by the Contractor's Engineer shall be stamped and signed.

B. Concrete mix designs shall be prepared, signed, and stamped by the Contractor's Engineer certifying that the mix design has been prepared under supervision and that the mix designs meet the requirements of the Contract Documents.

C. Temporary supports required for concrete sample panels, or mock-ups, or both, shall be designed by the Contractor's Engineer.

1.07 ENVIRONMENTAL QUALITY ASSURANCE

A. Adhesives, sealants, and sealant primers shall not exceed VOC limits established in Section 01 3500, LEED Requirements.

B. Provide concrete mixes with minimum percentage of recycled content from supplementary cmentitious materials specified in the Concrete Mix Schedule on the structural drawings.

C. Applicable LEED Credits:

1. Category – Indoor Environmental Quality:

a. Credit 4.1: Low-Emitting Materials, Adhesives and Sealants.

2. Category – Materials and Resources

a. Credits 4.1 and 4.2: Recycled Content.
b. Credits 5.1 and 5.2: Regional Maerials.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Water: Clean, potable, and free from deleterious material.

B. Cementitious materials and aggregates:

1. Proven history of successful use together, or submit evidence satisfactory to the Owner's Representative that aggregate will not react harmfully in presence of alkalis in cement.

2. From constant sources throughout the work and of the same type and source as those used in establishing mix proportions.

C. Portland cement: ASTM C 150, Type II, Low Alkali. Same brand and type of cement shall be used throughout.

D. Fly ash: ASTM C 618, Class F, with the following modified requirements:

1. Chemical Requirements (Table 1 of ASTM C 618)

a. Sulfur trioxide (SO3) shall not exceed 3% by weight.
b. Loss on ignition (L.O.I.): Maximum 1%.

2. Physical Requirements (Table 2 of ASTM C 618)

a. Water requirement, maximum, 100% of control.

3. Sulfate resistance, R = 0.75% maximum, where:

R = (C-5)/F, where:
C = Percent CaO (Calcium Oxide)
F = Percent Fe_2O_3 (Ferric Oxide)

E. Ground Blast Furnace Slag: ASTM C 989.

F. Aggregates:

1. Normal weight concrete: ASTM C 33, except as modified herein.

a. Coarse aggregates:

1) Crushed limestone, granite, Clayton, Sechelt,
2) Crushed gravel or gravel used as a gradation transition aggregate,
3) Cleanness Value (CV) of not less than 75 when tested according to TransLab's California Test 227,
4) Maximum aggregate size shall be determined by the Contractor for each class of concrete based on the parameters established in the specification subsection herein titled "Mix Designs".

b. Fine aggregates: Sand Equivalent (SE) of not less than 75 when tested according to TransLab's California Test 217.

2. Lightweight concrete:

a. Coarse aggregates: ASTM C 330, expanded shale type, by rotary-kiln method,
b. Fine aggregates: ASTM C 33.

3. Chloride ion content: Coarse and fine aggregates for use in concrete shall be thoroughly washed and cleaned such that their water-soluble chloride ion contents do not exceed the limitations established in the submitted concrete mix designs for each class of concrete.

G. Admixtures: Admixtures containing chlorides, fluorides, sulphites, nitrates, or those that contain chemicals that may have a harmful effect on cement or aggregate, shall not be used. Combinations of

admixtures in a given mix shall be chemically compatible. Acceptable admixture manufacturers include, but are not limited to W.R. Grace & Co., Master Builders, Euclid, and Sika & Co.

1. Water-reducing admixtures: ASTM C 494 Type A,

2. Retarding admixtures: ASTM C 494 Type B,

3. Accelerating admixtures: ASTM C 494 Type C, non-chloride,

4. Water-reducing and retarding admixtures: ASTM C 494 Type D,

5. Water-reducing and accelerating admixtures: ASTM C 494 Type E,

6. High-range water-reducing admixtures (superplasticizers): ASTM C 494 Type F,

7. High-range water reducing and retarding admixture: ASTM C 494 Type G,

8. Mid-range water reducing admixtures: ASTM C 494 Type A and F.

9. Shrinkage-reducing admixture: W.R. Grace's "Eclipse", Euclid Chemical Company's "Eucon SRA", or equal,

10. Viscosity-modifying admixtures: Euclid Chemical Company's "Visctrol" or "Eucon ABS", W.R. Grace Company's "V-MAR 3", or equal,

11. Waterproofing admixtures: Xypex Admix C-Series or equal.

H. Controlled low-strength material (CLSM) fill and backfill:

1. Minimum 28-day Compressive Strength: 150 psi.

2. Material Components:

a. Cement: ASTM C 150, Type II.
b. Fly Ash: ASTM C 618, Class F or C.
c. Water: Clean, potable, ASTM C 94.
d. Aggregates: ASTM C 33.
e. Air Entraining Admixtures: Refer to Section titled "Cast-in-Place Concrete".

2.02 CONCRETE ACCESSORIES

A. Preformed expansion joint fillers: ASTM D 994, ASTM D 1751, or ASTM D 1752

B. Expansive water stops for concrete construction joints: Grace Adcor ES or Cetco RX Series, or approved equal. Provide double row of waterstop where detailed and as required.

C. Injection Tube Waterstop: Deneef, or approved equal.

D. Rock base below slabs on grade: Refer to Final Geotechnical Report. At a minimum, below interior slabs on grade use free draining, clean, crushed rock or gravel conforming to the requirements of the Geotechnical Report.

E. Vapor retarder: Flexible sheet membrane, minimum 15 mils thick, conforming to ASTM E 1745 Class C. See Section 07 2616.

F. Sand cover: Sand cover on top of vapor retarder shall not be used.

G. Slab on grade bulkheads:

1. Wood bulkheads with keys, as indicated on the Drawings.

2. Preformed metal bulkheads specifically intended for slab on grade construction.

H. Expanded polystyrene (EPS) below slabs on grade:

1. Not subject to vehicular traffic: ASTM C 578.

2. Subject to vehicular traffic: Extruded, ASTM C 578 Type VII or V with minimum density of 2.0 LB/CF and 60 psi minimum compressive resistance at 10% deformation.

I. Cardboard fill below structural slabs above expansive soils shall be SureVoid's "SlabVoid", or VoidForm International's "FloorVoid", or equal.

J. Fibrillated Polypropolene Fiber Reinforcement: ASTM C 1116/C 1116M, Section 4.1.3, Type III, and Note 2, MasterFiber M70 by BASF or equal.

K. Evaporation reducing compounds: Film-forming compound for temporary protection from rapid moisture loss. Acceptable products include "Confilm" by BASF, "Eucobar" by Euclid Chemical Co., or equal.

L. Non-Shrink Grout for Column Base Plates: ASTM C 1107 premixed, non-shrink, non-staining grout. Acceptable products include Masterflow 928 grout as manufactured by BASF Construction Chemicals LLC, Edoco Non-Ferrous, Non-Shrink Grout as manufactured by Edoco Construction Chemicals, Five Star Grout as manufactured by Five Star Products Inc., or equal. Grout shall attain a minimum compressive strength of 7000-psi at 28-days.

M. Epoxy waterproofing at pile caps where indicated: Structural grade 2-component epoxy resin adhesive, ASTM C-881: Sikadur 35, Mi-Mod LV.

2.03 CONCRETE MIX DESIGNS

A. General:

1. Concrete mix designs shall be designed and documented by the Contractor's Engineer.

2. The Contractor shall review proposed concrete mix designs for compatibility with the intended placement requirements, including reinforcement layout, to ensure that the concrete, as designed, can be placed in accordance with the Contract Documents.

3. The proportions of the concrete mixes shall be such as to produce concrete for each class of concrete that conforms to the specified minimum compressive strength, and, where required, drying shrinkage, permeability, and thermal control limits, within the specified maximum water-cementitious materials ratio.

4. Aggregate size and gradation shall be determined by the Contractor, within the established limitations.

    a. The size and grading of aggregates shall be such that it will produce dense and uniform concrete free from rock pockets, honeycombs and other irregularities. The maximum size of aggregates for each class of concrete shall not be more than:

        1) 1/5 the narrowest dimension between faces of forms,
        2) 1/3 the depth of slabs,
        3) 3/4 the minimum clearance between the closest spaced reinforcement bars,
        4) The minimum required concrete cover,
        5) 1-1/2 inches.

    b. Aggregate gradation shall meet the limits of ASTM C 33.

5. Determination of the amount of water in the batch shall include water contained in the aggregates.

6. The slump of wet concrete, measured at the delivery point, shall be determined and designed by the Contractor.

    a. Acceptable slump tolerances shall be as established in ASTM C 94, with the exception that slump tolerances for concrete mixes with a minimum 45% cement replacement by pozzolans may be double the listed values.

7. The plastic concrete consistency shall allow thorough compaction of the concrete into formwork corners and around concrete reinforcement without excessive puddling, spading, or vibration, and without causing the mixed materials to segregate or causing free water to collect on horizontal concrete surfaces.

8. The maximum percent water-soluble chloride ion content measured by weight of cement from the composite sum of concrete ingredients for each class of concrete shall be calculated for the concrete mix design proposed for each class of concrete. Where total calculated chloride ions exceed the CBC limits, either historic data or trial test batch data shall be submitted demonstrating that the water-soluble chloride ion content in each respective concrete mix does not exceed the allowable limits. Foundation members, slabs on grade, below grade walls, and buried roof structures shall be considered as concrete in wet conditions.

9. Architectural concrete shall be supplied, produced, and delivered from a single source.

B. Normal Weight Concretes:

1. Aggregates: At the Contractor's option, up to 25% of coarse aggregates may be gravel or crushed gravel, as measured by weight.

2. Air content: 2% maximum air content measured by volume,

3. Unit weight: Wet and dry unit weight shall be calculated in conformance with ASTM C 138 and ASTM C 567, respectively. Maximum unit dry weight shall be between 147 and 153 pounds per cubic foot (pcf).

4. Cement replacement: Replacement of a portion of Portland cement by flyash and/or ground blast furnace slag is allowed for all classes of concrete with a maximum allowable replacement of 60%.

5. Normal weight concrete mixes shall be designed in accordance with the following requirements:

NORMAL WEIGHT CONCRETE MIX REQUIREMENTS (Note 1)							
Concrete Class	Concrete Elements	Performance Criteria				Limiting Parameters	Additional Notes
		Minimum Compressive Strength (psi) (Note 2)	28-Day Maximum Drying Shrinkage Percentage (Note 3)	28-Day Maximum Permeability (Coulombs) (Note 4)	Mass Concrete Requirements (Note 5)	Maximum Water to Cementitious Materials Ratio (W / CM) (Note 6)	
A.	Drilled piers	5,000	N/A	N/A	N/A	0.55	
B.	Footings, grade beams	5,000	N/A	N/A	N/A	0.45	
C.	Interior slabs on grade	4,000	N/A	N/A	N/A	0.45	-
D.	Interior Architectural topping slabs	3,000	0.020	N/A	N/A	0.45	7, 8
E.	Exterior slabs on grade or topping slabs	3,000	N/A	N/A	N/A	0.45	-
F.	Walls	5,000	N/A	N/A	N/A	0.45	
G.	Beams, columns	5,000	N/A	N/A	N/A	0.45	
H.	Subgrade walls	5,000	0.042	2000	N/A	0.40	7
I.	Architectural walls	5,000	0.042	N/A	N/A	0.45	7
J.	Architectural beams, columns	5,000	0.042	N/A	N/A	0.45	7
K.	Suspended slabs	5,000	N/A	N/A	N/A	0.45	-
L.	Fill on metal deck	4,000	N/A	N/A	N/A	0.45	-

Notes:

1. N/A stands for “not applicable”.
2. Compressive strength shall be determined on the basis of field experience and trial mixtures as required in the CBC. Specifications are based on developing compressive strength achieved at 28 days. Greater times to achieve specified compressive strength are allowed provided formwork stripping times are adjusted accordingly. Time to achieve specified compressive strength shall not exceed 56 days. If 56-day compressive strength is used, minimum 28-day compressive strength shall be 80% of required minimum 56-day compressive strength.
3. Drying shrinkage limit shall be verified by either historic data or trial batch test specimens prepared and measured in accordance with ASTM C 157 from concrete prepared in laboratory conditions in accordance with ASTM C 192.
4. Permeability limit listed above shall be validated by either historic data or trial batch test specimens prepared and measured in accordance with ASTM C1202 from concrete prepared in laboratory conditions in accordance with ASTM C192.

5. Mass concrete requirements: Maximum concrete temperature during curing = 180 degrees Fahrenheit, maximum temperature differential between interior and exterior concrete = 35 degrees Fahrenheit. Thermal requirements shall be verified by either historic data or trial batch test specimens; or by preparing and submitting a Thermal Control Plan for review.
6. W = weight of water. CM = weight of cementitious materials (cement plus flyash and/or ground blast furnace slag). Any mix that uses greater than 45% cement replacement shall have a maximum W/CM of 0.38.
7. The mix design submittal for this class of concrete shall include evidence that the proposed mix meets each of the required performance criteria listed above through either trial batch test data or historic data for the exact mix to be used on this project.
8. This mix shall contain shrinkage reducing admixture (SRA), and fibrillated polypropylene fiber reinforcement added at a rate of 1.5 LB per cubic yard.

C. Lightweight Concretes:

1. Air content: 4% to 7% air content measured by volume.

2. Unit weight: Wet and dry unit weight shall be calculated in conformance with ASTM C 138 and ASTM C 567, respectively. Maximum unit dry weight shall be between 107 and 113 pounds per cubic foot (pcf).

3. Lightweight concrete mixes shall be designed in accordance with the following requirements:

LIGHTWEIGHT CONCRETE MIX REQUIREMENTS (Note 1)

Concrete Class	Concrete Elements	Performance Criteria				Limiting Parameters	Additional Notes
		Specified Compressive Strength (psi) (Note 2)	Maximum Drying Shrinkage Percentage (Note 3)	Permeability (Coulombs) (Note 4)	Mass Concrete Requirements (Note 5)	Maximum Water to Cementitious Materials Ratio (W / CM) (Note 6)	
M.	Fill on Metal Deck	4,000	N/A	N/A	N/A	0.50	-

Notes: See notes for normal weight concrete mixes above.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.02 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in concrete members and verify conformance to structural requirements shown on the Drawings.

3.03 TOLERANCES

A. Dimensional tolerances shall be in conformance with ACI 117.

3.04 PREPARATION

A. Wood chips, shavings, and other debris shall be removed from the interior of the forms.

B. Existing and previously placed concrete surfaces shall be prepared as required herein.

C. Reinforcement shall be cleaned, if necessary, prior to placing concrete.

D. Reinforcement and other work to be embedded in the concrete shall be secured in position before casting.

E. Anchor bolts shall be accurately set to line and grade and shall be securely held in position such that they are not displaced while concrete is being place.

F. Pipes or conduits passing through (perpendicular to) structural concrete grade beams, joists, beams, girders, slabs, and walls shall be sleeved in Schedule 40 galvanized carbon steel or PVC sleeves as detailed on the Drawings. Adjacent pipes or conduits, passing through structural concrete, shall be spaced not less than three diameters on center and shall not displace concrete reinforcement, unless otherwise shown on the Drawings. Pipes and conduit shall not pass parallel inside of structural members except as specifically allowed in slabs and walls in this specification.

G. Electrical conduit runs in structural concrete slabs and walls, where specifically indicated as acceptable on the Drawings, shall be limited to one inch nominal conduits placed with a maximum of two crossing layers spaced at a minimum of 6 conduit diameters on center.

H. Electrical conduit shall not be allowed in concrete fill on metal deck.

I. Forms and existing concrete and masonry surfaces shall be thoroughly wetted immediately before casting.

J. Freestanding water shall be removed from forms and groundwater diverted from forms and excavations.

3.05 MIXING CONCRETE

A. Concrete shall be ready-mixed concrete and shall be mixed in accordance with ASTM C 94.

B. Concrete shall be mixed with quantities and ingredients conforming to the approved mix designs. Ingredients shall be proportioned by weight.

C. Mixed concrete shall be homogeneous in distribution of material and uniform in consistency and color. Concrete shall be mixed for at least 10 minutes after ingredients have been added, and three minutes of this time must be immediately prior to discharging at the job site. Mixed concrete shall be placed in forms within 90 minutes from the time of combination of cement and water. When air temperature is between 85 and 90 degrees F (30 and 32 degrees C), reduce mixing and delivery time to 75 minutes; when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

D. Addition of admixtures shall be in accordance with manufacturer's recommendations and under the review of the Owner’s Testing Agency.

E. Clean equipment used to mix and deliver cast-in-place Architectural Concrete to prevent contamination from other concrete.

3.06 TRANSPORTING

A. Transport of concrete shall be in accordance with ASTM C 94.

3.07 CONVEYING

A. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods that prevent the separation or loss of the ingredients. Deposit concrete as near as practical to its final position to avoid re-handling or flowing. Concrete shall not be dropped freely where reinforcement or embedments will cause segregation, and in no case shall it be dropped more than six feet. Spouts, elephant trunks, or other acceptable means shall be used to prevent segregation.

B. At the Contractor's option, concrete may be pumped from the transit mixer to place of deposit provided that submitted mix designs reflect selection of pumping methods. Pumps shall be adequate for the mix, aggregate size, and slump.

3.08 PLACING

A. A record shall be kept of the time and date of placing the concrete in each portion of the structure. Such reports shall be kept until the completion of the structure and shall be open to the inspection of the Owner’s Representative and Owner’s Testing Agency.

B. Concrete shall not be placed under water.

C. Concreting, once started, shall be carried on as a continuous operation until the section of acceptable size and shape is completed. Construction joints must be of acceptable detail and location.

D. Concrete shall be so deposited as to maintain, until the completion of the unit, a plastic surface approximately horizontal. No concrete shall be deposited that has started to set or stiffen. The remixing or re-tempering of concrete that has begun to set shall not be permitted.

E. Concrete, when placed in walls, shall not be placed in layers exceeding two feet in depth. Schedule of pouring shall be such that no concrete layer takes initial set before the next layer is placed. Concrete placement shall be scheduled such that horizontal joints in exposed exterior walls are located where shown on the Drawings without exception.

F. At least two hours must elapse after depositing concrete in walls or columns before depositing concrete in supported beams or slabs above.

G. Reinforcement, inserts, anchor bolts, welding plates, or other embedded items shall be prevented from shifting or displacing during or after concrete placement.

H. Concrete spilled on forms or reinforcement in portions of structure not immediately concreted, shall be completely removed before the concrete sets.

I. Concrete shall be placed in such a manner as to prevent staining or splattering of completed work.

J. Interruption in placement of concrete exceeding 90 minutes will be cause for stopping placement of further concrete in the affected areas. Remaining mixed concrete in hoppers or mixers shall not be placed. In case such interruption occurs, the Contractor shall provide construction joints, where and as directed, and cut concrete back to such line, cleaning forms and reinforcement as herein specified.

K. Placement of subsequent, adjacent concrete shall be staggered a minimum of 48 hours.

L. Conveyors, trucks, or buggies must be thoroughly cleaned after each pour.

3.09 HOT WEATHER PLACMENT:

A. During hot weather, procedures for mixing, transporting, and placing concrete shall conform to ACI 305.

3.10 COLD WEATHER PLACEMENT:

A. During cold weather, procedures for mixing, transporting, and placing concrete shall conform to ACI 306.

3.11 CONSOLIDATION

A. Consolidation of concrete shall be in conformance with ACI 309. Concrete shall be thoroughly compacted by puddling with suitable tools during placing, and thoroughly worked around the reinforcement, around embedded fixtures and into the corners of the forms. In addition to manual spading and tamping, concrete shall be internally vibrated with high-speed mechanical vibrators. A mechanical vibrator shall be utilized at each point of placement.

B. Vibration shall be sufficient to minimize honeycombs and accomplish compaction of concrete. Do not over-vibrate as this can result in loss of entrained air or excess of fines at the concrete surfaces. In the event, during concrete placement, there is a delay of more than fifteen minutes between lifts, manipulate previously placed concrete with vibrators just prior to placement of fresh concrete.

3.12 FINISHING

A. See section titled, “Concrete Finishing”.

3.13 CURING

A. See section titled, “Concrete Curing”.

3.14 CONSTRUCTION JOINTS, KEYS, CONCRETE INTERFACES

A. Construction joints:

1. Location of construction joints shall be as shown on the Drawings. If not shown on the Drawings the following maximum distances between construction joints shall be used: 100 feet for continuous footings and grade beams, 60 feet for walls.

2. Construction joints not indicated on the Drawings shall be made and located so as not to impair the strength of the structure. Vertical construction joints in joists, beams, girders, and slabs shall be located in the middle third of the member span.

3. Reinforcement through construction joints: Extend concrete reinforcement continuously through construction joints unless otherwise shown on the Drawings. Reinforcement extensions beyond construction joint locations shall be long enough to provide the scheduled lap splice length shown on the drawings, unless mechanical couplers are utilized.

4. Construction and control joints for slabs on grade shall be located as shown on the Drawings. Concrete placement in adjacent pours shall be staggered a minimum of 48 hours. Construction and control joints shall be keyed as detailed on the Drawings.

a. Where slab on grade construction joints are not shown on the Drawings, the maximum distance between construction joints shall be 15 feet for 5 inch thick slabs, 18 feet for 6 inch slabs, and 21 feet for 7 inch thick slabs. Maximum length-to-width ratio shall be 1.5 to 1.

B. Keys:

1. Keys shall be provided across vertical construction joints in girders, beams, slabs, walls, and other members, as detailed on the Drawings. Horizontal construction joints across joists, beams, girders, and slabs shall not be allowed unless otherwise shown on the Drawings.

2. Keys shall be provided across horizontal construction joints in walls and columns, as shown on the Drawings. Vertical construction joints shall not be allowed in columns or pilaster members, unless otherwise shown on the Drawings.

C. Concrete Interfaces:

1. Prior to placement of concrete against previously placed concrete, the previously placed concrete surfaces shall be cleaned and roughened. Surface shall be roughened utilizing sandblasting or other acceptable means. Uniformly expose the face of coarse aggregates embedded in the concrete mortar matrix.

2. Prior to placement of concrete against existing concrete, the existing concrete surfaces shall be free from loose concrete and laitance, cleaned, and roughened. Prepared surfaces shall meet the criteria established above for concrete placed against previously placed concrete.

3.15 CONTROL JOINTS

A. Control joints shall be installed by use of a tooled joint, ¾" minimum depth. Joints shall be located per the architectural drawings.

3.16 SLABS ON GRADE AND UNDERLAYMENTS

A. Rock base beneath interior slabs on grade shall be lightly tamped. Rock base under exterior slabs on grade (where shown on the Structural Drawings) shall be compacted in accordance with Section 26 of the referenced CalTrans Standard Specifications.

B. Install, splice, seal, and patch the vapor retarder over the rock base beneath interior slabs on grade, and elsewhere as indicated on Drawings, in conformance with ASTM E 1643 and the manufacturer's recommendations, see Section 07 2616.

1. The vapor retarder membrane shall be continuous at slab-on-grade construction joints.

2. Overlap adjacent edges of vapor retarder membrane sheets a minimum of 6 inches, or more as recommended by manufacturer, and seal.

3. Penetrations through vapor retarders, such as staking holes for slab on grade construction joint bulkheads, other than penetrations for permanent utilities shall not be permitted.

4. Vapor retarder penetrations shall be allowable only at utilities such as pipes and conduits. Seal the retarder membrane around the penetration to the utility.

5. Seal vapor retarder membrane sheets to the face of concrete foundation elements, walls, and columns. Vapor retarder membranes shall not interrupt or pass through concrete construction joints.

6. Repair damaged membrane locations with sealed membrane patches overlapping damaged area a minimum of 6 inches or more if recommended by manufacturer.

C. Install integrally bonded waterproof membrane per manufacturer's instructions, see Section 07 1355.

D. Screed supports for concrete slabs on grade placed over vapor retarders or waterproofing membranes shall be of cradle, pad, or base type that will not puncture the vapor retarder or waterproofing membrane.

3.17 GROUTING OF COLUMN BASE PLATES

A. The entire bearing area under plates shall be grouted solid with non-shrink grout placed in strict accordance with the manufacturer's recommended procedures.

3.18 EXAMINATION

A. Immediately after removing forms, concrete surfaces shall be examined for defects.

3.19 TIE HOLE FILLING

A. Form tie holes in concrete surfaces shall be plugged to effectively seal form tie metal from moisture, unless otherwise shown on the Drawings or when directed by the Owner's Representative.

3.20 PROTECTION

A. Protect cast concrete from damage from construction and weather.

B. Wheeling, working and walking on concrete shall be avoided for at least 24 hours after casting. Cover traffic areas with plywood or utilize other suitable means as necessary to protect concrete from damage.

C. Protect concrete during and after curing from damage during subsequent construction operations.

D. Concrete shall not be subjected to loads unless those loads are resisted directly by shoring until concrete has attained its specified compressive strength (but no sooner than 14 days after casting) and until curing operations have been completed.

E. Self-supporting structures shall be protected from mechanical disturbances and shall not be loaded in such a manner as to overstress the concrete.

3.21 ACCEPTANCE CRITERIA

A. Concrete shall meet the following acceptance criteria:

1. Concrete shall conform to the established tolerances.

2. Concrete shall meet the established performance criteria.

3. Concrete shall be free from voids, rock pockets, cracks, pour joints, spalls, honeycombs, and air bubbles that adversely affect the structural adequacy.

B. Architectural concrete, in addition to the requirements above shall meet the additional criteria:

1. Architectural concrete shall be free from defects affecting color, texture, fins, voids, rock pockets, cracks, pour joints, spalls, honeycombs, and air bubbles that, in the opinion of the Owner's Representative, affect the appearance of the concrete.

3.22 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.23 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 3000

SECTION 03 3500
CONCRETE FINISHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the finishing of cast-in-place concrete and shotcrete.

B. Finishes at concrete, concrete topping slabs.

C. Finish at interior and exterior building walls.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming – 03 1000
2. Concrete Reinforcing – 03 2000
3. Cast-In-Place Concrete – 03 3000
4. Concrete Curing – 03 3900
5. Shotcrete – 03 3713
6. Polished Concrete Floor Finish – 03 3543
7. Concrete Topping - 035300

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.
2. ACI - American Concrete Institute, Manual of Concrete Practice, including, but not limited to, the following sections:

   a. ACI 117 " Standard Specifications for Tolerances for Concrete Construction and Materials".
   b. ACI 301 "Specification for Structural Concrete for Buildings".
   c. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.
   d. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete".

3. ASTM, American Society for Testing and Materials, designations referenced herein.

1.04 SUBMITTALS

A. General: Submittals shall be submitted as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Product Data: The Contractor shall submit manufacturer's data to the Owner's Representative for review.

C. Sample panels: Refer to specification titled "Cast-in-Place Concrete" for sample panel submittal requirements. In addition, provide 48" x 48" mock-up of each finish type showing required finish.

D. Mock-up: Refer to specification titled "Cast-in-Place Concrete" for mock-up submittal requirements.

E. Shop drawings showing layout of joints in new concrete topping surface.

1.05 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. Formed Surface Finish: Inspect cast finish of formed surfaces for compliance with applicable class A, B, or C surface as defined in ACI 117.

3. Slab Finish Tolerance: Measure slab tolerance by 10-foot straightedge or measure floor flatness and levelness by ASTM E 1155 to confirm that specification limits herein have been satisfied.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Evaporation reducing compounds: Film-forming compound for temporary protection from rapid moisture loss. Acceptable products include "Confilm" by BASF, "Eucobar" by Euclid Chemical Co., or equal.

B. Slip-resistive aggregate: Factory graded, rustproof, non-glazing, and unaffected by cleaning materials. Acceptable products include "Frictex NS" by Sonneborn-Contech, "Fut-Sure" by General Abrasive Company, or equal.

C. Concrete Sealer: See Division 9.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.02 FINISHES FOR FORMED SURFACES

A. General: Perform subsequent finishing operations as soon as practical after stripping formwork, except as specifically noted.

B. Rough Form Finish: As cast finish obtained using rough form finish formwork. Repair honeycombed areas, fill tie holes and defects, and remove fins, offsets, and projections exceeding 1/4 inch.

C. Smooth Form finish: As cast finish obtained using smooth form finish formwork. Repair honeycombed areas, fill tie holes and defects, and remove and smooth all fins, offsets, and projections.

D. Architectural Concrete Finish:

1. Match Architectural Sample Panel and Mock-up specified in section titled "Cast-in-Place Concrete" to satisfaction of Owner's Representative.

2. As cast finish obtained using architectural concrete formwork. Repair honeycombed areas, fill tie holes, and remove all fins, offsets, and projections without marring adjacent surface. Do not fill surface blemishes.

3. Sandblasted Finish: Provide a light sandblasted finish on architectural concrete surfaces to match accepted samples.

4. Seal concrete.

3.03 SHOTCRETE FINISHES

A. Natural rod finish: Natural rod finish shall be finish obtained by slicing off excess shotcrete outside of forms and ground wires with a sharp-edged cutting screed after the surface has reached initial set. Remove ground wires and remove wire impressions by floating.

B. Steel trowel finish:

1. Slice off excess shotcrete outside of forms and ground wires with a sharp-edged cutting screed after the surface has reached initial set.

2. Immediately after screeding apply thin shotcrete flash coat, containing finer than normal sand, by holding nozzle well back from work. Flash coat shall be followed by a steel trowel finish to true planes with a tolerance of a maximum deviation of 1/4" per 10 ft. when measured with a straightedge.

C. Architectural Shotcrete Finish:

1. Match Architectural Sample Panel and Mock-up specified in section titled "Cast-in-Place Concrete" to satisfaction of Owner's Representative.

2. Provide steel trowel finish requirements for architectural shotcrete.

3. Sandblasted Finish: Provide a light, medium, or heavy sandblasted finish on architectural shotcrete surfaces to match accepted samples.

3.04 SLAB FINISHES

A. General: Follow ACI 302.1R recommendations for screeding, floating, restraightening, and finishing operations for slabs.

B. Evaporation Control: Protect concrete from rapid moisture loss before and during finishing operations. Apply evaporation control material prior to the commencement of finishing operations and periodically during finishing as needed. Do not apply water to the slab surface prior to the completion of finishing operations.

C. Measurement of Slab Tolerances: Measure slab finish tolerances within 72 hours after slab finishing and before removal of supporting formwork or shoring. Use the specified method and tolerance listed for each type of finish.

D. Scratch Finish: Screed and bullfloat concrete surface. Roughen the surface with stiff brushes or rakes to produce a profile of 1/4 inch in one direction before final set of concrete.

1. Finish Tolerance: 1/2 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

E. Float Finish: Screed and bullfloat concrete surface. Consolidate surface with power-driven floats or by hand floating if area is too small or inaccessible by power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

F. Light Trowel Finish: Apply float finish. Consolidate concrete surface by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks, uniform in texture, and planed to the specified tolerance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Finish Tolerance:

a. When slab is not sloped and total project area is greater than 10,000 square feet, use the F-number system as measured by ASTM E 1155 with tolerances as follows:

1) Flatness: Overall F(F) 30; with a minimum local value of F(F) 24.
2) Levelness: Overall F(L) 20; with a minimum local value of F(L) 15.

b. Otherwise, use 3/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

G. Hard Trowel Finish: Apply light trowel finish. Continue hand troweling until a ringing sound is produced as the trowel is moved over the surface. Final hand-troweling shall leave finished surface free of trowel marks, uniform in texture and appearance, and planed to the specified tolerance.

1. Finish Tolerance:

a. When slab is not sloped and total project area is greater than 10,000 square feet, use the F-number system as measured by ASTM E 1155 with tolerances as follows:

1) Flatness: Overall F(F) 30; with a minimum local value of F(F) 24.
2) Levelness: Overall F(L) 20; with a minimum local value of F(L) 15.

b. Otherwise, use 3/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

H. Broom Finish: Apply float finish. Lightly steel trowel to remove irregularities. Roughen surface by drawing a fiber bristle broom, not less than 24 inches wide, across surface perpendicular to main traffic route. Produce even texture from edge to edge, lapping adjacent strokes slightly to produce a uniform pattern.

1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

2. Obtain Owner's Representative's approval for texture of final finish before application.

I. Swirl Finish: Apply float finish. Hand float using a wood float to produce a continuous swirl patterned surface, free from porous and rough spots that may be produced by disturbing particles of coarse aggregate embedded near the surface.

1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

2. Obtain Owner's Representative's approval for texture and pattern of final finish before application.

J. Slip-Resistive Finish: Apply float finish. Before final floating, apply slip-resistive aggregate according to manufacturer's written instructions. Minimum rate of application shall be 25 pounds per 100 square feet. Follow spreading and tamping of slip-resistive aggregate with a final float and apply a light trowel finish.

1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

3.05 FINISH SCHEDULE

A. The concrete finish types specified in the tables below shall be used except as otherwise shown on the Drawings.

B. Refer to the section titled "Concrete Forming" for formwork requirements.

Table 1: Finishes for Formed or Shotcrete Surfaces

Surface Type	Formed Concrete Surfaces	Un-formed Shotcrete Surfaces
Concealed	Rough Form Finish	Natural Rod Finish
To receive waterproofing or cement plaster	Smooth Form Finish	Steel Trowel Finish
Pits (inside face)	Smooth Form Finish	Steel Trowel Finish
Exposed to view, building interior,	Smooth Form Finish	Steel Trowel Finish

Table 1: Finishes for Formed or Shotcrete Surfaces		
Surface Type	**Formed Concrete Surfaces**	**Un-formed Shotcrete Surfaces**
unless otherwise noted		
Exposed to view, mechanical rooms and storage areas	Smooth Form Finish	Steel Trowel Finish
Exposed to view, slab soffits	Smooth Form Finish	Not Applicable
Architectural Concrete Surfaces	Architectural Concrete Finish	Architectural Shotcrete Finish

Table 2: Slab Finishes	
Surface Type	**Finish**
To receive carpet, resilient flooring, or thin-set tile	Light Trowel
To receive bonded topping or mortar bed	Scratch
To receive unbonded topping, terrazzo, or wood flooring	Float
To receive built-up waterproofing	Float
To receive fluid applied waterproofing	Light Trowel
Exposed to view, mechanical rooms and storage areas	Hard Trowel
Exposed to view, building interior	Hard Trowel
Exposed to view, ramps, stair landings, and treads	Slip-Resistive
Parking surfaces	Swirl
Exterior	Broom

3.06 CONCRETE SEALING

A. Refer to Division 9 of the project specifications.

3.07 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.08 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 3500

SECTION 03 3543
POLISHED CONCRETE FLOOR FINISH

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Honed surface treatment for concrete floors and slabs.

2. Liquid-applied sealers and finishers.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Pre-Installation Meeting: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to be attended by Owner's Representative, Contractor, concrete producer, concrete finisher, concrete polisher, technical representative of liquid applied product manufacturers, and walkway auditor.

1. At meeting, polisher shall demonstrate understanding of work required by reviewing and discussing procedures for surface preparations, sequence of procedures, and other preparatory work performed by other installers.

a. Details of each step of grinding, honing, and polishing operations.
b. Application of liquid applied products.
c. Protecting concrete floor surfaces until polishing work begins.
d. Protecting polished concrete floors after polishing work is completed.

2. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. EQ 4.2: For field applied coatings inside the weatherproofing, include manufacturers' product data, including chemical components, and printed statement verifying compliance with required VOC content.

1) Include statement indicating costs for each product.

1.04 INFORMATIONAL SUBMITTALS

A. Pre-installation meeting report.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Walkway Auditor: Certified by National Floor Safety Institute (NFSI) to test polished floors for static coefficient of friction according to NFSI 101-A.

2. Polisher Qualifications:

a. Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
b. The following company has been pre-approved as an acceptable polisher: Building Green Projects, San Francisco, CA, 415-664-5127.

B. Slip Resistance: Completed concrete flatwork, after surface preparation and sealing, shall maintain a minimum wet and dry value of 0.50 coefficient of friction when tested in accordance with NFSI 101-A.

C. Mockup: Construct mockup area under conditions similar to those that will exist during application, with coatings applied.

1. Notify Owner’s Representative 5 working days in advance of dates and times when mockup will be prepared.

2. Mockup Size: 10 square feet.

3. Locate in a Utility Room or area that is scheduled to receive an applied floor covering.

4. Prepare surface and apply sealer to test panel area using specified and proposed procedures and products.

5. Contractor shall allow for up to 3 mockups for initial evaluation and approval.

1.07 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished. Comply with procedures and methods reviewed at the pre-installation meeting.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.01 COATINGS

A. Liquid Densifier: Odorless, non-hazardous, silicate that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and densifies concrete surface.

B. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified.

2.02 ACCESSORIES

A. Patching Compound: Compound composed of 40 percent Portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.

B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.

C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.03 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:

1. Variable speed, multiple head, counter-rotating, walk-behind machine with not less than 600 pounds of down pressure on grinding or diamond polishing pads.

2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

PART 3 - EXECUTION

3.01 PREPARATION

A. Concrete surfaces shall be free of release agents and curing compounds, clean, dry, and free of contaminates in accordance with ASTM D4258.

B. Surfaces shall be prepared to remove laitance, adhesive residue, stains, layout markings, oils, grease, wax, and other contamination.

C. Do not proceed with polishing and finishing process if concrete is not acceptable.

1. Notify Owner's Representative to review concrete conditions and to arrive at a mutually acceptable method for correcting unacceptable conditions and proceeding with the work.

2. Starting work within a particular area will be construed as acceptance of surface conditions.

3.02 POLISHING CONCRETE FLOORS

A. General:

1. Sequence of Polishing: Perform polishing before partition studs are erected.

2. Decorative ground concrete shall be produced by grinding and finishing the trowel-finished and cured slab, in accordance with procedures used in preparation of accepted mockup, to achieve the following Concrete Polishing Association of America (CPAA) finish:.

a. Finish Texture: Medium Aggregate - Class C. Remove not more than 1/8 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.
b. Medium Gloss Level Appearance - Level 2:

1) Procedure: Not less than 4 step process with full refinement of each diamond pad to 800 grit or higher resin bonded pad with one application of densifier.
2) Gloss Reading:

a) Reflective Clarity Reading: Not less than 55 according to ASTM D5767 prior to the application of sealers.
b) Reflective Sheen Reading: Not less than 25 according to ASTM D523 prior to the application of sealers.

B. Initial Grinding:

1. Use grinding equipment with metal bonded grinding pads.

2. Begin grinding in one direction using sufficient size grit pad.

3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 150 grit.

4. Achieve maximum refinement with each pass before proceeding to finer grit pads.

5. Vacuum floor using squeegee vacuum attachment after each pass.

6. Continue grinding until aggregate exposure matches approved field mockup.

C. Treating Surface Imperfections:

1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.

2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.

3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow to cure according to manufacturer's instructions.

E. Grout Grinding:

1. Use grinding equipment and appropriate grit grinding pads.

2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches.

3. Vacuum floor using squeegee vacuum attachment after each pass.

F. Honing:

1. Use grinding equipment with resin bonded grinding pads.

2. Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.

3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

G. Polishing:

1. Use polishing equipment with resin bonded polishing and burnishing pads.

2. Begin polishing in one direction starting with 800 grit pad.

3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 3000 grit.

4. Achieve maximum refinement with each pass before proceeding to finer grit pads.

5. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

6. Continue polishing until gloss appearance matches approved field mockups.

H. Polish Guard: Uniformly apply and remove excessive liquid according to manufacturer's instructions.

I. Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mockup.

3.03 FIELD QUALITY CONTROL

A. Field Testing: Engage a qualified walkway auditor to perform field testing according to NFSI 101-A to determine if polished concrete floor finish complies with specified static coefficient of friction.

3.04 CLOSEOUT ACTIVITIES

A. Maintenance Training: A CPAA Master Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

END OF SECTION 03 3543

SECTION 03 3713
SHOTCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, test panels, tests and inspections necessary for the installation of shotcrete work. The work also includes the following:

1. Installation of inserts, sleeves, dowels, anchor bolts and other items embedded in shotcrete, but furnished under other sections.

B. Engineering: Provide engineering services for the design and implementation of shotcrete mix designs.

C. Shotcrete may be used only where specifically noted on the Drawings. Where shotcrete may be used, it is the Contractor's responsibility to confirm which work, if any, is appropriate to be placed with shotcrete.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming

2. Concrete Reinforcing

3. Cast-In-Place Concrete

4. Concrete Curing

5. Concrete Finishing

6. Architectural Concrete

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.

2. ACI - American Concrete Institute, Manual of Concrete Practice, including, but not limited to, the following sections:

a. ACI 301 "Specification for Structural Concrete for Buildings".
b. ACI 304R "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
c. ACI 506R "Guide to Shotcrete".

d. ACI 506.2 “Specification for Materials, Proportioning, and Application of Shotcrete.”

3. ASTM, American Society for Testing and Materials, designations referenced herein.

1.04 SUBMITTALS

A. General: Submittals shall be sent to the Owner’s Representative, or Owner’s Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Procedures: The Contractor shall submit a description of the shotcrete process proposed for use for review by the Owner’s Representative and Owner’s Testing Agency. The description shall include all proposed deviations from provisions of ACI 506R and ACI 506.2, requirements of these Specifications, and provisions of other specified reference specifications or standards.

C. Shop Drawings: The Contractor shall prepare and submit shop drawings to the Owner’s Representative showing:

1. Joints: Indicate details and locations of construction, control, and expansion joints.

2. Penetrations and Openings: Indicate locations and sizes of penetrations in shotcrete members.

3. Placing Sequence: The Contractor shall submit a proposed sequence for placing shotcrete to the Owner’s Representative for review before commencing with the work. The sequence shall include the locations, extents, and structural members included in each placement as well as which side of the structural member has formwork.

D. Product Data and Certificates of Compliance: The Contractor shall submit manufacturer’s data and certificates of compliance for each product to the Owner’s Representative for review.

E. Qualifications: Contractor shall submit qualifications to the Owner’s Representative and Owner’s Testing Agency as follows:

1. Shotcrete Foreman: Submit evidence of the following:

a. Licensed to perform shotcrete work in the State of California.
b. Minimum of five years of experience of similar responsibility on other shotcrete projects of similar scope.

2. Shotcrete Operator: Submit evidence of the following:

a. Licensed to perform shotcrete work in the State of California.
b. Minimum of five years of experience successfully placing shotcrete on projects of similar scope.

F. Test Panels: Prepare preconstruction test panels at least 21 days prior to job placement, using the mix and equipment proposed for the project.

1. Each proposed nozzleman shall prepare a minimum 3 foot by 3 foot test panel demonstrating each shooting orientation for each shotcrete class.

2. Fabricate test panels in accordance with ASTM C1140 and CBC 1913.5 and as approved by the Owner's Representative.

3. The formwork shall be as specified and the reinforcing steel shall represent the most congested condition proposed for shotcrete. Specified curing and finishing measures for the concrete class shall be utilized.

4. Notify Owner's Testing Agency to observe placement of panels. Maintain panels at point of fabrication for 7 days and until Owner's Testing Agency has taken cores.

5. In the event of failure, nozzlemen shall be permitted one retest. Any nozzleman failing the second test shall not be permitted on the project.

6. Test panels will be removed from the site after acceptance of shotcrete work.

G. Architectural sample panels: Provide sample panels as specified in section titled "Cast-in-place Concrete".

H. Architectural mock-up: Provide one concrete mock-up as specified in section titled "Cast-in-place Concrete". One of the required test panels may also be used as the Architectural mock-up.

I. Mix Design: The Contractor shall submit shotcrete mix designs for review by the Owner's Representative and Owner's Testing Agency at least seven days before placing concrete. Review of mix designs covers general conformance with the specifications, but does not constitute an approval of the mix proportions. Submit one mix design for each class of concrete. Each mix design shall include the following information:

1. Concrete class,

2. Member types and specific placement locations,

3. Material quantities per cubic yard,

4. Material ingredient certificates of compliance,

5. Coarse and fine aggregate sources, types, sizes, and gradation,

6. Admixture product data and dosage,

7. Design compressive strength, age (in days) required to reach design compressive strength, and compressive strength historic data,

8. Maximum water to cementitious materials ratio,

9. Unit weight of freshly mixed and oven-dry concrete,

10. Calculated percent water-soluble chloride ions (Cl-) by weight of cement, considering the chloride ion content of all concrete ingredients,

11. Water-soluble chloride ion content historic data or trial batch test data, when required herein,

12. Contractor's Engineer's stamp and signature certifying that the concrete mix has been designed under the supervision of the Contractor's Engineer.

J. Contractor's quality control test and inspection reports: The Contractor shall submit quality control test and inspection reports to the Owner's Representative and Owner's Testing Agency for review.

1.05 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

3. The Contractor shall notify the Owner's Representative 48 hours prior to placing shotcrete to facilitate structural observation.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. Code Required Tests and Inspections: The Owner's Testing Agency shall perform tests and inspections in compliance with the CBC (1913.10) except where more restrictive requirements are specified herein.

3. Test Panel Tests and Inspections: Owner's Testing Agency shall provide full time inspection of the placement and construction of the test panels.

   a. Take six cores from each panel, three with reinforcement and three non-reinforced.
   b. Visually inspect and grade cores with reinforcement in accordance with Section 1.7 of ACI 506.2, "Shotcrete Core Grades". Samples taken from each test panel shall achieve a mean core grade of 2.0. No single core shall have a core grade exceeding 3.0
   c. Test panel shall be sawcut or broken at the discretion of the Owner's Testing Agency when required to determine the soundness and uniformity of the panel.
   d. Test non-reinforced cores for compressive strength at 7 days in accordance with ASTM C 42.
   e. The mock-up panel report is subject to the review and approval of the Owner's Representative.

4. Pre-Placement Inspection: Shotcrete shall not be placed until the screeds and reinforcement have been reviewed by the Owner's Testing Agency.

5. Job Site Special Inspections: The Owner's Testing Agency shall provide the following special inspections during the project construction:

   a. Special inspection of shotcrete placement as per CBC Chapter 17 is required. The special inspector shall check the materials, placing equipment, details of construction and construction procedure. The inspector shall furnish a verified report, based on personal knowledge, that the work has been performed, and materials used, and installed in accordance with, and in conformity to, the approved Drawings and Specifications.
   b. Special inspection of location of embedded items and anchor bolts and anchor rods.

6. Job Site Tests: Perform the following tests not less than once each shift nor less than once for each 50 cubic yards of shotcrete placed through the nozzle:

    a. Density, yield, and air content: ASTM C 138.
    b. Temperature: ASTM C 1064.

7. Collection of Test Cores: During the progress of the shotcrete work a set of three 3-inch minimum diameter cores shall be taken not less than once each shift nor less than once for each 50 cubic yards of shotcrete placed through the nozzle.

    a. Cores shall be taken and tested either from the structure, if approved by the Owner's Representative, or from separately gunned test panels in accordance with ASTM C 42 and ACI 506.2. If test panels are used, they shall be constructed in accordance with ASTM C 1140.
    b. Cores shall be taken at least 14 days after shotcrete is placed. Core holes taken from the structure shall be plugged immediately after inspection of holes by special inspector. Do not cut steel reinforcement.
    c. Prior to testing, cores shall be taken to the Owner's Testing Agency and soaked in water for a minimum period of 24 hours.

8. Laboratory Tests of Test Cores: Cores shall be tested in accordance with ASTM C 42 and the average compressive strength of each set of 3 cores taken from the structure or test panels must equal or exceed 0.85 f'c* with no individual core in the set testing below 0.75f'c*.

    f'_c* = specified minimum 28-day compressive strength

    a. Should the compressive strength of the test cores be less than the specified compressive strength, the shotcrete represented by the cores shall be considered defective work. The extent of the defective work shall be determined by the Owner's Representative.

C. Contractor's Quality Control Tests and Inspections:

1. General:

    a. Quality control tests and inspections shall be the responsibility of the Contractor.
    b. Where required herein, the Contractor shall demonstrate that quality control conforms to the requirements of the Contract Documents.
    c. Quality Control Test and Inspection Reports shall be prepared and submitted for review.

2. Concrete Mix Trial Batching: Where required herein, the Contractor shall prepare shotcrete trial batches in accordance with ASTM C 192 as needed for preparation of test specimens. The number of batches and quantity of each batch shall be at least adequate to prepare the required number of test specimens for each of the required tests as follows. Test specimens for different tests may be taken from a single batch.
    a. Compressive test specimens: Trial batch and test specimen quantity shall be in conformance with the requirements of the governing building code.

1.06 CONTRACTOR'S ENGINEERING SERVICES

A. General: Where engineering services are required herein, the Contractor shall retain either a Civil or Structural Engineer registered in the State of California, referred to herein as the Contractor's Engineer.

1. Documents prepared by the Contractor's Engineer shall be stamped and signed.

B. Shotcrete mix designs shall be prepared, signed, and stamped by the Contractor's Engineer certifying that the mix design has been prepared under supervision and that the mix designs meet the requirements of the Contract Documents.

C. Temporary supports required for shotcrete test panels, sample panels, and/or mock-ups shall be designed by the Contractor's Engineer.

PART 2 - PRODUCTS

2.01 SHOTCRETE MATERIALS

A. Concrete materials shall conform to applicable requirements of Section Titled, "Cast-in-Place Concrete," ACI 506R and ACI 506.2, except as otherwise specified herein.

1. Aggregates:

a. General: ASTM C 33 except as otherwise specified.
b. Coarse Aggregates: ½" maximum crushed stone. Comply with gradation No. 3 requirements from ACI 506R.

2.02 SHOTCRETE EQUIPMENT

A. General: Equipment shall conform with the requirements of ACI 506R.

B. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.

C. Delivery Equipment: Capable of discharging shotcrete material mixture accurately, uniformly, and continuously.

2.03 SHOTCRETE MIX DESIGNS

A. General:

1. Shotcrete mix designs shall be designed and documented by the Contractor's Engineer.

2. The Contractor shall review proposed shotcrete mix designs for compatibility with the intended placement requirements to ensure that the shotcrete, as designed, can be placed in accordance with the Contract Documents.

3. The proportions of the shotcrete mixes shall be such as to produce shotcrete for each class of shotcrete that conforms to the specified minimum compressive strength, within the specified maximum water-cementitious materials ratio.

4. Determination of the amount of water in the batch shall include water contained in the aggregates.

5. The proportion of materials shall be accurately controlled so as to produce thorough & uniform hydration of the shotcrete which when shot will form a homogeneous mass containing neither sags nor dry sand formations.

6. Architectural shotcrete shall be supplied, produced, and delivered from a single source.

B. Shotcrete Mix Requirements:

1. Air content: Use of air entrainment admixtures shall not be permitted.

2. Unit weight: Wet and dry unit weight shall be calculated in conformance with ASTM C 138 and ASTM C 567, respectively. Maximum unit dry weight shall be between 147 and 153 pounds per cubic foot (pcf).

3. Shotcrete mixes shall be designed in accordance with the following requirements:

SHOTCRETE MIX REQUIREMENTS				
Concrete Class	Concrete Elements	Performance Criteria	Limiting Parameters	Additional Notes
		Minimum Compressive Strength (psi) (Note 2)	Maximum Water to Cementitious Materials Ratio (W / CM) (Note 3)	
A	Walls	5,000	0.45	4

1. N/A stands for "not applicable".
2. Based on 28-day minimum compressive strength. When 56-day minimum compressive strength is used, minimum 28-day compressive strength shall be 80% of required minimum 56-day compressive strength.
3. W = weight of water. CM = weight of cementitious materials (cement plus fly ash or ground blast furnace slag).
4. The mix design submittal for this class of shotcrete shall include evidence that the proposed mix meets each of the required performance criteria listed above through trial batch test data or historic data for the exact mix to be used on this project.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.02 PREPARATION

A. General: Before any shotcrete is placed, the Contractor shall ascertain that all reinforcing steel has been installed and blocked from the formed surface, and that all fittings, anchors, inserts, etc., to be embedded in the shotcrete have been placed as specified. The Contractor shall be responsible for maintaining the alignment of all work embedded in the shotcrete during its installation.

B. Preparation of Surfaces to Receive Shotcrete: Clean reinforcement of loose mill scale, rust, oil and other substances which will interfere with bond, in accordance with ACI 506R. Sandblast concrete, masonry or steel to which new shotcrete will be applied. Just before application, clean sandblast residue from surfaces. Keep concrete and masonry surfaces damp for several hours before application.

C. Reinforcing Steel: Comply with the requirements of CBC Section 1913.4 for reinforcing steel placement unless satisfactory shotcrete placement with the test panel demonstrates that deviations may be accepted. The Contractor shall propose revisions to the reinforcing steel layout shown on the drawings where appropriate to meet the requirements of CBC Section 1913.4 or to facilitate shotcrete placment.

D. Protection: Protect walls, floors, equipment and other items from damage by dust, rebound and water. Promptly clean all items contacted by dust or rebound by scraping, brushing or washing as surfaces permit.

E. Alignment Wires: Install 20-gage hard steel piano wire for alignment wires (horizontally and vertically) at corners and offsets not clearly established by forms, at exterior corners of walls, columns, beams, and other locations. Alignment wires may be used as screed guides. Alignment wires shall be tight, true to line, and placed so they may be further tightened.

3.03 PLACING

A. General: Place all shotcrete in accordance with the provisions of ACI 506.2. Do not place shotcrete unless in presence of special shotcrete inspector. Do not permit premixed material which stands more than 45 minutes to get to nozzle.

B. Gunning: Build up each layer of shotcrete with several passes of nozzle. Except when enclosing reinforcing steel, the nozzle shall be held at right angles to the surface to be shotcreted and at a distance from 2-1/2 to 3 ft. When enclosing reinforcing steel, the nozzle shall be held so as to direct the material behind the bars. Each side of each bar shall be shot separately. Application to walls shall begin at the bottom. Direct intermittent flowing shotcrete away from work until flow again becomes constant. Completely encase reinforcement with sound shotcrete. Thickness of layer, when gunning walls, is thickness at which shotcrete does not sag. Keep top surface of thick layers at about 45 degree slope. Any deposits of loose sand or rebound shall be removed from surfaces before shotcreting. A second experienced nozzleman equipped with an air jet shall attend the operators whenever reinforcing steel is being enclosed and shall precede the nozzle and blow out all rebound and sand which may have lodged behind the steel.

C. Preparation for Succeeding Layers: Allow preceding layer to take initial set. Remove laitance, loose material and rebound by brooming; remove laitance which has taken final set by sandblasting, then clean surface with air water jet. Cut out rebound pockets, unbonded areas, sags and other defects; replace with new shotcrete. Apply succeeding layer to dampened preceding layer.

D. Rebound: Keep rebound out of work. Do not use rebound; remove rebound from site daily.

E. Construction Joints: Slope shotcrete surface to shallow edge form (1” thick board laid flat). Do not use square construction joints except where noted on the Drawings. Remove rebound trapped at joints. Thoroughly clean and wet entire joint prior to application of additional shotcrete

F. Hot Weather Placing: During hot weather, mix, place, and protect shotcrete according to ACI 506.2.

G. Cold Weather Placing: During cold weather, mix, place, and protect shotcrete according to ACI 506.2.

3.04 FINISHING

A. See Section Titled, “Concrete Finishing”.

3.05 CURING

A. See Section Titled, “Concrete Curing”.

3.06 PROTECTION

A. Protect shotcrete from damage from construction and weather.

B. Contact with shotcrete shall be avoided for at least 24 hours after placing.

C. Protect shotcrete during and after curing from damage during subsequent construction operations.

D. Shotcrete shall not be subjected to loads unless those loads are resisted directly by shoring until shotcrete has attained its specified compressive strength (14 day minimum) and until curing operations have been completed.

3.07 ACCEPTANCE CRITERIA

A. Shotcrete shall meet the following acceptance criteria:

1. Shotcrete shall conform to the established tolerances.

2. Shotcrete shall meet the established performance criteria.

3. Shotcrete shall be free from voids, rock pockets, cracks, pour joints, spalls, honeycombs, and air bubbles that adversely affect the structural adequacy.

B. Architectural shotcrete, in addition to the requirements above shall meet the additional criteria:

1. Architectural shotcrete shall be free from defects affecting color, texture, fins, voids, rock pockets, cracks, pour joints, spalls, honeycombs, and air bubbles that, in the opinion of the Owner’s Representative, affect the appearance of the shotcrete.

3.08 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner’s Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner’s Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor’s proposed corrections.

E. Correction of defective work shall not commence until the Owner’s Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner’s Testing Agency.

3.09 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 3713

SECTION 03 3900
CONCRETE CURING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the curing of concrete.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming – 03 1000
2. Concrete Reinforcing – 03 2000
3. Cast-In-Place Concrete – 03 3000
4. Shotcrete – 03 3713
5. Concrete Finishing – 03 3500

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.
2. ACI - American Concrete Institute, Manual of Concrete Practice, including, but not limited to, the following sections:
    a. ACI 301 "Specification for Structural Concrete for Buildings".
    b. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.
    c. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete".
    d. ACI 305 “Hot Weather Concreting”.
    e. ACI 308 "Standard Practice for Curing Concrete".
    f. ACI 506R “Guide to Shotcrete”.
    g. ACI 506.2 “Specification for Materials, Proportioning, and Application of Shotcrete.”
3. ASTM, American Society for Testing and Materials, designations referenced herein.

1.04 SUBMITTALS

A. General: Submittals shall be sent to the Owner’s Representative, or Owner’s Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not

cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Product Data: The Contractor shall submit manufacturer's data to the Owner's Representative for review.

C. Sample panels: Refer to specification titled "Cast-in-Place Concrete" for sample panel submittal requirements.

D. Mock-up: Refer to specification titled "Cast-in-Place Concrete" for mock-up submittal requirements.

1.05 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. Curing inspection: Observe curing operations of all concrete to verify that products and procedures described herein have been followed, and that curing has been applied for the specified durations.

PART 2 - PRODUCTS

2.01 MOISTURE-RETAINING COVERS

A. Reinforced Curing Paper: Waterproof paper conforming to ASTM C 171, non-staining. Acceptable products include "Orange Label Sisalkraft" by Fortifiber Building Systems Group, or equal.

B. Curing Fabric: Plastic-backed burlap conforming to ASTM C 171. Acceptable products include "Curlap", or approved equal.

2.02 CURING COMPOUNDS

A. Curing Compounds: ASTM C 309, Type 1-D or 2, Class B, or ASTM C 1315, Type 1, Class A. Curing compound shall not discolor concrete or affect bonding of other finishes applied there over. Curing compounds shall not adversely affect the color of the architectural concrete.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.02 CURING METHODS

A. Moist Curing: Continuous misting, sprinkling, or ponding. Intermittent wetting is not acceptable.

B. Moisture-Retaining Cover Curing: Thoroughly wet the surface of the concrete and then cover with moisture-retaining cover, placed in widest practical width, with edges lapped at least 12 inches and extended 18 inches beyond area of concrete to be cured, and sealed with waterproof tape. Maintain a film of water under the cover through the curing period by rolling back and rewetting. Immediately repair holes or tears that occur using cover material and waterproof tape.

C. Compound Curing: Uniformly apply two coats of compound in a continuous operation with second coat at right angles to first. The total coverage for two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous film that will not crack or peel. Immediately apply an additional coat of compound to areas where film is defective. Recoat concrete surfaces subjected to rainfall within 3 hours after the curing compound application. Maintain compound on the concrete surface throughout the curing period and immediately repair any damage.

3.03 CAST-IN-PLACE CONCRETE CURING

A. General: Do not permit concrete to become dry during curing period. Conform to the recommendations of ACI 308 and the following.

B. Unformed Surfaces: Start curing operations as soon as free water has disappeared from concrete surface following finishing. Curing shall be maintained for 7 days.

1. Curing Method Limitations: Accomplish curing by moist curing, moisture-retaining cover curing or compound curing subject to the following limitations.

    a. Compound curing is not permitted for surfaces to receive glue-adhered floor coverings including carpet and resilient flooring.
    b. Compound curing is not permitted for surfaces to receive bonded concrete, mortar, or plaster.
    c. Compound curing is not permitted for surfaces to receive coatings or penetrants, including but not limited to: sealers, epoxy, paint, and fluid applied waterproofing.
    d. Compound curing is the only acceptable method for floors that remain exposed in completed construction.

C. Formed Surfaces: Concrete in forms shall be kept continuously wet until the forms are removed, as specified in the specification section titled Concrete Forming. If forms are removed before 7 days the concrete shall immediately be cured until the end of 7 days by one of the methods specified herein.

1. Curing Method Limitations: Accomplish curing by moist curing, moisture-retaining cover curing or compound curing subject to the following limitations.

    a. Compound curing is not permitted for surfaces to receive bonded concrete, mortar, or plaster.
    b. Compound curing is not permitted for surfaces to receive coatings or penetrants, including but not limited to: sealers, epoxy, paint, and fluid applied waterproofing.

3.04 SHOTCRETE CURING

A. General: Do not permit shotcrete to become dry during curing period. Conform to the recommendations of the governing building code, ACI 308, and the following.

B. Unformed Shotcrete Surfaces: Start curing operations immediately following finishing. Curing shall be maintained for 10 days.

1. Curing Method Limitations: Accomplish curing by moist curing, moisture-retaining cover curing or compound curing subject to the following limitations.

a. Moisture-retaining cover curing is not permitted for the initial 24 hours of curing after finishing.
b. Compound curing is not permitted for surfaces to receive bonded concrete, mortar, or plaster.
c. Compound curing is not permitted for surfaces to receive coatings or penetrants, including but not limited to: sealers, epoxy, paint, and fluid applied waterproofing.

C. Formed Shotcrete Surfaces: Shotcrete in forms shall be kept continuously wet until the forms are removed, as specified in the specification section titled Concrete Forming. If forms are removed before 10 days the shotcrete shall immediately be cured until the end of 10 days by one of the methods specified herein.

1. Curing Method Limitations: Accomplish curing by moist curing, moisture-retaining cover curing or compound curing subject to the following limitations.

a. Moisture-retaining cover curing is not permitted for the initial 24 hours of curing after finishing.
b. Compound curing is not permitted for surfaces to receive bonded concrete, mortar, or plaster.
c. Compound curing is not permitted for surfaces to receive coatings or penetrants, including but not limited to: sealers, epoxy, paint, and fluid applied waterproofing.

3.05 COLD WEATHER REQUIREMENTS

A. When concrete will be subjected to freezing temperatures within 24 hours after placement, or when the concrete will be subjected to a period of 3 or more successive days within 7 days after placement where the average daily outdoor temperature drops below 40 degrees F, the concrete shall be protected from freezing. After placing concrete, maintain air temperature adjacent to the concrete at 50 degrees F minimum for 7 days, or 70 degrees F for a period of 3 days after placing and 40 degrees F minimum for the remaining 4 days.

3.06 HOT WEATHER REQUIREMENTS

A. When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours by moist cure or moisture-retaining cover methods.

3.07 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.08 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 3900

SECTION 03 4819
PRECAST CONCRETE STAIR TREADS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Precast concrete stair treads, starter risers, and landing planks.

B. Related Requirements:

1. Metal Stairs: Section 05 5100 and the Structural Drawings; steel stair supporting structure.

2. Decorative Metal: Section 05 7000; railing and guardrail assemblies for stairs.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

1.03 ACTION SUBMITTALS

A. Shop Drawings Including: Fabrication and installation drawings for precast components including information not completely shown by manufacturer's data sheets.

1. Prepare for each stairway using same stair identification used on the Drawings.

2. Show tread dimensions, cross sections, and visual safety strips.

3. Welded connections shall use AWS standard symbols.

4. Show location and details of anchorage and attachment devices to be embedded in other construction or attached to the structural frame.

5. Drawings shall be signed by design engineer, or submit certification that precast units and anchorage as shown are in compliance with design calculations.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. Credit EQ 4.1: Printed statement of volatile organic compounds (VOCs) for field-applied adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

C. Delegated-Design Services: Provide engineering calculations verifying compliance with structural design criteria and indicating reactions to supporting steel structure. Calculations shall be signed and sealed by the engineer in responsible charge retained by the Contractor. Engineer shall be a California licensed civil or structural engineer. Although all calculations shall be submitted, only reactions to support framing are subject to review by Owner's Representative.

D. Samples: Tread, and landing plank, full size, 6 inches minimum length in each required color and texture. Samples shall show intended profile, slip-resistant texture, and integral accessibility compliant warning stripe.

1.04 INFORMATIONAL SUBMITTALS

A. Product Data: Manufacturer's specifications, dimension diagrams, anchor details, and installation instructions for products to be used in the fabrication work.

B. Welding:

1. Statement of welders' qualifications.

2. Completed "Procedure Qualification Record" (PQR) and "Welding Procedures Specification" (WPS) forms for the welds to be performed under this Section.

1.05 QUALITY ASSURANCE

A. Acceptance: Precast fabrications which do not meet specified color and finish of accepted samples may be rejected, at option of Owner's Representative, if they cannot be satisfactorily corrected.

B. Mockup:

1. First installed example of each installation condition shall serve as a mockup for review and approval by Owner's Representative of workmanship, fit and finish, visual effect, and interface with adjacent construction.

2. If requested, make modifications to mockups without additional charge to Owner.

3. Do not proceed with remainder of installation until mockups have been approved.

4. Where appropriate and acceptable to Owner's Representative, approved mockups may become part of the completed Work.

1.06 FIELD MEASUREMENTS

A. Field-verify conditions affecting stairs. Obtain accurate dimensions for incorporation in shop drawings submitted before fabrication.

B. Verify dimensions before fabrication to ensure proper coordination and fit.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark units for assembly and coordinated installation.

B. Steel components shall be protected from corrosion.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

PART 2 - PRODUCTS

2.01 MANUFACTURER AND SYSTEM

A. Precast Concrete Stair Components: "Steptread System" by Stepstone, Inc. Los Angeles, CA, or equal.

1. Tread Profile: "Modern."

2. Stair Type: Full width precast treads with closed-riser-type tread, starter step, and landings.

3. Landings: Same face profile as treads.

4. Treads and landings shall have silica carbide troweled into the surface to provide a slip-resistant surface meeting specified slip-resistance requirements.

B. Visual Safety Strips: Cast in, ADA compliant, black color.

2.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Slip Resistance: Treads shall provide a minimum wet DCOF AcuTest value of 0.42 in accordance with ANSI A137.1-2012.

B. Conform to CBC and the following, whichever is more stringent:

1. Individual stair treads shall support a 300 pound concentrated load placed in a position which would cause maximum stress.

2. Treads, landings and connections shall be capable of supporting all dead load plus a uniform live load of 100 pounds per square foot with a maximum deflection of L/480.

C. Exposed metal work provided under this Section at Architectural Class stairs shall conform to requirements for Architecturally Exposed Structural Steel (AESS) included in Section 10 of the American Institute of Steel Construction (AISC) Code of Standard Practice and the additional

requirements for “Architectural Class” metal stairs of the “Metal Stairs Manual” published by the Architectural Metal Products Division (AMP) of the National Association of Architectural Metal Manufacturers (NAAMM).

2.03 MATERIALS AND COMPONENTS

A. Steel:

1. Structural Shapes, Bars, and Plates: ASTM A36, minimum yield 36,000 psi.

2. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as items to which they will be connected, unless otherwise indicated.

B. Concrete: Lightweight (105 to 120 pcf), minimum 5,000 psi compressive strength at 28 days and tensile strength of 300 psi.

1. Portland Cement: ASTM C150, Type III, high early strength.

2. Aggregate: ASTM C33.

3. Color Admixture: Davis Colors, or equal, as required to achieve color scheduled on the Drawings.

4. Aggregate for exposed aggregate surface: As selected by fabricator to achieve appearance of accepted mockup.

5. Reinforcement:

a. Typical: Galvanized welded wire mesh, No. 7 and No. 10, 2 inch by 6 inch.
b. Long Span Treads: Galvanized #3 rebar cage.

C. Safety Strips: Cast in, ADA compliant, and acceptable to Architect.

1. Color: Black; typical for treads except as otherwise noted.

2. At upper approach and bottom tread, use a strip of contrasting color selected by Architect.

D. Attachment Accessories:

1. Weld plates, sized by manufacturer for tread design and span.

2. Fastenings:

a. Unfinished Bolts and Nuts: Low-carbon steel externally and internally threaded standard fasteners; ASTM A307.
b. Furnish lugs, clips, bolts, nuts, screws, washers, concrete inserts, weld plates, anchors, and any other fastenings required for erection of stair assembly.
c. Expansion Bolts: "Wej-It" Concrete Anchors by Wej-It Expansion Inc., or equal.

E. Nonmetallic Shrinkage-Resistant Grout: As specified in Section 05 5000 Metal Fabrications.

F. Welding Electrodes: Conform to applicable AWS Code requirements. Electrodes shall be coated rods or wire of size and classification number as recommended by their manufacturer to positions and conditions of actual use.

2.04 PROTECTIVE COATINGS

A. Galvanizing: Provide zinc coating for steel attachment accessories and fasteners using the hot-dip process after fabrication at exterior stairs.

1. Comply with ASTM A153 for galvanizing of iron and steel hardware.

2. Comply with ASTM A123 for galvanizing of assembled steel products and rolled, pressed, and forged-steel shapes, plates, bars, and strips 1/8 inch thick and heavier.

B. Metal Primer Paints:

1. Primer for Non -Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

2. Primer for Galvanized Steel: Two-component, water-based epoxy tinted to match color of topcoat; Tnemec “27WP,” or equal UV stable epoxy primer.

3. Galvanizing-Repair Paint: Minimum 82 percent zinc-dust-content paint for regalvanizing welds in galvanized steel; Z.R.C. Cold Galvanizing Compound by ZRC Worldwide, International Protective Coatings, or accepted equal.

2.05 FABRICATION

A. Stair Type: Precast treads with closed-riser-type tread, starter step, and landings as shown on the Drawings.

1. Units shall be precast with steel reinforcement, built-in metal attachments, slip-resistant finish, and contrasting color strips on each tread in compliance with ADA requirements.

2. Sizes shall be as indicated on the Drawings.

B. Precast Treads and Landing Planks: Reinforced steam-cured concrete.

1. Precast treads and landing planks shall have silica carbide troweled into the surface to provide a slip-resistant surface meeting specified slip-resistance requirements.

2. Precast components shall be finished on all surfaces.

3. Color: As selected by Architect from standard range available from manufacturer.

4. Provide with a factory applied sealer on all surfaces.

a. Sealer shall be non-staining, penetrating material, suitable for exterior or interior use, type which does not discolor or darken the surface.
b. Conform to sealer manufacturer's recommendations for application of sealer.
c. Surfaces shall meet specified slip-resistance after application of sealer.

C. Attachment Methods:

1. Provide all embed plates necessary for field connections.

2. Bolts, if used in exposed work in accordance with accepted shop drawings, shall have not more than 1/8 inch of thread project beyond nut.

3. Welding: Surfaces to be welded shall be clean and free from scale, slag, rust, grease, paint, and other foreign materials.

D. Acceptance: Precast fabrications which do not meet specified color and finish of accepted samples may be rejected, at option of Architect, if they cannot be satisfactorily corrected.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Before beginning installation, examine the area where stairs are to be placed. Should conditions that will prevent proper execution of be found, report such conditions in writing to Owner's Representative. Installation work shall not proceed until such conditions are corrected or adjusted.

B. Install clips, hangers, and other accessories not installed under other Sections and required for erection of precast stairs to supporting members.

3.02 INSTALLATION

A. Anchor stairs to supporting structure by bolting or welding as indicated on accepted shop drawings.

B. Field welding shall comply with the AWS Structural Welding Code.

C. Remove temporary shims, wedges, and spacers after anchoring is completed.

D. Workmanship:

1. Comply with specified installation tolerances.

2. Do not install defective precast components. Repair or replace stairs that have been damaged during installation or before time of final acceptance.

3. Patching and Repair:
   a. If any patching and repair is to be attempted, submit manufacturer recommended patch and repair procedures to Owner's Representative for review and acceptance before proceeding.
   b. Mix and place patching material to match color and finish of adjacent precast components.
   c. Remove fabrications which cannot be satisfactorily patched, or if patches are visible, and replace with new.

4. Do not cut, trim, weld, or braze components during erection in any manner that would damage finish, decrease strength, or result in visual imperfection or failure in performance of construction.

5. Secure work to structure with nonstaining and noncorrosive shims, anchors, fasteners, spacers, and fillers. Use erection equipment that will not damage finished surfaces.

E. Exposed steel attachment devices and fastenings shall be field finish painted as specified in Section 09 9000, "Painting and Coating."

3.03 FIELD QUALITY CONTROL

A. Construction Tolerances:

1. Tread Levelness: 1/8 inch per 4 feet.

2. Edge Alignment: 1/8 inch.

B. Replace unsatisfactory precast stairs which cannot be satisfactorily patched, as required and as directed by Owner's Representative.

C. In-place precast stairs will be rejected for any one of the following reasons:

1. Noncompliance with the Drawings, Specifications, submittals and review of samples.

2. Exceeding specified installation tolerances.

3. Damage to stairs during construction or as a result of inadequate protection of precast stairs.

3.04 CLEANING

A. Clean to remove dirt and stains that may be on stairs after installation. If required, wash and rinse in accordance with precast manufacturer's recommendations.

END OF SECTION 03 4819

SECTION 03 5415
PORTLAND CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Liquid-applied, high-strength, fast-setting, non-shrink cement underlayments for patching, filling, and leveling floors to meet flatness and levelness requirements of the respective finish flooring materials including, but not necessarily limited to, the following:

1. Resilient Flooring: Section 09 6500.

2. Tile Carpeting: Section 09 6813.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

1.03 INFORMATIONAL SUBMITTALS

A. Product Data: Manufacturer's literature describing materials and specifications for mixing, placing, curing, and protecting.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. EQ 4.1: Printed statement of volatile organic compounds (VOCs) for sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Ensure that storage facilities are weathertight and dry.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Portland Cement Underlayment: Raeco Inc., Ardex Inc., Thoro System products, or equal. Raeco product numbers are specified as a standard of quality.

2.02 MATERIALS

A. General:

1. Materials listed below are not necessarily all-inclusive, nor are all materials listed necessarily required to be used.

2. Contractor shall develop systems for preparing substrate for finish materials using approved products from a single manufacturer.

B. Trowelable Underlayment: Two component, premixed blend of Portland cements, graded silica aggregates, and latex modifiers; Raeco "R-25" in pre-blended bag.

1. Compressive Strength: 4,000 psi at 28 days, ASTM C-1439.

2. Tensile Strength: 750 psi at 28 days, ASTM C-190.

C. Self-Leveling Underlayment: Non-structural, premixed blend of cement, graded aggregate, polymers, and control additives capable of being installed to feather edge; Raeco "SLU."

D. Floor Patching Filler: Raeco "Level Flex Latex Underlayment." Where to be left exposed, select filler to match color and appearance of existing exposed concrete topping slab to greatest extent possible.

E. Primer: Raeco "R-2000" unless otherwise recommended by manufacturer for existing conditions.

F. Water: Clean and potable, free from impurities detrimental to underlayment.

2.03 MIXES

A. Mix underlayment and patching compounds in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate and verify that surfaces are free from debris, oil, grease, wax, curing compounds and dust and are reasonably clean and dry and that conditions are otherwise suitable to receive underlayment.

3.02 PREPARATION

A. Select and apply proper primer for condition of substrate, and mix.

3.03 PLACING

A. General:

1. Follow manufacturer's technical bulletins for application of each product.

2. Surface texture of underlayment shall be as recommended by manufacturer for reception of specified finish materials where covered, and to match appearance of in-place concrete where to be left exposed.

B. Apply troweled underlayment to those areas where it is necessary to bring substrate up to levelness and flatness tolerances acceptable to manufacturer for application of applied floor coverings.

1. Do not exceed thickness recommended by manufacturer for an unreinforced and non-aggregated mix.

2. Install in one pour from feather edge spreading and screeding to a smooth surface.

C. Use self-leveling underlayment at large areas where use of a trowel-applied underlayment would be more labor intensive.

D. Use floor patching filler to fill abandoned floor cores, cracks and voids, to provide localized correction of damaged floors to remain exposed, and where necessary to bring localized areas of substrate into levelness and flatness tolerances acceptable to manufacturer for application of applied floor coverings.

3.04 CURING

A. Allow underlayment to cure as recommended by manufacturer.

B. Do not allow traffic on underlayment during hardening period; minimum 2 hours or longer if special conditions exist.

C. Do not load floors until reasonable strength has been achieved. Any loading on topping shall be distributed and not concentrated.

3.05 ADJUSTMENT

A. Repair defects, evident after curing, that make underlayment an unacceptable substrate for finish flooring. Use materials recommended by underlayment manufacturer.

1. Fill dimples and sand down protrusions smooth and flush with adjacent surface.

2. Repair underlayment damaged prior to installation of scheduled floor finish.

END OF SECTION 03 5415

SECTION 03 5600
CONCRETE FILL FOR METAL PAN STAIRS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete fill at metal pan stairs and intermediate landings.

B. Related Requirements:

1. Cast-In-Place Concrete: Section 03 3000; general requirements for concrete.

2. Metal Stairs: Section 05 5100.

3. Resilient Flooring: Section 09 6500; rubber treads, risers, and landing tile.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

1.03 ACTION SUBMITTALS

A. Product Data: Printed literature for proprietary materials to be included in concrete mix.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for products regionally extracted, processed, and manufactured.

1) Include statement indicating costs for each product.

1.04 INFORMATIONAL SUBMITTALS

A. Concrete mix design for concrete specified, including compressive strength.

1.05 QUALITY ASSURANCE

A. Concrete shall conform to provisions of the latest edition of the American Society for Testing and Materials (ASTM) and the American Concrete Institute (ACI) publications noted within this specification, except as modified by requirements included herein.

1.06 FIELD CONDITIONS

A. Coordinate curing times for concrete and subsequent application of sealer.

B. Maintain jobsite conditions and work of other subcontractors, and keep persons from walking on, or placing tools, equipment or other items on top of concrete fill during curing period. Access to other areas of the jobsite shall be via alternative routes, clearly marked.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Ensure that storage facilities are weathertight and dry.

B. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

C. Store aggregate in covered bins to preserve moisture content of aggregate.

D. Use sacked cement in chronological order of delivery.

E. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150, Type I or Type II, standard gray. Use only one brand and type of cement.

B. Aggregate: 1/8 to 1/4 inch pea gravel and washed river sand without salt content.

C. Reinforcement: 2 inch x 2 inch x 14 gage galvanized wire.

D. Admixtures:

1. Water-Reducing Admixtures: ASTM C494, Type A, and not containing more chloride ions than are present in municipal drinking water; "Eucon WR-75" by Euclid Chemical, or equal.

2. Non-corrosive, Non-chloride Accelerator: ASTM C494, Type C or E, and not containing more chloride ions than are present in municipal drinking water; "Accelguard 80" by Euclid Chemical or equal.

3. Air-Entraining Admixture: Conform to ASTM C260.

4. Prohibited Admixtures: Calcium chloride, thiocyanate, and admixtures containing more than 0.05 percent chloride ions.

E. Curing and Sealing Compound: Acrylic emulsion meeting the requirements of ASTM C309, Type 1 and meeting VOC code requirements; "Aqua-Cure" by Euclid Chemical Co. or equal.

1. Sodium silicate compounds are prohibited.

2. Verify compatibility with adhesive to be used for resilient stair covering.

F. Patching Compound: Free-flowing, polymer-modified cementitious coating; "Euco Thin Coat" by Euclid Chemical Co., "Vulkem 2300" by Mameco International, "Sikatop 121" by Sika Chemical Co., or equal.

2.02 DESIGN OF MIX

A. Minimum compressive strength shall be 3,000 psi determined after 28 days when tested in accordance with ASTM C39.

B. Mix shall be designed so that average compressive strength will exceed specified 28-day strength by an amount as specified by ACI 318.

C. Maximum Water/Cement Ratio: 0.60.

D. Air Content: Optional.

PART 3 - EXECUTION

3.01 PLACEMENT OF METAL PAN FILL

A. Before placing concrete, inspect and complete installation of required edge forms, reinforcing steel, accessibility strips, and other items to be imbedded.

B. Placement:

1. Convey concrete as rapidly and directly as practicable to preserve quality and to prevent separation from rehandling and flowing.

a. Place concrete within 1 hour after adding water, unless otherwise specified.
b. Do not deposit concrete initially set. Retempering of concrete which has partially set will not be permitted.

2. Deposit and consolidate concrete in a continuous operation until each pan or landing is completed.

3. Make level with not more than 1/16 inch tolerance in 5 feet.

4. Consolidate concrete during placement so that concrete is thoroughly worked around reinforcement and embedded items and into corners without displacing reinforcement or other items.

C. Finishing:

1. After placement, float to a true, uniform plane with no coarse aggregate visible. Work to a gritty surface.

2. Use stainless steel trowel to bring up matrix to smooth surface without aggregate showing.

3. Finish surface free from defects and blemishes, to match approved sample.

3.02 APPLICATION OF CURING/SEALING COMPOUND

A. Apply to completed concrete in accordance with manufacturer's recommendations and as specified herein.

B. Coordinate with requirements for applied floor finish.

3.03 INSTALLATION OF OTHER MATERIALS

A. Install patching compounds, mortar, and grout where required for installation of other materials and preparation of surfaces for finishes.

END OF SECTION 03 5600

SECTION 05 1200
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of structural steel including bracing and shoring required for erection and related work. The work also includes the following:

1. Verification of anchor bolt setting and levels to assure adequate fit of the steel work.
2. Temporary and permanent identification of SLRS protected zones.
3. Deformed bar anchors and steel reinforcing welded to structural steel.
4. Grouting of column bases.
5. Installation of slide bearings.
6. Installation of buckling restrained braces.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. 01 3560 Special Environmental Requirements (LEED)
2. 01 4339 Mock Ups
3. 01 7419 Construction and Demolition Waste Management
4. 03 3000 Cast-in-Place Concrete
5. 05 3100 Metal Decking
6. 05 5000 Metal Fabrication
7. 05 5100 Metal Stairs
8. 05 7000 Decorative Metal
9. 09 9000 Painting and Coating

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.

2. AISC - American Institute of Steel Construction:

   a. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges, except as follows:

      1) Horizontal and vertical dimensions may not be shown entirely on the Structural Drawings.
      2) Division 1 requirements and those specified herein shall govern in case of conflict.

   b. ANSI/AISC 341 - Seismic Provisions for Structural Steel Buildings, Including Supplement No. 1.
   c. ANSI/AISC 358 - Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications.
   d. ANSI/AISC 360 - Specification for Structural Steel Buildings.
   e. AISC - Steel Construction Manual

3. RCSC – Research Council on Structural Connections "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

4. AWS - American Welding Society's

   a. AWS D1.1 - Structural Welding Code - Steel.
   b. AWS D1.8 - Structural Welding Code - Seismic Supplement.

5. SPC - Society for Protective Coatings (formerly Steel Structures Painting Council), designations referenced herein.

6. AASHTO - American Association of State Highway and Transportation Officials "Standard Specifications for Highway Bridges.

7. ICC Evaluation Service - Provide "Evaluation Report" for product where specified herein.

8. ASTM, American Society for Testing and Materials, designations referenced herein.

1.04 DEFINITIONS

A. Structural Steel: As defined in Section 2 of AISC 303.

B. Seismic Load Resisting System (SLRS): Members and connections designated on the Drawings to resist seismic forces, including:

   1. Collectors and chords: Framing members designated on the Drawings to receive collector connections at one or both ends.

   2. Other members and connections designated as SLRS on the Drawings.

C. Demand Critical Welds (DCW): Welds designated as DCW on the Drawings that are anticipated to be in areas of moderate to high inelastic strain demand or have a significant consequence if failure occurs.

D. Protected Zone: Areas of members and connections of the SLRS designated on the Drawings where discontinuities created by fabrication and erection operations, installation of welded shear studs,

decking attachments that penetrate beam flanges and other structural and non-structural welded, bolted, screwed and shot-in attachments are restricted per ANSI/AISC 341, Section 7.4.

1.05 SUBMITTALS

A. General: Submittals shall be sent to the Owner's Representative, or Owner's Testing Agency, or both, as required herein and as specified per Division 1 for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Mill Analysis Reports: Contractor shall submit certified copies of mill analysis reports covering the chemical and physical properties of the structural steel to the Owner's Testing Agency for review.

C. Certificates of Conformance: Contractor shall submit to the Owner's Testing Agency for review manufacturer's certificates of conformance for the following materials:

1. Bolts, nuts, washers

2. Welding electrodes, fluxes, shielding gases

3. Welded studs.

D. Filler Metal Toughness: For SLRS and demand critical welds, submit manufacturer's certificates of conformance to the Owner's Representative and the Owner's Testing Agency confirming that the filler metals meet the Charpy V-Notch toughness requirements of Part 2 of this specification.

E. Shop and Erection Drawings: Contractor shall submit shop drawings to the Owner's Representative for review. Shop drawings shall include, but not be limited to, anchor bolt sizes and layout, member sizes and materials, details of members, connections, weld sizes and profiles, sizes and spacing of bolts, surface preparations and finishes, and corresponding erection plans showing the marking, position and orientation of each member and connection. Detail drawings shall indicate the marking of each member as shown on the erection plans. Shop and erection details incorporating SLRS and demand critical welds shall include explicit references to corresponding weld procedure specifications.

1. Complete horizontal and vertical control information may not be shown on the Structural Drawings and the Contractor shall obtain such information from the documents of other disciplines in order to provide a complete submittal. Prior to the preparation of detailed fabrication drawings, the Contractor shall prepare, submit, and obtain approval of coordinated erection drawings complete with horizontal and vertical dimensions.

2. The Contractor shall survey, review and confirm the as-built conditions prior to developing shop drawings. Field modifications to suit as-built conditions shall be at the Contractor's expense.

3. Fabrications Exposed to View: Identify on Shop Drawings all structural steel members and fabrications that will be exposed to view. These items require attention to fabrication detail and finish to ensure visual quality and uniformity of the final installed fabrications.

a. Fabrications that will be exposed to view include, but are not limited to, the following:

1) Columns, beams, and other exposed steel at building interior.
2) Exterior roof canopy beams and channels.
3) Interior steel feature stairs.

4) Exterior stair and bridge.

b. Indicate on Drawings basic preparation procedures for steel to be exposed to view, including steel surface preparation, weld quality, grinding, finishing, etc.
c. Show erection tabs and holes and indicate on Drawings where removal of tabs and patching of holes will follow erection at steel exposed to view.
d. Indicate type of primer, galvanizing, and other finish preparation.

4. Material samples for testing as requested by Owner's Representative, Structural Engineer, or Owner's Testing Agency.

a. Steel Exposed to View:

1) Submit for Owner's Representative's approval and constructed fabricated steel samples of sufficient size to demonstrate aesthetic effects as well as qualities of materials and execution, and to define quality level that, when approved, will become the standard to be carried throughout the project for steel exposed to view.
2) Fabricated steel samples shall include methods of joining and anchorage, profiles and finish quality of surfaces, including welds and grinding, priming, painting, and galvanizing.

F. Welding Procedure Specifications: Contractor shall submit welding procedure specifications (WPS) for each shop and field welding joint type and process to the Owner's Representative and the Owner's Testing Agency for review.

1. The WPS shall be prepared and signed by a welding professional whose qualifications include a minimum of 5 years' experience with the welding technologies proposed.

2. The WPS shall include, at a minimum, the information specified in AWS D1.1, Section 3 and the supplemental provisions of Annex H.

3. Prequalified WPS may be used provided they meet the requirements of AWS D1.1, Section 3 for prequalified welds.

4. Any single deviation from the AWS D1.1 requirements for prequalified welds shall necessitate qualification by test per AWS D1.1, Section 4. WPS that are qualified by testing shall conform the additional requirements of AWS D1.1, Annex IV and shall include the corresponding Procedure Qualification Records (PQRs).

5. WPS for demand critical welds shall conform to the additional requirements of AWS D1.8, Section 6.1, ANSI/AISC 341.

6. SLRS and demand critical welds shall be indicated on the applicable WPS. Alternately they may be identified in the table of contents of the WPS submittal.

G. Welder Performance Qualification Records (WPQR): Contractor shall submit WPQR for each shop and field welder to the Owner's Testing Agency for review.

H. Slide Bearings: Submit the following:

1. Manufacturer's data, details, and samples for each type of bearing.

2. Certified test data for compressive strain, shear resistance, durometer hardness, and coefficient of friction for the applicable elements.

3. Manufacturer's certificates of conformance for the steel plates, elastomeric pads, and PTFE.

I. Manufacturer Data: Submit manufacturer data and ICC report for deformed bar anchors.

J. Contractor's quality control test reports: The Contractor shall submit quality control test reports to the Owner's Representative and Owner's Testing Agency for review.

K. LEED Submittals:

1. Submit product data indicating that all paints and coatings used inside building and applied on site comply with LEED VOC Requirements outlined in Environmental Quality Assurance article.

2. Recycled Content: Submit product data indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for each product having recycled content.

3. Regional Materials: Submit product data indicating manufacturing locations and origins of materials for products manufactured and sourced within 500 miles of project site.

1.06 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. The Owner's Testing Agency shall submit written procedures, qualifications and reports as specified in ANSI/AISC 341, Appendix Q, Section Q4.

3. The Owner's Testing Agency shall perform tests and inspections per CBC, Chapter 17 and as follows:

a. Collect and review certified mill analysis reports.
b. Review steel identification per CBC Section 2203.2. Material that cannot be identified or has a questionable source shall be tested by the Contractor's Testing Agency.
c. Collect and review certificates of conformance. Materials not accompanied by manufacturer certificates shall be tested by the Contractor's Testing Agency.

d. Welding Tests and Inspections:

1) Personnel performing welding inspections and nondestructive testing shall meet the minimum qualifications specified in AWS D1.1, Section 6.
2) Personnel performing welding inspections and nondestructive testing on SLRS and demand critical welds shall meet the additional qualifications specified in AWS D1.8, Section 7.
3) Review shop and field WPS in accordance with AWS D1.1 and D1.8.
4) Confirm welders, welding foreman, and QC Inspectors have a copy of the approved WPS.
5) Review WPQR in accordance with AWS D1.1 and D1.8 for the welds to be performed.
6) Confirm welding equipment settings, and voltage and amperage at point of welding.
7) Perform visual inspection of shop and field welds in accordance with ANSI/AISC 341, Appendix Q, Section Q5.1. Inspections for items marked P (Perform) for both QC and QA inspections shall be the performed by the Owner's Testing Agency. Acceptance criteria for visually inspected welds shall be in accordance with AWS D1.1, Section 6.
8) Perform nondestructive tests (NDT) of shop and field welds in accordance with ANSI/AISC 341, Appendix Q, Section Q5.2, except as noted below. Provide NDT equipment as required to perform specified tests.

a) Ultrasonic testing (UT) shall conform to AWS D1.8, Section 7.10.
b) The rate of ultrasonic testing on complete joint penetration (CJP) groove welds may be reduced to 25-percent for an individual welder or welding operator after sufficient project experience is demonstrated per Appendix Q, subsection Q5.2g. However, no reduction in testing frequency shall be permitted for demand critical welds.
c) Magnetic Particle (MP) testing shall conform to AWS D1.8, Section 7.9.
d) The rate of magnetic particle testing on CJP groove welds may be reduced to 10-percent for an individual welder or welding operator after sufficient project experience is demonstrated per Appendix Q, subsection Q5.2h. However, no reduction in testing frequency shall be permitted for demand critical welds.

e. High-Strength Bolting Tests and Inspections:

1) Sample and test high strength bolts, nuts and washers in accordance with the requirements of the Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
2) Inspect installation of high strength bolts per ANSI/AISC 341, Appendix Q, Section Q5.3. Inspections for items marked P (Perform) for both QC and QA inspections shall be the performed by the Owner's Testing Agency.

f. Welded and bolted connections that fail to meet the acceptance criteria specified shall be re-inspected and/or re-tested after corrections have been made by the Contractor.
g. Welded Studs: Inspect size, number, placement and welding of welded studs in accordance with Section 7 of AWS D1.1.
h. Deformed Bar Anchors: Inspect size, number, placement and welding of deformed bar anchors in accordance with the manufacturer's ICC report.
i. Confirm structural and non-structural connections do not occur in the protected zones of the SLRS, except as indicated on the Drawings.
j. The Owner's Testing Agency shall review Contractor quality control test and inspection reports.
k. Take one set of three 2-inch mortar cubes for compressive strength tests per ASTM C 109 each day grout is placed. Test one cube 7 days after molding and two cubes at 28 days after molding.

C. Contractor's Quality Control Tests and Inspections:

1. General: Quality control tests and inspections shall be the responsibility of the Contractor. Where required herein, the Contractor shall retain a testing agency, referred to herein as the Contractor's Testing Agency, to demonstrate that quality control conforms to the requirements of the Contract Documents. Quality Control Test and Inspection Reports shall be prepared and submitted for review.

2. Welding Quality Control Inspections: The Contractor's Testing Agency shall perform visual inspection of welding per ANSI/AISC 341, Appendix Q, Section Q5.1.

   a. Personnel performing quality control inspections of welding shall meet the minimum qualifications specified in AWS D1.8, Section 7.
   b. The Contractor's Testing Agency need not perform inspections for items marked P (Perform) for both QC and QA inspections. These inspections will be performed by the Owner's Testing Agency.

3. High-Strength Bolting Quality Control Inspections: The Contractor's Testing Agency shall perform visual inspection of high-strength bolting per ANSI/AISC 341, Appendix Q, Section Q5.3.

   a. The Contractor's Testing Agency need not perform inspections for items marked P (Perform) for both QC and QA inspections. These inspections will be performed by the Owner's Testing Agency.

4. Tension Tests: The Contractor's Testing Agency shall conduct one tension test and one bend test in accordance with ASTM A 370 for each heat of structural steel not accompanied by certified mill analysis reports. Test reports shall be reviewed by the Owner's Testing Agency before placement of steel.

5. Filler Metal Toughness Tests: The Contractor's Testing Agency shall test each type of filler metal not accompanied by the manufacturer's certificate of conformance for the filler metal toughness requirements in Part 2 of this specification. Test procedures shall conform to ANSI/AISC 341, Appendix X.

D. Pre-Construction Conference: The contractor shall arrange and sponsor one preconstruction conference, following approval of project WPSs and prior to start of shop and field welding operations. At a minimum, the Contractor, Contractor's Welding Quality Control Inspector, the Contractor's Welding Foreman, the Owner's Testing Agency and the Engineer of Record shall attend. Attendees shall review the approved Welding Procedure Specifications (WPS) and other special welding requirements for the project. A sample agenda is included at the end of this section.

1.07 CONTRACTOR'S ENGINEERING SERVICES

A. General: Where engineering services are required herein, the Contractor shall retain a Structural Engineer registered in the State of California, referred to herein as the Contractor's Engineer.

1. Where explicitly allowed, a Civil Engineer registered in the State of California is acceptable as the Contractor's Engineer.

2. Documents prepared by the Contractor's Engineer shall be stamped and signed.

1.08 ENVIRONMENTAL QUALITY ASSURANCE

A. Paints, coatings, and primers shall not exceed VOC limits established in Section 013560 Special Environmental Requirements (LEED).

B. Provide material with minimum percentage of recycled content specified in Part 2 Steel Materials article.

C. Applicable LEED Credits:

1. Category – Indoor Environmental Quality:

a. Credit 4.2, Low-Emitting Materials, Paints and Coatings.

2. Category – Materials and Resources:

a. Credits 4.1 and 4.2, Recycled Content.
b. Credits 5.1 and 5.2, Regional Materials.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL MATERIALS

A. Wide Flange Shapes: ASTM A 992.

1. Heavy Sections: Heavy sections shall meet the requirements of ANSI/AISC 360, Section A3.1c. Hot rolled shapes in the SLRS with flange thicknesses 1-1/2 inch and thicker shall also have a minimum Charpy V-Notch toughness of 20 ft-lb at 70 degrees F tested in the alternate core location as described in ASTM A6, Supplementary Requirement S30.

B. Plates and Bars: ASTM A 36, typical. Provide ASTM A572, Grade 50, for SLRS, unless otherwise noted on the Drawings.

1. Heavy Sections: Heavy sections shall meet the requirements of ANSI/AISC 360 Section A3.1d. Steel plates 2” and thicker used in the SLRS for built-up sections, cover plates and base plates shall also have a minimum Charpy V-notch toughness of 20 ft-lb at 70 degrees F tested at any location permitted by ASTM A673.

C. Channel and Angles: ASTM A 36.

D. Round and Rectangular Hollow Structural Sections: ASTM A 500, Grade B.

E. Pipe: ASTM A 53, Grade B.

F. Recycled Content: Minimum 90 percent.

2.02 FASTENER PRODUCTS AND MATERIALS

A. Anchor Bolts: ASTM A 307, Grade A, hex headed bolts with ASTM A 563, Grade A, heavy hex nuts.

B. Anchor Rods: ASTM F1554, Grade 36 or ASTM A 36 with ASTM A 563, Grade A heavy hex nuts.

C. High-Strength Anchor Rods: Provide ASTM F1554, Grade 55, high-strength anchor rods with ASTM A 563, Grade DH heavy hex nuts where noted on the Drawings.

D. Machine Bolts: ASTM A 307, Grade A, hex headed bolts with ASTM A 563, Grade A, hex nut.

E. High-Strength Bolts: ASTM A 325, Type 1, with ASTM A 563, Grade C or DH, heavy hex nuts and ASTM F 436 washers, typical. Provide connection type N typical and X or SC where noted on the Drawings.

1. Twist-off type tension-control bolt assemblies conforming to the requirements of ASTM F 1852 shall be permitted at pretensioned bolt locations, except at slip critical bolted connections and where noted on the Drawings.

2. Compressible-washer-type direct indicators conforming to the requirements of ASTM F 959, Type 325, shall be permitted at pretensioned bolt locations, except at where noted on the Drawings.

F. Welded Studs: Type B headed shear studs per AWS D1.1, Section 7.

G. Deformed Bar Anchors: ASTM A 496 deformed wire. Acceptable manufacturers include Nelson Stud Welding Inc., Stud Welding Associates or equal. Alternately, welded ASTM A 706 reinforcing bars may be used.

2.03 WELDING MATERIALS AND PRODUCTS

A. Arc-Welding Filler Metals: Filler metals shall be low hydrogen types conforming to AWS D1.1, Table 3.1 and shall be as recommended by the manufacturer for the position, thickness and other conditions of use.

1. Electrode Wire Diameter: Wire diameter shall not exceed the maximum values specified in AWS D1.1, Table 3.7.

2. Filler Metal Toughness:

a. Filler metals for shop and field welded joints designated as SLRS on the Drawings shall have a minimum Charpy V-Notch (CVN) toughness of 20 ft-lb at 0 degrees Fahrenheit as determined by AWS A5 classification test method or manufacturer certification.
b. Filler metals for shop and field welded joints designated as demand critical welds on the Drawings shall have a minimum Charpy V-Notch (CVN) toughness of 20 ft-lb at -20 degrees Fahrenheit as determined by the appropriate AWS classification test method or manufacturer certification and 40 ft-lb at 70 degrees Fahrenheit as determined by ANSI/AISC 341, Appendix X or other approved method.

B. Arc-welding equipment: Welding equipment shall have calibrated meters for voltage and amperage that accurately indicate these values at the point of welding for the length of cable to be used. Contractor shall demonstrate to the satisfaction of the Owner's Testing Agency the accuracy of the meters, using external meters attached to extension cables of a length that reflects actual project conditions. If equipment meters do not accurately reflect the electrical properties at the point of welding, the Contractor shall provide external meters.

2.04 COATING PRODUCTS AND MATERIALS

A. Structural Steel Primer Paint at all exposed and concealed steel at building interior: Flat finish waterborne acrylic coating, direct to metal primer intended for direct application to properly prepared steel: ~~Devflex 4020PF~~ **MetalCoat** as manufactured by ~~Devoe Coatings~~**AFM Safecoat**, or equal, and

compatible with finish coating. See Section 099000 Painting and Coating. Volatile Organic Compounds (V.O.C.) shall not exceed ~~100~~ **0** grams per liter as applied.

1. Color: White

B. Shop Galvanizing: Items noted on the Drawings or in the specifications as galvanized, including all exterior steel exposed to weather, shall be hot-dip galvanized in accordance with ASTM A 123.

C. Galvanizing Repair: Repair materials shall conform to ASTM A 780.

2.05 MISCELLANEOUS MATERIALS AND PRODUCTS

A. Non-Shrink Grout: ASTM C 1107 premixed, non-shrink, non-staining grout. Acceptable products include Masterflow 928 grout as manufactured by BASF Construction Chemicals LLC, Edoco Non-Ferrous, Non-Shrink Grout as manufactured by Edoco Construction Chemicals, Five Star Grout as manufactured by Five Star Products Inc., or equal. Grout shall attain a minimum compressive strength of 7000-psi at 28-days.

B. Slide Bearings: Provide bearings as manufactured by Con-Serv Inc., JVI Inc., Voss Engineering Inc., or equal. Bearings shall consist of steel bearing plates, stainless steel sliding plates, elastomeric elements, and TFE elements in the configurations shown on the Drawings. Slide bearing assemblies shall have certified compression and shear capacities equal to 1.5 times the design loads shown on the Drawings. Bearings shall also conform to the requirements of Section 18 of the AASHTO Standard Specifications for Highway Bridge and as follows:

1. Steel Bearing Plates: ASTM A 36.

2. Reinforcing Steel Plates: ASTM A 36 or equal.

3. Stainless Steel Sliding Surface: ASTM A 240, Type 304 Sheet, with No. 2B finish per ASTM A 480. Attach stainless steel to concrete or steel supports as shown on the Drawings. Sliding surfaces shall not be painted or otherwise marred.

4. TFE Elements: TFE elements shall be 100 percent virgin polytetrafluoroethylene (TFE) reinforced with 15 percent glass fibers and shall not deform more than 0.002 inches under a static load of 2,000 psi. The coefficient of sliding friction of the TFE to stainless steel shall be between 5 and 7 percent at the time of installation. TFE shall be factory bonded to the steel bearing plate with heat-cured, high temperature epoxy that is stable in a temperature range of -320ºF to +400ºF.

5. Elastomeric Elements: Elastomeric elements shall be either 100-percent virgin polyisopropene or 100-percent virgin chloroprene, with a minimum Shore A durometer hardness of 60 + 5 per ASTM D 2240. The elastomeric element shall be vulcanized to the steel bearing plates and reinforcing steel plate, if any.

6. Clear mating surfaces of particle matter and other debris prior to final assembly. Do not fireproof slide bearings.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

B. Provide temporary identification of SLRS protected zones prior to erection. Provide permanent identification as soon as practical after temporary identification is covered by fireproofing or paint or other finishes.

3.02 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in structural steel with the Drawings and the work of other trades. Verify conformance with the structural requirements shown on the Drawings.

3.03 FABRICATION

A. General: Fabricate structural steel in accordance with AISC 303 and ANSI/AISC 360.

1. Conform to the additional requirements of ANSI/AISC 341 for members and connections in the SLRS.

B. Dimensions: Contractor shall obtain dimensions from the Structural Drawings, drawings of the other disciplines, and field measurements as necessary for the fabrication of the structural steel. Complete dimensions may not be shown on the Structural Drawings.

C. Thermal Cutting: Thermal cutting shall be done by machine to the greatest extent possible. Plane thermally cut edges as necessary to comply with edge preparation requirements of AWS D1.1.

D. Bearing Surfaces: Column bases, base plates and other bearing plates shall be milled to a true plane perpendicular to the axis of the member for complete bearing at the contact face.

1. Bearing plates 2-inches or less in thickness are permitted without milling, provided a satisfactory contact bearing is obtained.

2. Top surfaces of base plates where columns are connected by CJP groove welds need not be milled.

3. Bottom surfaces of base plates to be grouted need not be milled.

E. Camber: Provide camber for beams and girders as indicated on the Drawings.

F. Anchor Rods and Bolts: Provide column anchor rods and bolts and setting templates for installation under the section entitled “Cast-In-Place Concrete.”

1. Anchor rod and bolt holes in base plates shall conform to table 14-2 of AISC’s “Steel Construction Manual” unless otherwise noted on the Drawings.

G. Machine Bolts: Install machine bolts snug tight, unless otherwise noted on the Drawings.

H. High-Strength Bolts (HSBs): Install high strength bolts in accordance with RCSC’s “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts” for the types of joints shown on the Drawings:

1. Holes for bolts shall be standard 1/16 inch larger than the nominal diameter of the bolt, unless otherwise noted on the Drawings.

2. Holes may be punched or drilled in material with a thickness not greater than the nominal bolt diameter plus 1/8 inch. Holes in thicker material shall be drilled or sub-punched and reamed. Thermal cutting of holes is not permitted. Burrs shall be removed from holes by grinding.

3. HSBs shall be fully tensioned unless otherwise noted on the Drawings.

4. Faying Surfaces: Provide Class A surfaces for connections of structural steel using slip-critical bolts. Provide Class C surfaces for connections of hot-dip galvanized steel using slip-critical bolts.

I. Welding: Welding shall conform to the requirements of ANSI/AISC 360 and AWS D1.1 using proven methods and techniques suitable for the connection configuration to be welded.

1. Use equipment that will supply the current and voltage at the point of welding shown on the approved WPS as recommended by the electrode manufacturer. Suitable meters and means of adjustment shall be provided for current and voltage.

2. Weld in accordance with the approved WPS.

3. Welders, welding foremen and the Contractor's QC Inspector shall have a copy of and be capable of reading the approved WPS. Welders shall be qualified by tests per AWS D1.1 to perform the types of welds required.

4. Filler metals shall conform to AWS D1.1, Table 3.1.

5. Groove welds shall be complete joint penetration welds unless noted otherwise on the Drawings. Joint preparation and fit-up shall be in accordance with the approved WPS.

6. Partial penetration groove welds shall have a root face of 1/8-inch unless otherwise noted on the Drawings. Joint preparation and fit-up shall be in accordance with the approved WPS.

7. Welded connections in the SLRS shall comply with the additional requirements of AWS D1.8, including the supplemental requirements for demand critical welds, and as follows:
   a. Filler metals shall conform to the filler metal toughness requirements specified in Part 2 of this specification.
   b. Weld Access Holes: Weld access holes for CJP groove welds of beams to columns shall conform to ANSI/AISC 360, Section J1.6, unless otherwise noted on the Drawings.
   c. Welders shall pass the "Supplemental Welder Qualification for Restricted Access Welding" as specified in AWS D1.8, Section 5.1 where welding beam flanges to columns through web and gusset plate access holes at demand critical weld locations.
   d. End dams shall not be permitted, except at the outboard edge of weld tabs that are to be removed after completion of the weld.
   e. Backing bars shall be removed where noted on the Drawings.
   f. Provide reinforcing fillets where noted on the Drawings. Geometry shall be in accordance with AWS D1.8, Figure 6.1.

J. Fabrication Tolerances: Fabrication tolerances shall conform to AISC 303, unless otherwise noted.

K. Welded Studs: Install welded studs in accordance with Section 7, Stud Welding, of AWS D1.1.

L. Deformed Bar Anchors: Install deformed bar anchors in accordance with the ICC report. See section entitled "Concrete Reinforcement" for welding requirements where ASTM A 706 is used.

3.04 FABRICATION OF STEEL EXPOSED TO VIEW

A. General: At all structural steel exposed to view shall comply with fabrication procedures listed below and as documented in Specification Division 5 – Miscellaneous Metal Fabrications and Division 9 – Paints and Coatings.

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.

2. Remove blemishes by filling and grinding or by welding and grinding, before cleaning, treating, and shop priming.

3. At interior steel locations, remove erection tabs, back-up bars and other tabs or holes after erection by filling and grinding or by welding and grinding, and before touch-up priming and finish painting. At exterior locations, minimize or eliminate specialty erection tabs and holes unless tabs or holes will be out of visual sightlines. Remove all erection aids.

4. Locate weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Owner's Representative in approved shop drawings.

5. Fabricate to assure abutting cross sectional configurations match.

6. Treat all surfaces and welds exposed to view as finished surfaces.

7. Make all exposed corners square and sharp unless noted otherwise, eased to a radius of 1/8- inch maximum.

8. Grind edges of sheared, punched or flame-cut steel to match approved samples.

9. Locate joints where indicated on the drawings.

10. Maintain a uniform gap (1/8 inch plus or minus1/32 inch unless otherwise noted) at all copes, blocks and joints.

11. Fabricate beams and girders with natural camber upward, unless shown otherwise.

12. Orient tubes and pipes such that seams are hidden from view to the greatest extent possible.

13. Prior to fabrication, straighten material by methods which do not injure material.

14. Prior to assembling component parts of connection, thoroughly clean contact surfaces of loose scale, rust and burrs and remove local twists and bends.

15. Stenciled, stamped or raised mill marks are not permitted in exposed-to-view locations. Where it is not possible to omit mill marks by cutting material, fill and/or grind to a surface finish consistent with approved mockup.

B. Exposed Welds:

1. Make exposed fillet welds smooth to uniform convex contour, radius and dimension for their full length. Grind welds smooth if not made to meet these criteria.

2. Mill or grind exposed surface welds smooth and flush with surfaces of the adjoining materials welded.

3. Grind out defects which would be visible in the finished work, fill with welding material, and grind flush prior to finishing.

4. Weld show-throughs on exposed steel surfaces are not permitted.

5. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

6. Remove weld splatter on exposed steel.

C. Exposed Fasteners:

1. For each connection align edges of bolts in exposed members.

2. In exposed connections orientate bolt heads on the same side of the connection.

3. Where only one side of a bolted connection is exposed to view, locate bolt heads on the exposed to view side (i.e. locate nuts on the concealed side).

4. Select bolt length such that threads will extend not more than 1/4 inch beyond the nuts unless noted otherwise.

5. Twist-off-type tension-control bolt assemblies are not allowed where twist-off portion of bolt is visible

6. Style of bolt head shall be the same for all bolts exposed to view in the completed structure.

3.05 FINISHES

A. Surface Preparation:

1. After fabrication, remove loose mill scale, rust, paint, and other detrimental foreign matter in accordance with SSPC-SP2 “Hand Tool Cleaning” for the following steel surfaces:

a. Steel to receive spayed-on fireproofing.
b. Steel to be embedded or encased in concrete.
c. Steel to be hot-dip galvanized.

2. After fabrication, remove loose mill scale, rust, paint, and other detrimental foreign matter from steel surfaces to be primed by sandblasting to a commercial blast level in accordance with SSPC-SP6 or ISO – Sa2

B. Shop Prime Painting:

1. Shop prime structural steel, except as follows:

a. Members or portions of members to be fireproofed
b. Members or portions of members to be embedded in concrete or mortar, except for the initial 2-inches.
c. Faying surfaces of connections using slip critical bolts.
d. Surfaces to be field welded, including flange surfaces to receive metal decking.
e. Surfaces to be hot-dip galvanized.

2. Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's instructions at a rate to provide a uniform dry film thickness of 3.0 mils. Use painting methods that will result in full coverage of joints, corners, edges and exposed surfaces.

a. Apply two coats of primer to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

C. Hot-Dip Galvanizing:

1. Hot-dip galvanize exterior steel and other members shown on the Drawings in accordance with ASTM A 123.

2. Hot-dip galvanize exterior steel bolts, nuts and washers, and other hardware shown on the Drawings in accordance with ASTM A 153.

3. To minimize surface imperfections (i.e. flux inclusions), material to be galvanized at work exposed to view shall be dipped into a solution of zinc ammonium chloride (pre-flux) immediately prior to galvanizing. The type of galvanizing process utilizing a flux blanket overlaying the molten zinc is NOT permitted.

~~3.~~**4.** After hot-dip galvanizing, roughen faying surfaces of slip critical connections by hand wire brushing to achieve Class C surface per RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts." Power wire brushing is not permitted.

3.06 ERECTION

A. General: Erect structural steel in accordance with AISC 303 and ANSI/AISC 360.

1. Conform to the additional requirements of ANSI/AISC 341 for members and connections in the SLRS.

B. Where erection requires fabrication on site, conform to the requirements of section 3.3 "Fabrication" of this Specification.

C. Machine Bolts: Install machine bolts snug tight, unless noted otherwise on the Drawings.

D. High-Strength Bolts: See section 3.3 "Fabrication" of this Specification.

E. Welding: See section 3.3 "Fabrication" of this Specification.

F. Column Base Plates: Column base plates shall be set level and to the correct elevation. Provide temporary supports until the columns have been plumbed and the base plates are grouted. The entire bearing area under base plates shall be grouted solid under section entitled "Cast-In-Place Concrete" with non-shrink grout in accordance with the manufacturer's written instructions. Anchor bolts shall be installed snug tight, unless otherwise noted on the Drawings.

G. Structural steel shall be erected true and plumb. Temporary shoring and bracing shall be provided wherever necessary and shall be adequate for the loads to which the structure may be subjected, including wind forces, erection equipment and operation of same. Temporary shoring and bracing shall remain in place as long as required for safety and until the final framing construction is complete. Final connections shall not be made until the structure has been properly aligned.

H. Provide temporary flooring, planking and scaffolding as necessary for the erection of the structural steel and support of erection equipment. Temporary elements shall conform to applicable Federal, State and Local regulations.

I. Erection Tolerances: Erection tolerances shall conform to AISC 303, unless otherwise noted.

3.07 FIELD TOUCH-UP PAINTING

A. After erection, touch-up field welded connections and areas where shop primer has been disturbed. Surface preparation and painting shall be as specified for shop prime painting.

B. Touch-up galvanized surfaces in accordance with ASTM A 780.

3.08 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.09 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

3.10 SAMPLE FORMS

A. Pre-Construction Conference Agenda: As included on the following page.

SAMPLE AGENDA FOR A

PRE-CONSTRUCTION CONFERENCE

FOR

WELDING AND WELDING INSPECTION

QUALITY CONTROL

CONTRACTOR'S QUALITY CONTROL PROGRAM
OWNER'S TESTING AGENCY QUALITY ASSURANCE REQUIREMENTS
COMMUNICATION BETWEEN CONTRACTOR AND TESTING AGENCY
COMMUNICATION WITH THE ENGINEER

MATERIAL SPECIFICATIONS

STRUCTURAL STEEL SHAPES AND PLATES
BOLTS
WELD FILLER METALS
STEEL PREPARATION REQUIREMENTS
PAINT/COATINGS/PRIMERS
SPECIAL REQUIREMENTS
QUALITY ASSURANCE

SUBMITTALS

MILL CERTIFICATES
WELD PROCEDURE SPECIFICATIONS
DISTORTION CONTROL PROGRAM

GENERAL WELDING REQUIREMENTS

WELDER QUALIFICATION
POSSESSION OF THE WPS
USE OF THE APPROVED WPS
ENFORCEMENT OF THE WPS
WELDING EQUIPMENT CALIBRATION AND METERS
WELDING TECHNIQUE
VISUAL INSPECTION CHECKLIST
NDT INSPECTION CHECKLIST

SPECIAL “SLRS" AND “DEMAND CRITICAL WELD” REQUIREMENTS

FILLER METALS
PREHEAT
POSTHEAT
TECHNIQUE
ACCESSORIES
PROTECTED ZONES

END OF AGENDA

END OF SECTION 05 1200

SECTION 05 3100
STEEL DECKING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of composite and non-composite floor and roof steel decking, accessories and welded studs.

1.02 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Cast-In-Place Concrete – 03 3000

2. Structural Steel – 05 1200

1.03 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2010 California Building Code.

2. AISI - American Iron and Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members."

3. AWS - American Welding Society
   a. AWS D1.1 Structural Welding Code - Steel
   b. AWS D1.3 Structural Welding Code – Sheet Steel

4. SDI – Steel Deck Institute
   a. Publication No. 31 – Design Manual for Composite Decks, Form Decks and Roof Decks.

5. SSPC - Steel Structures Painting Council, designations referenced herein.

6. ICC Evaluation Service - Provide “Evaluation Report” for product where specified herein.

7. ASTM, American Society for Testing and Materials, designations referenced herein.

1.04 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or Owner’s Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Shop Drawings: The Contractor shall submit shop drawings for review by the Architect showing the layout, fabrication and installation details, locations and dimensions of openings, opening reinforcing, and sizes and locations of welds and welded studs. Fabrication or delivery of material to the building site shall not begin until the Architect's review is complete.

C. Manufacturer's Data: Submit current ICC report for steel decking, including allowable vertical load and diaphragm shear capacities.

D. Certified Mill Analysis Reports: The Contractor shall submit certified mill analysis reports in accordance with ASTM designations referenced herein for each heat of steel decking, welded studs and welding electrodes to the Owner's Testing Agency for review.

E. Welding Documents: The Contractor shall submit Welding Procedure Specifications (WPSs), Procedure Qualification Records (PQRs), and Welder Qualification Test Records (WQTRs) prepared in accordance with AWS D1.3 for each type of weld and position to be performed to the Owner's Testing Agency for review.

F. Contractor's quality control test reports: The Contractor shall submit quality control test reports to the Architect and Owner's Testing Agency for review.

G. LEED Submittals:

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR4: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.

1) Include statement indicating costs for each product having recycled content.

1.05 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Architect if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall

perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. The Owner's Testing Agency shall perform tests and inspections in accordance with CBC Chapter 17, AWS D1.3, and AWS D1.1 where indicated:

   a. Review WPSs, PQRs, WQTRs and suitability of welding equipment.
   b. Inspect layout of steel deck and welding of deck to supports.
   c. Inspect size, number, placement and welding of welded studs in accordance with Section 7 of AWS D1.1.

3. The Owner's Testing Agency shall review Contractor quality control test and inspection reports.

C. Contractor's Quality Control Tests and Inspections:

1. General:

   a. Quality control tests and inspections shall be the responsibility of the Contractor.
   b. Where required herein, the Contractor shall demonstrate that quality control conforms to the requirements of the Contract Documents.
   c. Quality Control Test and Inspection Reports shall be prepared and submitted to the Architect and Owner's Testing Agency for review.

2. Tension tests of steel deck not accompanied by certified mill analysis reports: The Contractor shall conduct one tension test and one bend test in accordance with ASTM A 370 for each 5 tons or fraction thereof of each size or gage of steel deck not accompanied by certified mill analysis reports. Test reports shall be reviewed by the Owner's Testing Agency before placement of reinforcement.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Decking, Closures and Edge Angles:

1. Acceptable Manufacturers: Decking and accessories shall be as manufactured by ASC Profiles, Inc. (ESR-1414), Verco Manufacturers, Inc. (ESR-2078), or approved equal.

2. Materials: Form from steel conforming to ASTM A 653, SS, Grade 33, with a minimum yield strength of 38,000 psi. Before forming, the steel shall receive a protective zinc coating conforming to ASTM A 653, G60 minimum.

3. Vent Tabs: Steel deck supporting concrete fill shall have factory punched vent tabs, unless otherwise noted on the Drawings. Steel deck without concrete fill shall not be vented.

4. Fire Resistance: Decks shall have been tested for fire resistance per ASTM E119 as part of an assembly of the type shown on the Drawings and shall be listed in the UL "Fire Resistance Directory."

B. Miscellaneous Steel Shapes and Plates: ASTM A 36.

C. Welded Studs: Type B headed shear studs per AWS D1.1, Section 7.

D. Arc-Welding Electrodes: Conform to Table 5.1 of AWS D1.3 and Table 3.1 of AWS D1.1. Electrodes shall be as recommended by the manufacturer for the position or other conditions of use.

E. Galvanizing Repair Paint: Zinc-Rich Primers conforming to SSPC-Paint 20.

F. LEED Performance Criteria:

1. Recycled Content Materials: Steel stud and zee girt framing shall contain a minimum of 30 percent recycled content by weight, calculated by adding the post-consumer recycled content percentage to one-half of the pre-consumer recycled content percentage.

PART 3 - EXECUTION

3.01 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.02 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in steel decking with the Drawings and the work of other trades. Verify conformance with the structural requirements shown on the Drawings.

3.03 FABRICATION

A. General Requirements: Properties of steel deck sections shall be computed in accordance with the AISI Specification. Decking units to receive concrete fill shall be designed with adequate provisions to transfer shear and to prevent vertical separation.

B. Deck sizes, profiles, gages and minimum properties and allowable diaphragm shears shall be as shown on the Drawings.

C. Fabrication, cuts, etc., shall be done in the shop in accordance with SDI standards and the manufacturer's recommendations. All deck units shall be shipped to the field in standard widths and precut lengths.

D. Deck units shall be supplied in lengths to span over at least three supports where layout permits.

E. Deck units shall abut over framing supports with minimum bearing as shown on the Drawings.

F. Fabricate closure strips of galvanized sheet steel of the same quality as the deck units, not less than 18 gage thick before coating. Form to the configuration required to provide tight-fitting closures at open ends and sides of decking.

G. Provide 14-gage weld plates for shear transfer where the deck low flutes do not align with beams parallel to the deck. See Drawings for details.

H. All deck units shall be provided with either an interlocking side laps or lapping type side laps.

3.04 INSTALLATION

A. Steel decking shall be installed in the field by a steel deck contractor with a minimum of 5-years' experience.

B. Installation work shall be performed by workers skilled in their trade, in conformance with SDI standards and the manufacturer's recommendations.

C. The steel deck units shall be placed on the supporting framework, aligned, and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting beams. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of steel units, notify the Architect before taking corrective action.

D. Deck units shall be placed in straight alignment for the entire length of run with close registration of the cells of one unit with those of abutting and adjoining units. Provide minimum end lapping of lapped units or butting of abutting units as noted on the Drawings.

E. Provide flashings and closures where required to prevent concrete leakage. Provide between decking and columns and at open ends of all cell runs at columns, walls, openings, etc., and those that occur where cells change direction. Closure pieces shall be cut same shape as deck profile as shown on the Drawings. Fasten in place by welding or sheet metal screws per manufacturer's printed directions, unless noted otherwise on the Drawings.

F. Galvanizing Repair: Where galvanized surfaces are damaged, repair surfaces with zinc rich paint in accordance with procedures specified in ASTM A 780.

3.05 WELDING

A. Make welds in accordance with Drawings. Use only welders certified for welding sheet steel per AWS D1.3. Button-punching or riv-clinching of deck will be permitted for vertical alignment only, unless otherwise noted on the Drawings. Crimp deck sections together at vertical side seams before welding.

B. Welded studs shall be welded through steel deck to beam flanges in accordance with Section 7, Stud Welding, AWS D1.1.

3.06 REINFORCEMENT AT OPENINGS

A. Provide reinforcement and closure pieces at openings as shown and detailed on the Drawings.

B. Not all openings are shown on the Drawings. Openings not shown, such as openings required for ducts, stacks, conduits, plumbing, etc., shall be cut, closed, supported, and reinforced by the trade requiring the openings in accordance with the structural requirements shown on the Drawings.

3.07 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor’s proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.08 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 05 3100

SECTION 05 4100
STRUCTURAL METAL STUD FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Delegated Design criteria for light-gage, load-bearing cold-formed steel stud framing system at exterior walls and for all other locations indicated on the Drawings and specified.

2. Engineering services for the design and implementation of cold-formed structural metal framing.

B. Related Information and Requirements:

1. Delegated Design: Section 01 3325

2. Mockups: Section 01 4339

3. Structural Steel: Section 05 1200

4. Non-Structural Metal Framing: Section 09 2216

1.02 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section.

1. CBC – 2010 California Building Code.

2. AISI - American Iron and Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members."

3. AWS - American Welding Society

a. AWS D1.1 Structural Welding Code - Steel
b. AWS D1.3 Structural Welding Code - Sheet Steel

4. ASTM, American Society for Testing and Materials, designations referenced herein.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

3. Submit plans, details, and calculations to the Building Department having jurisdiction for the project prior to installation.

B. Coordinate locations and sizes of penetrations and openings in cold-formed metal framing with the Drawings and the work of other trades. Verify conformance with the structural requirements shown on the Drawings or as required by the Contractor's engineer.

1.04 ACTION SUBMITTALS

A. Shop Drawings:

1. Show materials, plans, dimensions, setting details, support details, wall elevations, spacing of members, connection details, welds, screws, bridging, bracing requirements, special details at openings and other details necessary for construction.
2. Include plans and elevations at not less than 1/4-inch-to-1-foot-0-inch scale and details at not less than 3-inch-to-1-foot-0-inch scale.

B. Product Data: Manufacturer's product literature, installation instructions and current ICC report for each item of cold-formed metal framing, accessories and anchors.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

D. Delegated-Design Services: Provide engineering calculations substantiating the members and details shown on the shop drawing. Calculations shall be signed and sealed by the engineer in responsible charge retained by the Contractor. Engineer shall be a California licensed civil or structural engineer.

1.05 INFORMATIONAL SUBMITTALS

A. Installer qualifications as specified.

B. Certified Mill Analysis Reports: Certified mill analysis reports in accordance with ASTM designations referenced herein for each heat of cold-formed metal framing to the Owner's Testing Agency for review.

C. Welding Documents: Welding Procedure Specifications (WPSs), Procedure Qualification Records (PQRs), and Welder Qualification Test Records (WQTRs) prepared in accordance with AWS D1.3 for each type of weld and position to be performed to the Owner's Testing Agency for review.

D. Contractor's Quality Control Test Reports: The Contractor shall submit quality control test reports to the Owner's Representative and Owner's Testing Agency for review.

E. Contractor's report on defective work and intended repairs as specified and if required.

1.06 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 48 hours.

2. The Contractor shall immediately notify the Owner's Representative if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections will be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. The Owner's Testing Agency shall perform tests and inspections in accordance with CBC Chapter 17, AWS D1.3, and AWS D1.1 where indicated:

a. Review WPSs, PQRs, WQTRs and suitability of welding equipment.
b. Inspect welding of cold-formed metal framing.
c. Inspect welding of cold-formed metal framing to structural steel in accordance with AWS D1.1.

3. The Owner's Testing Agency shall review Contractor quality control test and inspection reports.

C. Contractor's Quality Control Tests and Inspections:

1. General:

a. Quality control tests and inspections shall be the responsibility of the Contractor.
b. Where required herein, the Contractor shall demonstrate that quality control conforms to the requirements of the Contract Documents.
c. Quality Control Test and Inspection Reports shall be prepared and submitted for review.

2. Tension tests of cold-formed metal framing not accompanied by certified mill analysis reports: The Contractor shall conduct one tension test and one bend test in accordance with ASTM A 370 for each 5 tons or fraction thereof of each size or gage of cold-formed metal framing not accompanied by certified mill analysis reports. Test reports shall be reviewed by the Owner's Testing Agency before placement of reinforcement.

1.07 QUALITY ASSURANCE

A. Qualifications:

1. Installer: Cold-formed metal framing contractor with a minimum of 5-years' experience.

B. Regulatory Requirements:

1. Comply with fire-resistance ratings as indicated and as required by governing authorities and codes.

2. Provide materials, accessories, and application procedures listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.

3. Comply with requirements of California Code of Regulations (CCR), Title 24, Section 2701, for design and identification of cold-formed steel.

C. Welding:

1. Welders: Qualified in accordance with AWS D1.3 for welding process, position, type of weld, and type of steel.

2. Comply with applicable provisions of referenced AWS code.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver in manufacturer's unopened containers or bundles fully identified with name, brand, type, and grade.

B. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Structural Performance: Provide cold-formed metal framing capable of withstanding the design loads, deflection limits and displacements indicated:

1. Design Loads: As indicated on the Drawings.

2. Deflection Limits:

a. Design exterior framing and their connections to limit overall deflections at or below the following:

1) Members supporting gypsum board or metal panels: 1/240 of the span.
2) Members supporting portland cement plaster: 1/360 of the span.

b. Provide more stringent deflection criteria at composite conditions or if required by exterior finish material manufacturer.

3. Design framing systems to provide for movement without damage to the framing and finishes when subjected to a maximum ambient temperature change of plus or minus 40 degrees F. Confirm ambient temperature change with Owner's Representative.

4. Design framing systems to accommodate the vertical live load deflection of the primary structure as noted on the Structural Drawings.

5. Design framing systems to accommodate the building inter-story drifts as noted on the Structural Drawings.

6. Design exterior non-load-bearing framing without regard to strength and stiffness contribution from sheathing materials.

7. Design exterior framing to accommodate loads of exterior skin and cladding systems including window systems and curtain wall systems.

B. The framing and details shown on the Drawings are only intended to indicate the basic configurations, dimensions, profiles and appearance of the cold-formed metal framing and their relation to the structural framing. Not every condition is shown. The complete design, detailing, calculations, permitting, construction support, and structural observation of the cold-formed metal framing is the responsibility of the Contractor.

C. All primary structural steel framing shall be considered as having no (zero) torsional capacity and no (zero) capacity for lateral loads applied transversely to unbraced flanges of beams. A beam flange that is not secured to the floor slab by welded studs shall be considered unbraced. Where connections impose torsional loads or loads to unbraced flanges of beams, complete secondary steel bracing of the supporting structure shall be designed and provided by the Contractor; refer to the Structural Drawings.

D. LEED Performance Criteria:

1. Recycled-Content Materials: Steel stud and zee girt framing shall contain a minimum of 30 percent recycled content by weight, calculated by adding the post-consumer recycled content percentage to one-half of the pre-consumer recycled content percentage.

2.02 MANUFACTURERS

A. Cold-Formed Metal Framing: CEMCO (California Expanded Metal Products Company), Innovative Steel Systems, ClarkDietrich Building Systems, Knorr Steel Framing Systems, Steeler, Inc., Safeco Steel Stud Manufacturing Corp., or equal.

2.03 MATERIALS

A. General: Thickness or gage identification shall be color coded in accordance with ASTM C955.

B. Sheet Steel: ASTM A1003/A1003M, metallic coated, of the Classification as follows:

1. Studs, Joists, Tracks, Plates and Accessories 43-mils and Thinner: Structural Grade 33 Type H, with minimum yield strength of 33,000 psi.

2. Studs, joists, Tracks, Plates and Accessories 54-mils and Thicker: Structural Grade 50 Type H, with minimum yield strength of 50,000 psi.

3. Bridging: Structural Grade 33 Type H, with minimum yield strength of 33,000 psi.

C. Framing and accessories shall have a protective metal finish coating of zinc conforming to ASTM A653, G60 minimum.

D. Fasteners: Provide fasteners with a corrosion-resistant plated finish. Fasteners shall include, but are not limited to, the following:

1. Anchor Bolts: See section entitled “Structural Steel.”

2. Machine Bolts: See section entitled “Structural Steel.”

3. Self-Drilling Tapping Screws: ITW Buildex (ESR-1976), Global Fasteners LTD. (ESR-1730), or approved equal.

4. Power Driven Fasteners: Hilti, Inc. (ESR-1752), ITW Ramset (ESR-1955), or approved equal.

5. Resin Anchors: See section entitled “Anchors and Dowels in Resin.”

6. Expansion Anchors: See section entitled “Expansion Anchors.”

E. Miscellaneous Steel Shapes and Plates: ASTM A36.

F. Electrodes for Welding: Comply with AWS D1.3 requirements and as recommended by the stud manufacturer.

G. Touch-up Primer for Galvanized Surfaces: SSPC Paint 20 zinc rich; Z.R.C. Cold Galvanizing Compound by ZRC Worldwide, International Protective Coatings, or equal.

H. Non-Metallic, Non-Shrink Grout: ASTM C1107 with minimum compressive strength of 5000-psi at 28-days.

2.04 SYSTEM COMPONENTS

A. General:

1. Provide manufacturers' standard load-bearing cold-formed steel studs and joists, of the type, size, shape, indicated on the Drawings, as determined by the Contractor’s engineer and as specified herein:

2. Sizes, gages and properties of cold-formed metal framing and accessories shall conform to the Steel Stud Manufacturer’s Association designations and ESR-4943P.

3. Provide manufacturer's standard metal tracks, blocking, lintels, clip angles, shoes, reinforcements, and accessories for each type and application of cold-formed framing to provide a complete cold-formed metal framing system.

B. Studs shall be pre-punched web type with minimum 1-5/8 inch wide flanges.

C. Tracks shall be un-punched web type with minimum 1-1/4 inch wide flanges.

D. Tracks shall be the same gage as the studs or joists framing into them at a minimum.

2.05 FABRICATION

A. General Requirements:

1. Properties of cold-formed sections shall be computed in accordance with the AISI standards.

2. Member sizes, profiles shall be as shown on the Drawings with gage and spacing as required by the Contractor's engineer.

B. Fabricate cold-formed framing and accessories plumb, square and true to line according to AISI standards, ASTM C1007, manufacturer's written instructions and as required herein:

1. Cut framing members by sawing or shearing. Flame cutting is not permitted.

2. Cutting of flanges in stud and joist framing is not permitted.

3. Cutting holes in webs of studs and joists is allowed within the limits permitted by the Contractor's engineer.

4. Splices in studs and joists are not permitted unless allowed by the Contractor's engineer.

5. Framing components may be pre-assembled into panels prior to erecting.

6. Fasten cold-formed metal framing members to other cold-formed metal framing by welds or screws. Wire tying is not permitted. Welding shall be limited to 43-mil and thicker material and shall conform to AWS D1.3. Screws shall penetrate joined members by not less than three exposed screw threads.

7. Fasten cold-formed metal framing to supporting concrete and steel members using welds, screws, expansion anchors, resin anchors, power-driven fasteners or other approved methods.

8. Slip track shall be detailed to allow for inter-story drift and vertical deflection as noted under Article 2.01.

C. Reinforce, stiffen and brace pre-assembled framing panels to withstand handling and delivery stresses and to prevent damage or permanent distortion.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation work shall be performed in conformance with AISI standards, ASTM C1007 and the manufacturer's recommendations.

B. Install continuous tracks sized to match studs.

1. Align tracks accurately to layout at base and top of studs.

2. Secure tracks to the structure as recommended by stud manufacturer or as required by the Contractor's engineer for type of construction involved, except do not exceed 16-inch on center spacing for screw and weld attachments, 24-inch on center spacing for power-driven attachments, and 32 inch on center spacing for expansion anchor and resin anchor attachments.

3. Provide a minimum of 2-fasteners per track. Fasteners shall be located no more than 4-inches from corners or ends of tracks.

C. Provide non-shrink grout under top and bottom tracks in axially loaded walls as required to provide continuous bearing with the adjacent structure.

D. Set studs plumb, except as required for diagonal bracing, non-plumb walls, sloped floor or roofs, warped surfaces and other similar conditions.

E. Secure studs to top and bottom runner tracks at both inside and outside flanges.

F. Anchor stud walls or joists abutting structural columns, beams or walls to supporting structure as required by the Contractor's engineer.

G. Install continuous bridging or solid blocking in stud wall and joist systems at a maximum of 5'-0" on center.

H. Install continuous backing plates or solid blocking at panel edges of exterior finishes and metal decking in stud wall and joist systems.

I. Install supplementary framing, blocking, backing or other accessories required to support fixtures, equipment, casework and other similar items shown on the Drawings. Sizes and gages of supplemental members shall be as required by the Contractor's engineer.

J. Cold-formed metal framing shall not be continuous across expansion or seismic joints.

K. Install insulation in jambs and headers in accordance with Division 7 of the Specifications where the members will be inaccessible after installation of the framing.

L. Reinforce, stiffen and brace pre-assembled framing panels to withstand handling and erection stresses and to prevent damage or permanent distortion.

M. Install temporary erection bracing and supports as required for stability of the stud wall or joist system for the loads to which the structure may be subjected, including wind forces and other construction loads.

N. Install power-driven fasteners and screws in accordance with the manufacturer's ICC report.

O. Exterior framing shall not be anchored to building framing with power-driven fasteners. Exterior anchorage shall be achieved with anchors that are approved for seismic loading including, but not limited to, screws, wedge anchors, and resin anchors.

3.02 WELDING

A. Welding shall be performed only by welders certified for cold-formed metal framing per AWS D1.3. Welding shall conform to AWS and AISI requirements.

3.03 REINFORCEMENT AT OPENINGS

A. Provide reinforcement at openings required by the Contractor's engineer and as follows:

1. Openings larger 2 feet in width shall have a double stud or joist at each jamb except where more than two are required by the Contractor's engineer.

2. Fasten jamb studs together to uniformly distribute load. Refer to the Drawings for opening sizes and locations.

B. Not all openings are shown on the Drawings. Openings not shown, such as openings required for ducts, stacks, conduits, plumbing, etc., shall be cut, closed, supported, and reinforced by the trade requiring the openings in accordance with the structural requirements required by the Contractor's engineer.

3.04 FIELD QUALITY CONTROL

A. General: Primary structural beams and columns are detailed and erected using tolerances in accordance with the latest edition of AISC Specifications and exterior cladding shall be detailed to permit installation within these tolerances.

B. Tolerances:

1. Primary structural beams and columns are detailed and erected using tolerances in accordance with the latest edition of AISC Specifications and exterior cladding shall be detailed to permit installation within these tolerances.

2. Individual members and pre-assembled panels shall conform to the following tolerances unless AISC tolerances govern:

   a. Vertical alignment of studs (plumbness) shall be within 1/8-inch in 10-feet of the span.
   b. Horizontal alignment of walls (levelness) shall be within 1/8-inch in 10-feet of their respective lengths.
   c. Spacing of framing members shall not be more than plus 1/8-inch from the designed spacing provided that the cumulative error does not exceed the requirements of the finishing materials.
   d. Squareness of prefabricated panels shall be no more than 1/8-inch out of square within the length of the panel.
   e. Axially loaded studs shall sit squarely within 1/16-inch of the web portion of top and bottom tracks.

C. Galvanizing Repair: Where galvanized surfaces are damaged, repair surfaces with zinc rich paint in accordance with procedures specified in ASTM A780.

3.05 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Owner's Representative.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Owner's Representative for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Owner's Representative has reviewed and accepted the submittal.

F. Correction of defective work may be inspected by the Owner's Testing Agency.

END OF SECTION 05 4100

SECTION 05 5000
METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. **Custom fabricated galvanized steel** ladders **at elevator pit and Exterior Mechanical Well**.

2. ~~Cane rail at stairs~~**Manufactured aluminum ladders for roof access and exterior roof transitions**.

3. Supports for elevator entrances, rails, and hoist beams.

4. Steel bar gratings at sumps and other locations **not subject to public access**.

5. Painted pipe bollards.

6. ~~Cast in safety strips at concrete stairs not receiving an applied floor finish.~~**Pre-engineered support system at Studio ceilings.**

7. Sleeves for miscellaneous metal items.

8. Grouting required for setting miscellaneous metal items.

9. Miscellaneous concealed framing and supports including support system for benches, countertops, partial height partitions, and similar assemblies.

10. Shop priming.

11. Hot-dip galvanizing.

B. Related Requirements:

1. Structural Steel: Section 05 1200

2. Decorative Metal: Section 05 7000; metal gratings at walking surfaces.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, “Guarantees,” and Section 01 7839, “As-Built Documents.”

1.03 ACTION SUBMITTALS

A. Shop Drawings: Large-scale drawings for fabrication and erection of custom assemblies.

B. Product Data: Manufacturer's specifications for manufactured products.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. EQ 4.1: Printed statement of volatile organic compounds (VOCs) for field-applied adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Delegated Design: Calculations prepared by the engineer in responsible charge retained by the Contractor shall be submitted for of any elements requiring structural framing, support or bracing not shown on the Drawings to demonstrate compliance with CBC and specified performance requirements. Where specifications and code differ, the more severe requirements shall govern.

1.04 INFORMATIONAL SUBMITTALS

A. Certification for each welder.

B. Completed “Procedure Qualification Record” (PQR) and “Welding Procedures Specification” (WPS) forms for the welds to be performed under this Specification.

1.05 QUALITY ASSURANCE

A. Engineer in Responsible Charge: A professional engineer lawfully eligible in the State of California to design the element or component and to seal the design in accordance with state law and having a minimum of 10 years’ experience in providing engineering services of the kind required.

B. Exposed fabrications shall comply with Section 10 of the AISC Code of Standard Practice, recommended practices of the National Association of Architectural Metal Manufacturers (NAAMM), and additional requirements specified.

C. Qualifications:

1. Fabricator/Erector: Not less than five years successful experience in work of similar nature and complexity to that required under this Contract.

D. Welding:

1. Qualifications: Certified and qualified in accordance with AWS D1.1.

2. Procedures and operations shall comply with the following AWS publications:
   a. "Standard for Welding Procedure and Performance Qualifications," B2.1.
   b. "Welding Zinc Coated Steel" for galvanized products.

3. Continuous inspection of welding shall be provided if required by governing authorities.

E. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect steel from corrosion.

B. Store packaged materials in original unbroken package or container.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.07 FIELD CONDITIONS

A. Field Measurements:

1. Where metal fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings.
   a. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.
   b. Coordinate fabrication schedule with construction progress to avoid construction delays.

2. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Coordinate with other construction in order to ensure that actual dimensions correspond to established dimensions.

B. Verify locations of pipe guards and areas to be protected from vehicular damage or intrusion.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Structural Performance:

1. Railing Assemblies, Handrails, and Guardrails: Fabricate and install solid without shake or wobble and to withstand the following loads:

a. Concentrated load of 250 pounds applied at any point, non-concurrently, vertically or horizontally at the top rail.
b. Concentrated load of 250 pounds applied horizontally over any 1-foot square area of intermediate rails or infill.
c. At top rail, a uniform load of 50 pounds per linear foot applied horizontally at top rail, and a simultaneous load of 100 pounds per linear foot applied vertically.
d. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Ladders:

a. For lengths up to 10 feet, ladders including attachments shall support two loads of 250 pounds each concentrated between any two consecutive attachments.
b. For each 10 feet additional length or fraction thereof, ladders including attachments shall support an additional concentrated load of 250 pounds.
c. Each step or rung in each ladder shall support a single concentrated load of 250 pounds minimum.

B. Industry Standards:

1. Comply with "Metal Rail Manual" of National Ornamental and Miscellaneous Metals Association (NOMMA).

2. Comply with "Pipe Railing Manual" of National Association of Architectural Metal Manufacturers (NAAMM).

C. Regulatory Requirements:

1. Comply with the Americans with Disabilities Act (ADA).

2. Comply with the CBC and applicable State regulations.

2.02 METAL MATERIALS

A. Standard Structural Steel Shapes, Bars and Plates: ASTM A36.

B. Architectural and Miscellaneous Steel Items: ASTM A283, grade optional.

C. Steel Tubing: ASTM A500 welded or seamless, grade as required for proper strength except where used structurally tubing shall have a strength of not less than Fy = 46 ksi.

D. Steel Pipe: ASTM A53, Type E or S, Grade B for structural pipe; Grade A or Type F for railings where bending is required.

2.03 FASTENERS

A. General: Furnish Bolts, nuts, screws, clips, washers and any other fastenings necessary for proper erection of items specified and shown.

B. Exterior: Unless otherwise indicated as hot-dip galvanized, provide Type 316 stainless-steel fasteners for exterior use.

2.04 OTHER MATERIALS AND COMPONENTS

A. Electrodes for Welding: In accordance with AWS Code.

B. Nonshrink Grout: ASTM C1107; nonmetallic, nonstaining, nongaseous premixed grout with at least 8,000-psi compressive strength at 28 days, specifically recommended for location of use.

2.05 PROTECTIVE COATINGS

A. Galvanizing: Provide for ferrous metal items exposed to exterior atmosphere, shown on the Drawings, or specified to be galvanized using the hot-dip process after fabrication.

B. Interior Shop Primer for Ferrous Metal: ~~Modified alkyd; Tnemec Series "FD88 Azeron"~~ **Low odor, low VOC acrylic; AFM Safecoat "MetalCoat,"** or equal, ~~1.5 to 2.5~~ **2.0 mil** DFT.

C. Field-Applied Finish Paints: As specified in Section 09 9000, "Painting and Coating."

2.06 METAL FABRICATION ITEMS

A. Elevator Pit Ladders: Comply with ANSI A14.3 and meet Cal-OSHA Standards CCR Title 8, "Elevator Safety Orders."

B. Steel Ladders: Construct to comply with ANSI A14.3 and meet applicable OSHA standards.

1. Stringers: Flat bars, 3/8 inch x 2 inches.

2. Weld 3/4-inch-diameter, slip-resistant rungs at 12-inch centers.

3. Anchor stringers at top, bottom, and at intermediate locations.

C. Metal Grating at Sumps: Steel, nominal 1 inch x 3/16 inch bearing bars at 1-3/16 inch centers with 1/2 inch square cross bars, welded at 4 inches centers, galvanized, with bolted anchorage.

D. Bollards, Where Shown: Steel pipe, concrete filled, crowned cap, as detailed.

E. Miscellaneous Framing and Supports: Provide as required to complete the Work.

2.07 MANUFACTURED ITEMS

A. Aluminum Wall-Mounted Ladders:

1. General:

a. Ladders shall comply with ANSI A14.3 and meet Cal-OSHA standards.
b. Coordinate overall height of each ladder from field measurements.

2. Construction:

a. Rails: 2-7/8 inch channels with cast aluminum rung connectors, each secured to rails by means of four solid aircraft rivets.
b. Rungs: Extruded aluminum; serrated finish, 1-1/8 inches in diameter.
c. Coordinate overall height from field measurements.

3. Third Floor Access Ladder to Roof: 70 degree folding ladder; Model 460 by Alaco Ladder Company as specified, or equal.

a. Steps: 4 inch wide flat profile with nonslip ridges, mounted on 12 inches center.
b. Equip with mounting bracket-slide assemblies for flat storage against the wall and non-marking solid rubber feet extending 3/4 inch from the rail ends to provide slip-resistant positioning of ladder at a 70 degree angle.
c. Provide with customized aluminum sheet metal security panel extending to 8 feet above floor, lockable.
d. Finish: Mill.

4. Roof Transition Ladders: Fixed, 90 degree pitch, with walk-thru; Model FL-X Aluminum Fixed Vertical Ladder by Precision Ladders, LLC as specified, or equal.

a. Stringers: 2-1/2 inch by 1-1/16 inch by 1/8 inch extruded aluminum channel with molded safety caps at top.
b. Treads: 2-1/4 inch by 3/4 inch by 1/4 inch extruded aluminum with deeply serrated slip-resistant top surface, nominal 24 inches wide.
c. Mounting Brackets: 8-1/2 inch by 2 inch by 3 inch by 1/4 inch thick aluminum angles.
d. Walk-Thru:

1) Hand Rails: 1-1/4 inch aluminum square tube with rounded edges.
2) Mounting Brackets: 4 inch by 4 inch by 1/4 inch aluminum.
3) Side Rails: 42 inch side rail extension for through ladder exits.

e. Finish: Manufacturer's optional thermoset powder coating.

1) Color: Custom, as selected by Owner's Representative.

B. Pre-Engineered Support System: (Delegated Design) Minimum 12 gage "C" channel supports with anchors, attachments, and accessories as required for complete installation; "Unistrut" by Atkore International as specified, or equal.
1. Steel: ASTM A1011, SS Grade 33.
2. Materials and fittings shall be stamped and identifiable by manufacturer and part number.
3. Profiles:
a. Slotted Channels: P1000T.
b. Support Clips: P1379S.
c. Channel End Caps: P1180.
4. Design Value for Beams: 600 pound uniform loading. Assume bracing with threaded rod at midpoint of span between beams as shown on the Drawings.
5. Accessories: As required and including gripping screws and nuts not provided by system manufacturer.
6. Finish: "PG," pre-galvanized. Support system shall be shop or field finish painted as specified in Section 09 9000, "Painting and Coating," in color to match ceiling.

PART 3 - EXECUTION

3.01 FIELD PREPARATION

A. At the time of connecting, bearing surfaces shall be free from loose or non-adherent rust, loose mill scale, oil, grease, dirt, mud, and any foreign matter, coating, or defect that adversely affects the connection.

B. Surface preparation for welding shall be in accordance AWS D1.1, except loose or non-adherent rust, loose mill scale, and paint shall be removed by wire brushing.

C. Corrosion Protection of Dissimilar Materials: Protect surfaces that are in contact with concrete or masonry, or contact surfaces of dissimilar metals by coating the contact surfaces of each with two heavy coats of bituminous paint, or by suitable isolation gaskets, as approved and as applicable for each condition. Do not extend coating onto exposed surfaces.

3.02 INSTALLATION

A. Install metal fabrications as shown on the Drawings in accordance with reviewed submittals and referenced standards.

B. Cut, drill, and fit as required for installation.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete.

D. Set work accurately in location, alignment, and elevation; plumb, level, true, and free of rack; measured from established lines and levels.

E. Provide grouting for work of this Section using specified grout in accordance with manufacturer's directions.

F. Adjust items prior to securing in place so as to ensure proper matching of components and correct alignment.

G. Anchors and Fastening:

1. Anchor bolts shall be placed within the allowable tolerances as defined in the AISC Code of Standard Practice for Steel Buildings and Bridges.

2. Cast-in-place miscellaneous metals and fasteners shall be installed and set by template prior to concrete placement.

H. Holes that require enlarging to admit bolts shall be reamed. Holes shall not be enlarged by flame cutting.

I. Field Welding:

1. Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work.

2. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

3. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

4. Protect and clean areas surrounding welds.

5. Welding shall be done in a sequence, which minimizes distortion and shrinkage.

3.03 ADJUSTMENT AND TOUCH-UP

A. Inspect installed work. Correct deficiencies.

B. Field Galvanizing Repair:

1. Wire brush welds and damaged coating to clean bright metal.

2. Apply one coat of galvanizing repair paint where surfaces are concealed or are to be finish painted.

3. Use the specified galvanizing repair compound where surfaces remain exposed and unpainted.

C. Clean field welds; field bolts, and all damaged shop primer after erection and apply a spot coat of the same primer as used for the shop coat. Comply with manufacturer's requirements for conditions of surface and ambient conditions.

D. Restored finishes, damaged during installation and construction period, shall show no evidence of correction work.

E. Wet storage stains on galvanized steel shall be removed after installation.

END OF SECTION 05 5000

SECTION 05 5100
METAL STAIRS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior open Architectural Class Stairs with concrete-filled metal pan treads and applied floor covering.

2. Exterior Architectural Class Stair with precast concrete stair treads and perforated metal risers.

3. Shop priming.

B. Related Requirements:

1. Delegated Design: Section 01 3325

2. Precast Concrete Stair Treads: Section 03 4819.

3. Concrete Fill for Metal Stairs: Section 03 5600.

4. Decorative Metal: Section 05 7000; railings, guardrails, balustrades, and perforated metal risers at stairs.

5. Interior Architectural Woodwork: Section 06 4023; wood handrails and guardrail panels at interior stairs.

6. Resilient Flooring: 09 6500; resilient stair covering.

7. Painting and Coating: Section 09 9000; field-applied coatings.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Submit for fabrication of metal stairs. Show complete details, thicknesses, sizes, types, grades, classes of metal, finishes, connecting and joining methods, reinforcement, anchorage, and installation.

B. Product Data:

1. Specifications and installation recommendations as applicable.

2. Manufacturer's literature for shop applied paint products and other components where necessary to explain construction.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. EQ 4.2: Printed statement of volatile organic compounds (VOCs) for adhesives, paints, and coatings applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Delegated Design: Engineering data for stairs by engineer in responsible charge retained by the Contractor verifying compliance with structural design criteria.

1. Drawings shall be sealed and signed by engineer, or certification that structural portion of drawings are in compliance with structural design calculations shall be submitted.

2. Although all structural calculations shall be submitted, only reactions to structure are subject to review. Design engineer shall seal and sign the structural calculations.

1.04 INFORMATIONAL SUBMITTALS

A. Certification for each welder.

1.05 QUALITY ASSURANCE

A. Engineer in Responsible Charge: A professional engineer lawfully eligible in the State of California to design the element or component and to seal the design in accordance with state law and having a minimum of 10 years' experience in providing engineering services of the kind required.

B. Industry Standards:

1. Architectural Metal Products Division (AMP) of the National Association of Architectural Metal Manufacturers (NAAMM): “Metal Stairs Manual.”

2. American Welding Society (AWS): Standard Code for Welding in Building Construction, as modified by the American Institute of Steel Construction, "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings."

3. American Hot-Dip Galvanizer's Association (AHDGA): Standard Specification.

C. Welders' Qualifications: Welding shall be performed by certified welders qualified in accordance with procedures specified in American Welding Society (AWS) Standard in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.

1.06 FIELD CONDITIONS

A. Field-verify conditions affecting stairs. Obtain accurate dimensions for incorporation in shop drawings submitted before fabrication.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Metal Stairs: Pacific Stair Corporation, American Stair Corporation, or equal.

2.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Comply with the requirements of the CBC and ADA.

B. Structural: Design shall conform to code but not less than the following:

1. Stairs and platforms shall support a minimum uniform live load of 100 psf.
2. Individual stair treads shall support a 300 pound concentrated load placed in a position which would cause maximum stress.
3. Refer to the Structural Drawings for structural requirements at intermediate landings.

C. Stairs shall conform to requirements for Architectural Class metal stairs in accordance with the AMP/NAAMM “Metal Stairs Manual” in accordance with the layout and details shown on the Drawings.

2.03 MATERIALS

A. Steel:

1. Shapes, Bars, and Plates: ASTM A572, Grade 50 or ASTM A36.

2. Tubing: ASTM A500, Grade B. or ASTM A53, Grade B, Schedule 40.

3. Rolled Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 for A283, Grade C or D.

B. Electrodes for Welding: In accordance with AWS Code.

C. Fasteners: Select fasteners for the type, grade, and class required for the installation of steel stair items.

D. Anchors:

1. Manufacturer shall supply all fasteners and anchors required for a complete installation.

2. Size and type as appropriate for intended use.

E. Non-Shrink Grout: As specified in Section 05 5000, “Metal Fabrications.”

2.04 FABRICATION OF STAIRS

A. General:

1. Fabricate to layouts as shown. detailed on the Drawings, and in accordance with approved mocklup.

2. Form to shape and size with sharp lines, angles and arrises.

3. Shearing and punching shall leave clean, true lines and surfaces.

4. Thickness of metal, details of metal, details of assembly, and support shall give ample strength and stiffness for the intended purpose.

5. Provide lugs, clips, anchors, and miscellaneous fastenings necessary for complete assembly and installation.

6. Miter corners and angles of exposed moldings and frames.

B. Construct as shop-made subassemblies to greatest extent possible to meet specified performance criteria. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Use all-welded construction.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds shall be sanded smooth to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 or better.

D. Tread and Landing Type: See Drawings for location of each Type.

1. Steel pan with field installed concrete fill as specified in Section 03 5600, “Concrete Fill for Metal Stairs.”

a. Treads and Risers: Minimum 14 gage (0.0677 inches) sheet steel or heavier, reinforced as necessary.

1) Form each tread and riser subassembly from one piece of steel.

b. Landings: Minimum 12 gage (0.0966 inches) sheet, reinforced as necessary.

1) Reinforcing angles exposed to view shall be laid out symmetrically as shown on the Drawings.

2. Precast concrete treads and landings specified in Section 03 4819, "Precast Concrete Stair Treads."

3. Perforated Metal Risers: As specified in Section 05 7000, "Decorative Metal."

E. Stringers: Channels and tubes, as shown on the Drawings.

1. Stringers shall have closed ends.

2. Grind smooth for proper fit to headers.

F. Stairs shall have a toe plate forming a curbing, at all open edges of platforms and at all open ends and open back edges of treads.

G. Joints and Fastenings:

1. Conceal fastenings where practicable.

2. Locate joints symmetrically.

3. Fit adjacent pieces with hairline joints and aligned surfaces.

H. Balustrade, Railings and Guardrails

1. Style as shown on Drawings for each stair and specified in Section 05 7000, "Decorative Metal."

2. Coordinate installation of wood handrails and guardrail panels with Section 06 4023, "Interior Architectural Woodwork."

2.05 PROTECTIVE COATINGS

A. General:

1. Properly clean ferrous metal.

2. Hot-dip galvanize all ferrous metal at exterior stair.

3. Galvanizing, surface preparation prior to application of paint coatings, and additional System requirements are specified in Section 05 7000, "Decorative Metal."

B. Shop-Applied Primers: As standard with stair manufacturer. Verify compatibility with specified finish coatings.

C. Finish Coatings: As specified in Section 09 9000, “Painting and Coating.”

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Grout frames, plates, sills, bolts, and similar items set in concrete with grout as determined by the Design Engineer.

B. Welded Connections:

1. For permanent connections, use welds where possible.

2. Welds exposed to view shall be ground and dressed smooth.

C. Bolted and Screwed Connections:

1. Provide holes and connections for work of other trades.

2. Use bolts for field connections only.

a. Draw nuts tight. Nick threads of permanent connections.
b. Use beveled washer where bearing is on sloped surfaces.

3. Where screws must be used for permanent connections, use countersunk flathead type. Space exposed screws evenly and symmetrically.

D. Pour concrete treads in metal pans as specified in Section 03 5600, “Concrete Fill for Metal Pan Stairs.” Provide embedded metal safety strips as specified in Section 05 5000, “Metal Fabrications,” at stairs not scheduled to receive applied floor covering.

E. Attach stringers to structure only at floor levels. Allow a minimum 1/2 inch gap between stringers and walls.

3.02 PAINTING AND PROTECTION

A. If protective wrappings have been provided for any stair components, maintain them until work is ready for final painting.

B. Field Painting:

1. Touch up shop coats abraded or burned out by welding, using the same paint used for shop coat.

2. Apply finish coats as specified in Section 09 9000, “Painting and Coating.”

C. Protect against galvanic action wherever dissimilar metals are in contact, using zinc-chromate primer on contact surfaces.

END OF SECTION 05 5100

SECTION 05 7000
DECORATIVE METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior:

a. Steel balustrades and guardrails.
b. Glass display cabinet.
c. Corner guards.
d. Cane rails at stairs and seismic braces where shown and required by ADA.
e. Handrail brackets and reinforcing.
f. Stainless steel wall panel at elevator door head.

2. Exterior:

a. Metal grating walk surface at Bridge and North side Mechanical pit at grade.
b. Railings and guardrails at Exterior Stair and Bridge including handrail brackets.

3. Additional custom ornamental iron and metal work, both interior and exterior, as shown on the Drawings.

4. Shop-applied finishes.

B. Related Requirements:

1. Alternates: Section 01 2300; alternates affecting the work of this Section.

2. Mockups: Section 01 4339.

3. Structural Steel: Section 05 1200; steel framing at Bridge.

4. Metal Fabrications: Section 05 5000; embedded steel supports for decorative metal work.

5. Metal Stairs: Section 05 5100.

6. Interior Architectural Woodwork: Section 06 4023; wood components integral with decorative metal items.

7. Sheet Metal Flashing and Trim: Section 07 6200; additional requirements for exterior decorative sheet metal.

8. Painting and Coating: Section 09 9000; field-applied coatings.

9. Electrical: Division 16; integral lighting at exterior stair and Bridge handrails.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination:

1. Coordinate installation of anchorages. Furnish setting drawings, diagrams, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors, to be embedded in concrete and masonry.

2. Exterior Items: Coordinate with other Sections to ensure watertight installation and proper drainage.

3. Coordinate sequence of installation with Sections whose work adjoins decorative metalwork.

C. Pre-installation Meeting: Prior to installation of selected decorative metal items, Contractor, Owner's Representative, representative of metal fabricator, installer, and others whose work interfaces with decorative metal work or may affect its quality shall meet at the Project site to coordinate related requirements.

1. Selected decorative metal items include, but may not be limited to, the following:

a. Stair railings and guardrails.

2. Notify participants at least 5 working days before conducting meeting.

3. Record discussions of meeting and any conflict, incompatibility or inadequacy. Furnish a copy of record to each participant.

D. In addition, attendance is required at pre-installation meetings specified in other Sections whose work interfaces with work of this Section.

1.03 ACTION SUBMITTALS

A. Shop Drawings:

1. Prepare large-scale drawings for fabrication and erection of assemblies not completely shown by manufacturer's product data including, but not necessarily limited to, the following:
   a. Guardrails and railings.
   b. Display case.

2. Include, as appropriate, plans, elevations, complete details, thicknesses, sizes, types, grades, classes of metal, connecting and joining methods, anchorages.

3. Show required field measurements and interface with work of other Sections.

4. Welds, both shop and field, shall be indicated by AWS "Symbols for Welding, Brazing and Nondestructive Examination," A2.4.

5. Indicate all required field measurements.

6. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices as applicable.

7. Coordinate with shop drawing requirements of other Sections whose work adjoins decorative metalwork or where decorative metal is a component.

8. Provide shop drawings for mockups specified below.

B. Product Data: Manufacturer's specifications and installation instructions for manufactured products to be used in the fabrication of work, including paint products, finish hardware, and other exposed hardware.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. Credit EQ 4.1: Printed statement of volatile organic compounds (VOCs) for adhesives applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Samples:

1. Each type of exposed fastener or hardware.

2. Stainless steel mesh.

3. Other products involving selection of color, texture, or design as requested by the Owner’s Representative.

1.04 INFORMATIONAL SUBMITTALS

A. Qualifications as specified.

B. Minutes of pre-installation meeting.

C. Welding:

1. Statement of qualifications for fabricator, installer, and welders.

2. Completed “Procedure Qualification Record” (PQR) and “Welding Procedures Specification” (WPS) forms for the welds to be performed under this Section.

D. Delegated-Design: Prepare and submit engineering calculations for metal gratings, railings, guardrails, and balustrade assemblies to verify compliance with performance and design criteria, and acceptance by the authorities having jurisdiction. Calculations shall be signed and sealed by the engineer in responsible charge retained by the Contractor. Engineer shall be a California licensed civil or structural engineer.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Fabricator/Installer: Documented experience in fabrication and installation of decorative metal similar to that indicated for this Project, and with a record of successful in-service performance.

2. Coating Applicator: A firm experienced in successfully applying organic coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

3. Welders: Certified and qualified in accordance with procedures specified in American Welding Society Standard in accordance with AWS D1.1, using procedures, materials, and equipment of the type required for the work.

B. Welding procedures and operations shall comply with AWS B2.1, "Standard for Welding Procedure and Performance Qualifications." Comply with AWS publication "Welding Zinc Coated Steel" for galvanized products.

C. Mockups:

1. General:

a. Each mockup shall consist of a typical assembly in specified finish, complete with mounting devices, and shall be sufficiently large and complete to demonstrate installation and aesthetic effect of completed assembly.
b. If requested by Owner’s Representative, install mockup at location selected by Owner’s Representative.
c. If requested, make modifications to mockups without additional charge to Owner.
d. Do not proceed with remainder of installation until mockups have been approved.
e. Where appropriate and acceptable to Owner’s Representative, approved mockups may become part of the completed Work.
f. Comply with the additional requirements specified in Section 01 4340, “Mockups.”

2. Provide a full-size mockup of the following items for review and approval by Owner's Representative:

    a. Section of each stair guardrail type including minimum of two supports, handrail, and infill mesh or panel as applicable to each design. Coordinate with Section 06 4023, "Interior Architectural Woodwork."

3. In addition, first installed example of each type or configuration of decorative metal, and each installation condition, if not illustrated by above mockups, shall serve as a mockup for review and approval by Owner's Representative of workmanship, visual effect, and interface with adjacent construction.

1.06 FIELD CONDITIONS

A. Field Measurements: Where decorative metal is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings.

1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.

2. Coordinate fabrication schedule with construction progress so as to avoid construction delays.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE REQUIREMENTS

A. Decorative steel shall be considered Architecturally Exposed Steel (referred to as "AES" or "AESS") and shall conform to the recommended practices of the Architectural Products Division (AMP) of the National Association of Architectural Metal Manufacturers (NAAMM), Section 10 of the AISC Code of Standard Practice, and the additional requirements of this Section.

B. Sheet metal work shall comply with applicable provisions of the "Architectural Sheet Metal Manual (SMACNA Manual)," as issued by the Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA).

C. Design exterior items to be watertight and to drain properly.

D. Structural Performance of Railing Assemblies, Handrails, and Guardrails:

1. General: In engineering stainless steel railing components to withstand structural loads indicated, determine allowable design working stresses of railing materials based on 60 percent of minimum yield strength.

2. Handrails and Top Rails of Guards:

    a. Uniform load of 50 lb/ft applied in any direction.
    b. Concentrated load of 200 lb applied in any direction.
    c. Uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Guards:

   a. Concentrated load of 50 lb applied horizontally on an area of 1 square foot.
   b. Infill load and other loads need not be assumed to act concurrently.

E. Industry Standards:

1. Comply with "Metal Rail Manual" of National Ornamental and Miscellaneous Metals Association (NOMMA).

2. Comply with "Pipe Railing Manual" of National Association of Architectural Metal Manufacturers (NAAMM).

F. Regulatory Requirements:

1. Comply with the Americans with Disabilities Act (ADA).

2. Comply with CBC.

G. If modifications to designs indicated are proposed in order to meet code requirements, indicate them as such on shop drawing submittals. Work with Owner's Representative to arrive at an acceptable design that is sufficiently similar to the design indicated.

2.02 METAL MATERIALS

A. General: Metal surfaces exposed to view shall not exhibit pitting, seam marks, roller marks, splice marks, mill identification markings, stains, discolorations, or other blemishes and imperfections.

B. Steel: Provide steel and iron, in form indicated, to comply with the following requirements:

1. Plate, Shapes, and Bars: ASTM A36.

2. Sheet: Commercial-quality, cold-rolled, stretcher-leveled, carbon-steel sheet complying with ASTM A1008, Class I, matte finish.

3. Tubing: Cold formed, ASTM A500.

4. Pipe: ASTM A53, Grade B, Schedule 40.

5. Gray-Iron Castings: ASTM A48, Class 30.

6. Malleable-Iron Castings: ASTM A47, grade as recommended by fabricator for type of use indicated.

C. Stainless Steel:

1. Alloy: Type 304 at interior, Type 316 at exterior, unless otherwise indicated or specified.

2. Sheet and Plate: ASTM A167 or A240.

3. Bars: ASTM A276.

4. Tubing for Railings and Guardrails: ASTM A554.

5. Finish: No. 4 directional satin.

D. Aluminum:

1. Plate and Sheet: ASTM B209, Alloy 3003.

2. Extrusions: ASTM B221, alloy 6063-T5. Provide high-strength 7000 Series alloy at locations required to meet specified performance criteria and where noted.

3. Finish: As specified.

2.03 ADDITIONAL MATERIALS

A. Resilient Pads: Closed-cell neoprene complying with ASTM C864, in black color.

B. Anchor Bolts: ASTM A307, nonheaded type, unless otherwise indicated.

C. Fasteners: Use fasteners of same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Fasteners for Exterior Steel Items:

a. Use stainless steel for fasteners up to 1/2 inch in diameter, unless otherwise shown.
b. Use hot-dip galvanized fasteners for fasteners over 1/2 inch in diameter, unless otherwise shown.

2. Provide concealed fasteners for interconnecting decorative metal components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method. Exposed fasteners shall be indicated on required submittals.

D. Wood Components Associated with Decorative Metalwork: As shown and conforming to requirements specified in Section 06 4023, "Interior Architectural Woodwork."

E. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength, and compatibility in fabricated items.

F. Adhesive: VOC compliant, epoxy resin type, unless otherwise recommended by metal manufacturer and fabricator.

G. Nonshrink Grout: As specified in Section 05 5000, “Metal Fabrications.”

2.04 MANUFACTURED ITEMS

A. Metal Mesh at Stair Guardrails: Rigid woven stainless steel fabric; “Plait” pattern by Cambridge Architectural, or equal.

1. Wire Diameter: 0.365 inches.

2. Open Area: 64 percent.

3. Aperture Diameter: 0.248 inches.

4. Material: Stainless steel.

B. Metal Grating at Bridge and Mechanical Well:

1. Manufacturer and Product: 2-1/4 inch by 3/16 inch close mesh; "GCM Series" by McNichols, or equal.

2. Material: Aluminum, mill finish.

3. Bar Sizing and Spacing: Delegated design.

4. Provide hinges and locking clasp at operable panels.

C. Corner Guards:

1. Material: 18-gage (nominal 0.050 inch) stainless steel, Type 304, with No. 4 polished finish.

2. Dimensions: 2 inches by 2 inches by 8 feet high.

3. Edges: Eased.

4. Corner Radius: 1/8 inch.

5. Adhesive: Low VOC epoxy or polyurethane type as recommended by manufacturer for intended application and substrate.

2.05 FABRICATION - GENERAL

A. Form decorative metal to required shapes and sizes, with true lines and angles. Provide components in sizes and profiles indicated.

B. Use special care so as to avoid bending, twisting, or otherwise distorting individual members.

C. Provide rebates, lugs, and brackets as required to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise indicated. Use concealed fasteners, unless otherwise indicated on reviewed shop drawings.

D. Joints and Connections:

1. Shop-assemble items to greatest extent possible so as to minimize field splicing and assembly. Disassemble only as necessary for shipping and handling limitations. Clearly mark items for reassembly and coordinated installation.

2. Use connections that maintain structural value of joined pieces.

3. Detail connections to facilitate fabrication and erection in accordance with the referenced AISC code.

4. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather so as to exclude water penetration.

5. Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, and other connectors as required.

6. Fabricate and space anchoring devices as shown and required to provide adequate support for intended use.

E. Welding and Brazing: Comply with AWS-recommended practices.

1. Welds shall be continuous unless otherwise approved for a specified fabrication by Owner's Representative during submittal review.

2. Weld and braze behind finished surfaces without distorting or discoloring exposed side.

3. Remove flux from exposed welded and brazed joints. Dress exposed and contact surfaces.

F. Finishing:

1. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.

2. Welds, burrs, roller marks, seams, and rough surfaces shall be ground neat and smooth unless otherwise approved for a specified fabrication by Owner's Representative during submittal review.

3. Mill markings shall be completely removed.

4. Gouges, dents, and other surface abuse shall be filled and ground smooth.

2.06 GALVANIZING

A. Provide zinc coating for items exposed to exterior atmosphere, shown on the Drawings, or specified to be galvanized using the hot-dip process after fabrication.

1. Comply with ASTM A153 for galvanizing of iron and steel hardware.

2. Comply with ASTM A123 for galvanizing of assembled steel products and rolled, pressed, and forged-steel shapes, plates, bars, and strips 1/8 inch thick and heavier.

B. Surface Preparation Prior to Galvanizing: In accordance with SSPC Specification SP-10, "Near White Blast Cleaning."

C. Newly galvanized items shall not be water quenched or chromate quenched after galvanizing if they are scheduled to receive a paint coating.

2.07 PROTECTIVE PAINT COATINGS

A. General:

1. Comply with manufacturer's preparation and application instructions for each coating and NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Manufacturer's instructions shall govern in event of conflict.

2. Coatings shall be shop-applied to the greatest extent possible, including galvanized items, except surfaces and edges to be field welded.

    a. Acrylic coating systems specified for galvanized steel products and specified in Section 09 9000, 'Painting and Coating," may be totally shop-applied, have primer applied in shop with topcoats applied in field, or be totally field-applied at Contractor's option. Specified waterborne epoxy primer is UV stable and may be left exposed in field prior to application of finish coats.
    b. Interior non-galvanized steel shall be shop-primed and either shop or field finish painted.

3. Corrosion Control: Prevent galvanic action and other forms of corrosion by insulating metals from direct contact with incompatible materials.

4. Steel members shall be protected and be free of corrosion when ready to receive field-applied finish coatings. Apply coatings before rusting occurs.

5. Metal shall be degreased.

6. Apply air-dried primer after cleaning and pretreatment, to provide a minimum dry film thickness.

7. Finish Painting: Where not shop finished, field finish painting shall conform to requirements specified in Section 09 9000, "Painting and Coating."

8. Finish exposed fasteners to match adjacent metal.

B. Products:

1. Shop Primers and Finish Paints: As specified under each coating system. Primer paint shall be compatible with finish coat.

2. Galvanizing-Repair Paint: Minimum 82 percent zinc-dust-content paint for regalvanizing welds in galvanized steel; "Z.R.C. Cold Galvanizing Compound" by ZRC Worldwide, "Cold Galv Primer" by Valspar, or equal.

C. Repair galvanized coating damaged after fabrication during handling, installation, or welding. Use specified repair paint in accordance with ASTM A780, AGA publication, "Recommended Practice for Touch-up of Damaged Galvanized Coatings," and manufacturer's recommendations for application of repair paint.

D. Surface Preparation - General:

1. All Metals: Removal soluble salts as specified in Section 09 9000, "Painting and Coating," prior to any surface preparation.

2. Non-Galvanized Steel: SSPC-SP No. 6/NCACE No. 3 "Commercial Blast Cleaning."

3. Galvanized Steel: As specified.

4. Comply with any additional procedures required by the coating manufacturer.

E. Surface Preparation - Galvanized Surfaces:

1. General: Surfaces shall be cleaned and profiled prior to receiving applied coatings in accordance with ASTM D6386 or ASTM D7396 for sheet products.

a. Methods shall be selected based on age of galvanized coating, condition of surface and intended paint coating.
b. High spots and rough edges shall be smoothed out.
c. Care shall be taken not to damage the zinc coating.
d. Do not use phosphate treatment on galvanized surfaces scheduled to receive zinc-rich primers.

2. Cleaning: Surface shall be prepared in accordance with SSPC SP-1 with specified cleaner and followed by application of pre-paint conditioner.

3. Profiling: After cleaning, surfaces shall be profiled by abrasive sweep or brush blasting to smooth surface.

a. Blast material particle size for profiling galvanized steel should range between 8 to 20 mils (200 to 500 microns).
b. The blast profile on the galvanized surface should be less than 2.0 mils and more than 1.0 mils.
c. Profiling is not required for galvanized sheet metal.

4. Comply with the additional recommendations included in the AGA document “Duplex Systems: Painting Over Hot Dip Galvanized Steel,” ASTM D6386, and any additional procedures required by the coating manufacturer.

F. Steel Coatings:

1. System INT 5.1M-5– Premium Performance Acrylic Coating - Interior:

a. Surface Preparation prior to Priming: As specified.
b. Shop Primer: Modified alkyd; Tnemec Series "FD88 Azeron" or equal.
c. Finish: As specified in Section 09 9000, "Painting and Coating."

2. System EXT 5.1H-5 - High-Performance Acrylic Polymer Coating - Exterior:

a. Galvanizing and Surface Preparation: As specified.
b. Primer, Intermediate, and Topcoat: As specified in Section 09 9000, "Painting and Coating."

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install decorative metalwork as shown on the Drawings in accordance with reviewed submittals and referenced standards.

B. Cut, drill, and fit as required for installation.

C. Set work accurately in location, alignment, and elevation; plumb, level, and true; and free of rack; measured from established lines and levels.

D. Adjust items prior to securing in place so as to ensure proper matching of components and correct alignment.

E. Field Welding:

1. Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds and for methods used in correcting welding work.

2. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

3. Grind exposed welded joints smooth, unless otherwise specified, and restore finish to match finish of adjacent surfaces.

F. Erection Tolerances:

1. Variation from Level: Maximum 1/4 inch in any column to column space or 20-foot run, noncumulative.

2. Offsets in End-to-End or Edge-to-Edge Alignment of Consecutive Members: 1/16 inch.

3.02 RAILINGS AND GUARDRAILS

A. Cope neatly to fit.

B. Longitudinal members shall be parallel to each other, to floor surface, or to slope of stairs as shown.

C. Center line of members within each railing run shall be in same vertical plane.

D. Secure wall railing brackets to stud wall construction with bolts into solid backing.

1. Space brackets as shown. If not shown, then space at maximum 60 inches on center and 9 inches from end of rails.

2. Return rails to walls at ends.

E. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction. Remove any burrs or protrusions that might snag fingers or clothing, and grind and polish smooth.

3.03 ADJUSTMENT AND TOUCH-UP

A. Inspect installed work, with particular attention to railings and handrails. Correct deficiencies.

B. Immediately after erection, touch up abraded areas of shop paint, and paint all exposed areas with same material as used for shop painting.

1. Apply by brush or spray.

2. Touch-up shall not be noticeable.

C. Restore finishes damaged during installation and construction period so that no evidence of correction work remains.

D. Return items that cannot be refinished in the field to the shop. Make required alterations and refinish entire unit, or provide new units.

3.04 PROTECTION

A. Protect finishes of decorative metal from damage during construction period as required.

END OF SECTION 05 7000

SECTION 06 1053
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Exposed plywood backing for utilities.
2. Miscellaneous blocking, backing, and nailers.
3. Wood treatments.

B. Related Requirements:

1. Built-up Bituminous Roofing: Section 07 5100.
2. Non-Structural Metal Framing: Section 09 2216.
3. Gypsum Board: Section 09 2900.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."
2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

1.03 ACTION SUBMITTALS

A. Product Data: Wood treatment certification and instructions for proper use of each type of treated material.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit EQ 4.1: Printed statement of volatile organic compounds (VOCs) for field-applied adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

b. Credit MR 6: Certificates of chain-of-custody signed by manufacturer certifying that wood products were obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

1) Include evidence that millwork manufacturer is certified for chain-of-custody by an FSC-accredited certification body.

2) Include statement indicating costs for each certified wood product.

1.04 INFORMATIONAL SUBMITTALS

A. Treated Wood Products:

1. Certified test report showing compliance with specified performance characteristics and physical properties. Include in test report certification that fire retardant solution does not contain ammonium phosphate.

2. ICC ES Report indicating flamespread, strength, corrosion and hygroscopic properties.

1.05 QUALITY ASSURANCE

A. Lumber-grading rules and wood species shall conform to Product Standard PS 20 and "Standard Grading and Dressing Rules No. 16" of the West Coast Lumber Inspection Bureau (WCLIB).

B. Plywood shall conform to requirements of Product Standard PS 1.

C. Rough carpentry shall conform to applicable requirements of local building code and CBC, Chapter 25, unless otherwise noted.

D. Grade Marks:

1. Identify lumber and plywood by official grademark, or provide inspection certificates from appropriate grading and inspecting agencies.

2. Do not expose faces with grademarks.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Immediately upon delivery to jobsite, place materials in area protected from weather.

B. Protect lumber stored on site from rain and excessive sun. Stack in such fashion as to prevent twisting and warping.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Sustainable Design: Not less than 50 percent of the miscellaneous rough carpentry wood on the Project shall be FSC Certified.

2.02 MATERIALS

A. Lumber:

1. Dimensions:
   a. Specified lumber dimensions are nominal.
   b. Actual dimensions shall conform to industry standards established by the National Grading Rule Committee.

2. Moisture Content: Provide S-Dry seasoned lumber at time of permanent closing in of building for all framing, except provide FOHC lumber for 4 inch or greater nominal thickness.

3. Dressing: Lumber shall be dressed S4S, unless otherwise noted.

4. Species: Unless otherwise noted, framing lumber shall be Douglas Fir.

5. Grades: Following lumbers are specified in accordance with WCLIB grade designations.
   a. Backing and Furring: 2 inches to 4 inches thick x 2 inches to 4 inches wide, "Standard" or better grade, paragraph 122-b.

B. Plywood: Group 1 species complying with US Product Standard PS 1.

1. Veneer Grade at Exposed Utility Backing: B-D or B-C Exterior or Interior with exterior glue, five plies for 1/2 inch and thicker.

C. Rough Hardware:

1. Screws for attaching wood members and plywood to metal stud walls, partitions and furring shall be Type S self-drilling, self-tapping, steel drywall screws of required lengths as specified in Section 09 2900, "Gypsum Board."

2. Hot-dip-galvanize items exposed to moisture or weather.

2.03 WOOD TREATMENTS

A. Fire-retardant-treated wood shall have an Underwriters' Laboratories stamp signifying a FR-S rating certifying a 25 or less flame-spread and smoke-developed value when tested in accordance with ASTM E84.

B. Acceptable Fire-Retardant Pressure Treatment: Registered for use as a wood preservative by the U.S. Environmental Protection Agency (EPA), free of halogens, sulfates and ammonium phosphate, and AWPA Standard U1; “Dricon” by Lonza Wood Protection, or equal.

C. After treatment, kiln-dry plywood to maximum 15 percent moisture content and lumber to maximum 19 percent moisture content.

D. Locations of Use:

1. All concealed lumber, and plywood except as otherwise specified, shall be fire retardant treated.

2. Exposed back boards for electrical and telephone panels and other equipment shall be fire retardant treated.

E. Where fire retardant treated wood is exposed to weather, it shall be identified as "Exterior" to indicate there is no increase in the listed flame spread index as defined in CBC Section 2303.2 when subjected to ASTM 2898.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Work shall be accurately cut and solidly fitted together so as to provide strong, rigid joints, with full bearing for all members.

2. Surfaces shall be level, plumb, and true.

3. Provide accessories and install in accordance with manufacturer's specifications.

B. Blocking:

1. Provide and install wood blocking, plywood backing, furring strips, or grounds detailed or required to provide anchorage for finishes, accessories, fixtures, and similar items required to complete work.

2. Blocking and/or backing shall be securely bolted or otherwise anchored in place.

C. Plywood: Comply with recommendations of the APA for fabrication and installation of plywood work.

1. Lay with face grain perpendicular to supports.

2. Butt panel ends and edges to a close but not tight fit (allow 1/16-inch space).

END OF SECTION 06 1053

SECTION 06 1643
GYPSUM SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for non-structural gypsum wall sheathing.

B. Related Requirements:

1. Delegated Design: Section 01 3325

2. Structural Metal Stud Framing: Section 05 4100.

3. Modified Bituminous Membrane Roofing: 07 5200; cover board at roof insulation.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data for each product.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Immediately upon delivery to jobsite, place materials in area protected from weather.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-Structural Gypsum Sheathing: ASTM C1177, Type X, fiberglass-faced, silicone-impregnated core; Georgia Pacific "DensGlass Fireguard," “Securerock” Firecode Core by United States Gypsum, or accepted equal.

1. Thickness: 5/8 inch.

2. Size: 4 feet x maximum lengths possible; 8 feet minimum.

3. Edge: Square.

2.02 ACCESSORIES

A. Fasteners:

1. Wall Sheathing: Corrosion-resistant conforming to ASTM C954 and requirements of CBC Section 1403.3; USG "Sheathing Type SF," or equal.

a. Length as recommended by manufacturer for board thickness and substrate.
b. Provide Type specifically designed for attachment to heavy steel gage metal framing.

PART 3 - EXECUTION

3.01 INSTALLATION – NON-STRUCTURAL WALL SHEATHING

A. Install sheathing vertically or horizontally using specified fasteners in accordance with board manufacturer's installation recommendations.

B. Fit boards tightly against each other and around openings.

1. If applied vertically, edges shall be parallel to and centered over studs.

2. Stagger end joints.

C. Provide back blocking or supplemental framing where recommended by board manufacturer and wherever end joints do not bear against framing.

D. Secure to framing using specified fasteners.

1. Secure to supports in accordance with manufacturer's recommended spacing, but space fasteners not more than 4 inches on center around perimeter at edge and end supports and 8 inches on center at intermediate supports.

2. Install flush with face of board; do not countersink.

3. Keep perimeter fasteners 3/8 inch from edges and ends of board units.

END OF SECTION 06 1643

SECTION 06 4023
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wood handrails.

2. Plywood infill panels at stair balustrades and guardrails.

3. Other miscellaneous millwork items as shown and not provided under other Sections.

B. Related Requirements:

1. Decorative Metal: Section 05 7000; metal balustrades and guardrails to receive millwork.

2. Architectural Wood Casework: Section 06 4100.

3. Wood Ceiling and Wall Panels: Section 09 5426; perforated plywood wall and ceiling panels.

4. Painting and Coating: Section 09 9000; field-applied coatings.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

B. Coordination:

1. Provide blocking and backing for finish items, including wood ceiling, as required. Coordinate with Section 06 1053, “Miscellaneous Rough Carpentry,” and Section 09 2216, “Non-Structural Metal Framing.”

2. Coordinate fabrication and finishing of plywood infill panels with Section 09 5426, “Wood Ceiling and Wall Panels.” Appearance match is required.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Submit for handrail layouts.

1. Include "to-scale" dimensioned plans and elevations and large-scale details, identifying components used, joint locations, brackets, and method of attachment.

2. Prepare in accordance with the Architectural Woodwork Standards (AWS) Section 1 Article entitled “Submittals.”

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

b. Credit MR 7: Certificates of chain-of-custody signed by millwork manufacturer certifying that wood products were obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

1) Include evidence that millwork manufacturer is certified for chain-of-custody by an FSC-accredited certification body.
2) Include statement indicating costs for each certified wood product.

c. Credit EQ 4.1:

1) Printed statement of volatile organic compounds (VOCs) for adhesives and sealers applied inside the weatherproofing.
2) Include statement indicating costs for each product.

d. Credit EQ 4.2:

1) Printed statement of volatile organic compounds (VOCs) for paints and coatings applied inside the weatherproofing.
2) Include statement indicating costs for each product.

e. Credit EQ 4.4:

1) Product data from manufacturer of composite wood and agrifiber materials stating that they contain no added urea-formaldehyde resins.
2) Include statement indicating costs for each product.

C. Samples:

1. Wood: 12-inch length of handrail in required profile and finished as specified.

a. Finish shall be applied in step fashion showing unfinished wood and each applied coating.
b. Submit for acceptance prior to fabrication of the work.

2. Perforated Panels: Nominal 16-inches wide by 24 inches in specified perforation pattern complete with application of specified fire retardant treatment and specified finish system.

    a. Clearly note with each submittal variations from specified coatings and methods used, if any, for unifying appearance prior to application of clear topcoats.
    b. Allow for up to two additional submittals with adjustments to veneer and coatings to achieve appearance acceptable to the Owner's Representative.

3. Additional Samples: As requested by Owner's Representative.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Verifiable successful experience in successful completion of work similar to work of this Project.

B. Mockups:

1. General:

    a. Upon completion of each mockup, notify Owner's Representative and make arrangements for review not less than one week in advance of the dates and times when mockup will be available for review.
    b. Modify the mockup, or construct new components if requested by the Owner's Representative for further evaluation and until final acceptance is obtained.
    c. Similar millwork shall not be installed until mockup is accepted.
    d. Accepted mockups may remain as part of the completed work and shall serve as a visual standard of quality and appearance of the work it represents, including interface with adjacent materials and components.
    e. See additional requirements specified in Section 01 4339, "Mockups."

2. Handrail and Guardrail Infill: Coordinate with mockup provided under Section 05 7000, "Decorative Metal."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until ambient conditions required can be and are maintained.

B. Do not deliver millwork until wet work, painting, grinding, and similar operations in storage and installation areas that could damage, soil, or deteriorate millwork have been completed.

C. Store products only in areas where ambient conditions required can be and are maintained.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.06 FIELD CONDITIONS

A. Before fabricating, obtain field measurements, and verify that dimensions are as indicated on the shop drawings

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Architectural wood casework shall comply with the applicable requirements of the AWS (referred to as the "woodworking standard") including Section 6, Interior & Exterior Millwork," and Section 7, "Stairwork & Rails." Where Contract Documents indicate requirements that conflict with or augment the woodworking standard, comply with the conflicting or augmenting requirements.

B. Sustainable Design Requirements:

1. Lumber shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

2. Adhesives shall meet or exceed the South Coast Air Quality Management District Rule 1168 VOC Requirements.

3. Plywood and adhesives shall be formaldehyde free.

2.02 WOOD MATERIALS

A. General:

1. Moisture Content at Time of Fabrication: As specified in woodworking standard.

2. Provide wood dressed on all exposed faces.

3. Do not use twisted, warped, bowed, or otherwise defective wood.

4. Sizes indicated on Drawings and specified are net actual size, unless otherwise indicated.

5. Do not mark or color material, except where such marking will be concealed in finish work.

6. Lumber shall be free of sapwood, knots, pitch, or resin and conform to AWS Custom Grade requirements; except that lumber to receive transparent finish shall conform to AWS Premium Grade requirements.

B. Handrails: Solid stock Premium Clear Hard Maple, 1-1/2 inch diameter, with radius corners. See Drawings for support details.

2.03 PANEL MATERIALS

A. Plywood Panels: Formaldehyde free, hardwood veneer plywood complying with ANSI/HPVA HP-1; "Europly PLUS" by Columbia Forest Products, or equal.

1. Nominal Panel Thickness: As noted on the Drawings.

2. Face Veneer Species: FSC certified White Maple, Plain sliced.

3. Inner Plies: Uniform laminations of solid Birch.

4. Panel Sizes: As shown on the Drawings.

5. Edge Profile: Square.

6. Perforation Pattern: As shown on the Drawings.

7. Shop cut penetrations, fixture cut-outs, and custom sizes.

8. Flammability:

   a. Stair Guardrail at Exit Enclosures (CBC 803.11.2): Class I or A.

      1) Smoke Developed: 50 or less.
      2) Flame Spread: 25 or less.

2.04 ACCESSORIES

A. Adhesive: VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Glue: VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Hardware:

1. General: Furnish items required to complete the Work.

2. Handrail Brackets: Custom, as shown on the Drawings.

3. Exposed Fasteners at Plywood Panels: As shown on the Drawings.

4. Edge Trim at Plywood Panels: As shown on the Drawings.

2.05 FABRICATION - GENERAL

A. Conform to AWS Custom Grade requirements, unless otherwise specified.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting.

C. Provide in maximum possible lengths to minimize joints.

2.06 FINISHING

A. General:

1. Do not apply finishes until sample submittals are reviewed and approved by the Owner's Representative.

2. Apply entire finish in shop to greatest extent possible with final touch-up performed after installation.

3. Comply with AWS Premium Grade requirements for transparent finish.

B. Fire-Retardant: Penetrating, non-toxic, formaldehyde free, VOC compliant treatment applied to achieve specified flammability requirements for panels after application of transparent finish system; "Flame Stop II" by Flame Stop, Inc., or equal.

1. Treatment shall not warp panel or discolor finish veneer.

2. Treatment shall be compatible with waterborne finish system.

C. Transparent Finish:

1. Stain: If required to provide a unified light Maple appearance and match panels specified in Section 09 5426, "Wood Ceiling and Wall Panels"; "Safecoat DuroStain."

2. Finish: Low VOC, low odor, spray-applied polyurethane; "Safecoat Polyureseal BP" by American Formulating and manufacturing, or equal.

a. One Coat Sealer: "Safecoat Safe Seal."
b. Two Topcoats: "Safecoat Polyureseal BP," satin gloss level.

1) Sand first topcoat.
2) Allow to cure full time recommended by manufacturer before buffing.

c. Appearance and Gloss Level: Satin, to match approved sample.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition millwork to humidity and temperature in installation area prior to installing.

3.02 INSTALLATION

A. General:

1. Do not use materials that are unsound, warped, improperly treated or finished, or inadequately seasoned.

2. Do not use fabricated units with defective surfaces, sizes, or shop-applied finish.

B. Install all millwork plumb, true, aligned with adjacent materials, and in accordance with the Drawings and AWS Standard. Match accepted mockups.

C. Fastening: Secure with anchorage as indicated and as recommended by manufacturer, when applicable.

D. Accurately scribe work abutting other components, with maximum gaps of 1/16 inch.

E. Install items specified in this Section, and items specified under other Sections which are not to be installed by manufacturer or supplier.

1. Install in accordance with the Drawings, manufacturer's printed instructions, and any additional requirements included in the respective Specification Section.

2. Wall-mounted items shall be securely fastened to solid backing or blocking.

F. Field Finishing: Apply in accordance with Section 09 9000, “Painting and Coating."

END OF SECTION 06 4023

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Custom cabinetry (casework) with wood veneer facing.

2. Preparation of casework for utilities.

3. Finish hardware for casework.

B. Related Requirements:

1. Joint Sealants: Section 07 9200.

2. Resilient Flooring: Section 09 6500; resilient base at cabinets.

3. Plastic-Laminate-Clad Countertops: Section 12 3623.

1.02 DEFINITIONS

A. Unless otherwise specified, exposed, semi-exposed, and concealed surfaces shall conform to the cabinet surface terminology in Section 10 - Casework of the "Architectural Woodwork Standards (AWS)," published jointly by WI, AWI and AWMAC.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

B. Coordinate the work with plumbing and electrical rough-in.

1.04 ACTION SUBMITTALS

A. Shop Drawings: Drawn to scale dimensioned plans, elevations, component profiles, and large scale details for each casework item and layout

1. Indicate materials, assembly methods, joint details, fastening methods, accessory listings, location of hardware, and schedule of finishes for each casework item.

2. Show mechanical, electrical, and building items in and adjacent to casework.

3. Show locations and types of blocking and other anchors to be built into substrates.

4. Prepare in accordance with AWS Section 1, “Submittals.”

B. Product Data: Manufacturer's literature for the following to be incorporated into the work:

1. Each finish material including laminates.

2. Hardware

3. Shop applied coatings.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. EQ 4.1: Printed statement of volatile organic compounds (VOCs) for adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Samples:

1. Wood veneers and solid stock, finished as specified.

2. Hardware:

a. Door pulls.
b. Other hardware items as requested.

1.05 INFORMATIONAL SUBMITTALS

A. Statement of fabricator qualifications.

B. Certified Compliance Certificate as specified.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Fabricator: Firm specializing in quality architectural cabinetwork and active member of WI or AWI. Fabricators not active members of WI or AWI will be considered upon submission of verifiable evidence of experience in successful completion of work similar to work of this Project.

2. Installer: Supply an adequate number of skilled workers, thoroughly trained, experienced, and familiar with the necessary crafts and methods needed for proper performance of the work of this Section.

B. Wood under this Section does not need to be pressure- and or fire-retardant treated.

C. WI Certified Compliance Program:

1. Casework and the installation thereof for this Project shall be certified by fabricator for compliance to the Contract Documents:

a. WI licensees shall issue a Certified Compliance Certificate indicating the casework products being furnished and certifying that these products and their installation will fully meet all the requirement of the WI Grade specified. Certificate shall be submitted prior to delivery of casework to the jobsite.
b. Non-licensees of the WI shall arrange to have a WI Inspector inspect the casework after completion of fabrication and installation and furnish a Certified Compliance Certificate. Contractor shall be responsible for all costs associated with corrections to fabricated or installed work as required to secure the WI Certified Compliance Certificate.

2. Fees charged by WI to either WI licensee or non-licensee are the responsibility of the Contractor.

3. Casework and/or installation determined to be non-compliant by WI and not corrected will be rejected.

4. Issuance of the WI Certified Compliance Certificate is a prerequisite of the Owner's Representative's final acceptance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until ambient conditions required can be and are maintained.

B. Do not deliver casework woodwork until wet work, painting, grinding, and similar operations which could damage, soil, or deteriorate wood work have been completed, HVAC system is operational, and space where casework will be stored and installed has been conditioned to that intended for final occupancy.

C. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.08 FIELD CONDITIONS

A. Obtain field measurements and verify dimensions are as indicated on shop drawings before fabricating casework.

B. Ambient Conditions:

1. Store materials indoors, in ventilated areas with constant but minimum temperature of 60 degrees F and maximum relative humidity of 25- 55 percent.

2. Do not begin installation of architectural woodwork until Building is fully enclosed and mechanical systems are fully operational.

3. Maintain interior installation areas at 70 degrees F and 50- 55 percent relative humidity.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Architectural wood casework shall comply with the applicable requirements of the AWS (referred to as the "woodworking standard") including Section 10, "Casework." Where Contract Documents indicate requirements that conflict with or augment the woodworking standard, comply with the conflicting or augmenting requirements.

B. Sustainable Design Requirements:

1. Lumber and plywood shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

2. Panel products shall be free of urea formaldehyde.

3. Adhesives and sealants shall meet or exceed the South Coast Air Quality Management District Rule 1168 VOC Requirements.

2.02 WOOD MATERIALS

A. Solid Stock:

1. General:

a. Moisture content at time of fabrication: As specified in woodworking standard.
b. Provide wood dressed on all exposed faces, unless otherwise indicated.
c. Do not use twisted, warped, bowed, or otherwise defective wood.
d. Sizes indicated are nominal, unless otherwise indicated.
e. Do not mark or color wood, except where such marking will be concealed in finish work.

2. Concealed: Species and grade as specified in woodworking standard for casework construction, unless otherwise indicated.

3. Exposed: Clear, Vertical Grain Douglas Fir (VGDF) Quartered to match specified face veneer on plywood panels in color, graining, and general appearance.

2.03 PANEL MATERIALS

A. Plywood at Exposed and Semi-Exposed Surfaces Including Cabinet Doors, Exterior Cabinet Returns, and Exposed Shelving: Formaldehyde free, hardwood veneer plywood complying with ANSI/HPVA HP-1; “Europly PLUS” by Columbia Forest Products, or equal.

1. Nominal Panel Thickness: 3/4 inch.

2. Face Species, Both Faces: FSC certified White Maple, Plain sliced.

3. Inner Plies: Uniform laminations of solid Birch.

4. Edge Profile: Square, eased; no banding.

B. Medium-Density Fiberboard (MDF) at Concealed Surfaces and Cabinet Interiors: ANSI A208.2, manufactured without added formaldehyde; "Medite II" by The Medford Division, SierraPine, Ltd. Medford, OR, or accepted equal.

1. Density: 47 lb/ft^3.

2. Type: Grade 155 MR 30.

3. Thickness: 3/4 inch, unless otherwise shown or required to meet AWS performance requirements.

C. Hardboard: Tempered Grade, conforming to standards of American Hardboard Association or PS-50; use smooth side exposed.

D. Thermally-Fused Melamine Panels (TFM): Not permitted.

E. Particle Board: Not permitted.

2.04 FABRICATION ACCESSORIES

A. Adhesive: VOC compliant, as recommended by panel manufacturer best suited for the intended use.

B. Glue: VOC compliant aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

C. Fasteners: Size and type to suit application.

2.05 HARDWARE

A. General: Comply with requirements of BHMA A156.9, Type 2 (Institutional).

B. Finishes:

1. Exposed Items: Satin chromium plated, 626 complying with ANSI/BHMA A156.18.

2. Concealed Items: Manufacturer's standard finish, complying with applicable product class of ANSI/BHMA A156.9.

C. Hinges:

1. Typical: “Rockford Process Control” (RPC) five knuckle, institutional, wrap-around hinges exceeding ANSI/BHMA 156.9 Grade 1 requirements.

a. Height: 2-1/2 inches.
b. Do not “let-in” hinges into door.

D. Door Catches: Adjustable ball type; Häfele # 244.21.110, or equal

E. Drawer Slides: Accuride as specified, or equal. Provide two per drawer.

1. Box Drawers: Model 3832SC for drawers up to 16 inches wide, and Model 7432 for drawers up to 24 inches wide.

F. Pulls: Plated die-cast zinc, nominal 13/32-inch diameter by 6-11/16 inches long; #DP128 by Doug Mockett & Company, or equal.

1. Finish: “26M,” matte chrome.

2. Unless otherwise indicated, provide one for each door or drawer, two for each drawer 30 inches or wider.

3. Mounting Direction: As shown or as otherwise noted on reviewed submittals.

G. Shelf Supports,

1. End Supported - Brackets: Knape & Vogt as specified, or accepted equal.

a. Shelf-Support Clips: No. 256 ZC.
b. Shelf Standards: No. 255 ZC.

H. Bumper Pads (Silencers): Hemispherical, quiet clear type, 55 Shore A hardness; 3M Bumpon Protective Products, or accepted equal.

I. Additional Hardware: As Scheduled on the Drawings.

2.06 FABRICATION - GENERAL

A. Construction shall conform to AWS requirements for wood and laminated plastic casework including 10-Casework of Appendix B.

1. Backs of doors shall be finished to match front of door.

2. Interior carcass surfaces behind doors shall be considered semi-exposed surfaces.

B. Grade: Custom.

C. Cabinets:

1. Door and Drawer Front Style:

a. Style: Flush overlay, AWS Style A.

b. Drawer and door panel edges shall be square, no edge banding, and with eased edges.
c. Finish: Specified Maple veneered plywood.

2. Carcass Construction: Type A frameless fabricated from specified MDF. Provide as single unit at open shelving.

3. Provide silencers at doors and drawers.

D. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.

E. Shop-assemble casework for delivery to site in units easily handled and to permit passage through building openings and transportation facilities.

F. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.07 SHOP FINISHING

A. General:

1. Do not apply finishes until sample submittals are reviewed and approved by the Owner's Representative.

2. Apply entire finish in shop. Final touch-up may be performed after installation.

3. Comply with AWS Premium Grade requirements for transparent finish system.

B. Back Painting: Surfaces of which are not exposed to view at any time shall be thoroughly back painted with one heavy coat of finishing material of fabricator's choice before leaving the shop.

C. Transparent System: Formaldehyde free, waterborne urethane polymer; American Formulating and Manufacturing (AFM) coatings as specified, or equal.

1. Stain: If required to provide a unified light Maple appearance and match approved sample; "Safecoat DuroStain."

2. One Coat Sealer: "Safecoat Safe Seal."

3. Two Topcoats: "Safecoat Polyureseal BP," satin gloss level.

a. Sand first topcoat.
b. Allow to cure full time recommended by manufacturer before buffing.

4. Appearance and Gloss Level: Satin, to match approved sample.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify painting, mechanical, electrical, and other work that will be concealed by casework, are completed.

3.02 INSTALLATION

A. Install cabinetwork plumb and level and in conformance with requirements of the woodworking standard.

1. Shim as necessary with concealed shims.

2. Accurately scribe and closely fit faceplates and filler strips to irregularities of adjacent surfaces.

3. Anchorage shall comply with AWS recommendations and Project seismic requirements.

B. Fasten cabinets to floor at toe space, unless base levelers are used, and to walls at 24 inches on center maximum.

C. Install sealant as specified in Section 07 9200, “Joint Sealants,” as required to close any small unavoidable gaps between casework and abutting surfaces.

D. Install hardware not previously installed in the shop. Drawer and door pulls shall be installed centered on drawers and to far edge of doors. If not shown, coordinate required edge distance with Owner’s Representative.

3.03 ADJUSTMENT AND CLEANING

A. Adjust moving or operating parts to function smoothly and correctly.

B. Damaged, stained, scratched, or otherwise disfigured portions of the work shall be touched up, refinished, or replaced to satisfaction of the Owner’s Representative.

C. Comply with the additional requirements for final cleaning in Section 01 7700, "Closeout Procedures.”

END OF SECTION 06 4100

SECTION 06 6420
REINFORCED PLASTIC WALL PANELING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Fiber-reinforced plastic wall paneling (FRP).

B. Related Requirements:

1. Joint Sealants: Section 07 9200.

2. Gypsum Board: Section 09 2900.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. Sustainable Design (LEED) Submittals shall comply with the additional requirements of Section 01 3560, "Sustainable Design Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7700, "Closeout Procedures," and Section 01 7836, "Warranties."

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
a. Sustainable design submittals are in addition to other submittals.
b. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. IEQ 4.1: Printed statement of volatile organic compounds (VOCs) for field-applied adhesives and sealers applied inside the weatherproofing.

2) Include statement indicating costs for each product.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's literature describing materials and installation instructions.

B. Sustainable Design:

1. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

2. Credit IEQ 4.1: Manufacturers' product data for interior adhesives and sealants, including chemical components and printed statement verifying compliance with required VOC content.

C. Samples:

1. Panels, 8 inch square, in specified color and finish.

2. Trim pieces, 8 inch lengths.

1.04 QUALITY ASSURANCE

A. Materials and installation shall meet USDA/FSIS requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Panels shall be unwrapped and allowed to acclimate to final building occupancy conditions for not less than 48 hours prior to installation.

B. Protect materials from breakage and damage while unloading and when stored.

PART 2 - PRODUCTS

2.01 LEED SUSTAINABLE DESIGN CRITERIA

A. Qualifying Products with Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

B. VOC Content: Products shall comply with VOC limits of Green Building Standards of SFBC Chapter 13C.5.103.3.2, and the following VOC limits, when calculated according 40 CFR 59, Subpart D (EPA Method 24):

2.02 WALL PANELING

A. Manufacturer and Product: Non-fiberglass reinforced plastic: “PLAS-TEX NRP” by Parkland Plastics, or equal.

1. Size: 48 inches wide x height shown.

2. Thickness: 0.060 inch.

3. Color: White.

4. Texture: Pebbled.

5. Flammability:

a. Flame Spread, ASTM E84: Less than 200.
b. Smoke Developed, ASTM E84: Under 450.

B. Trim: Manufacturer's matching solid polymer moldings for corners, end caps and division bars at joints between panels.

2.03 ACCESSORIES

A. Sealant: Silicone type, as provided by panel manufacturer. Color to match wall panels.

B. Adhesives: VOC compliant, high quality, low odor, non-flammable, water and mold resistant, latex-based as recommended or provided by panel manufacturer.

C. Provide fasteners, trim, clips, cleaner and other materials as recommended by panel manufacturer and required for a complete installation.

PART 3 - EXECUTION

3.01 WALL PANELING INSTALLATION

A. Set panels on top of flooring base. Secure to walls with adhesive in accordance with panel manufacturer's instructions. Allow 1/8 inch expansion space to insure proper installation of trim.

B. Install matching trim at joints, corners, and other exposed edges unless otherwise shown or noted on the Drawings.

C. Install panels vertically, cut to required height, without horizontal joints.

1. Where used as a wainscot 48-inches or less in height, install horizontally without vertical joints except where wall length exceeds maximum available panel length.

2. Match joint layout shown on the Drawings.

D. Seal gaps remaining after installation, using silicone sealant.

3.02 CLEANING

A. Clean soiled or discolored surfaces after installation.

B. Remove and replace damaged or improperly installed work.

END OF SECTION 06 6420

SECTION 07 0116
REPAIR OF MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Repairs to existing sheet membrane waterproofing at exposed below grade walls of existing Etcheverry Basement at damaged areas exposed by excavation beyond edge of new Jacobs Hall building footprint.

2. Drainage composites.

3. Accessory materials.

B. Related Requirements:

1. Selective Demolition: Section 02 4113.

2. Pre-Applied Integrally Bonded Membrane Waterproofing: Section 07 1355

3. Earthwork: Section 31 0000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees."

B. Pre-installation Meeting: After demolition and removal of earthwork abutting existing concrete foundation wall and prior to proceeding with repairs to the below the grade waterproofing systems, Contractor, Owner's Representative, and waterproofing installer shall meet at the Project site to coordinate related requirements and below grade waterproofing work.

1. Notify participants at least 10 calendar days before conducting meeting.

2. Review material selections and procedures to be followed in performing the work.

3. Review in detail job conditions, schedule, sequencing of the various systems, and application requirements.

4. Record discussions of conference and any conflict, incompatibility, or inadequacy. Furnish a copy of record to each participant.

C. Coordination: Waterproofing membrane shall not be left exposed to the weather for a period longer than that recommended by the manufacturer, or 60 days maximum. Coordinate review by Owner's Representative and installation of protection board covering accordingly.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's descriptive data for each proposed product, installation instructions for each product of system, use limitations of materials, including temperature limitations, and job-specific details of penetration conditions.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of applicator qualifications.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Applicator shall have specialized experience in installation of specified products and shall be acceptable to manufacturer.

B. Single Source Responsibility:

1. To assure a complete and coordinated monolithic envelope, resistant to hydrostatic pressure between subgrade construction and earthwork, all below grade systems shall be installed under the direction supervision of the same waterproofing subcontractor.

2. Contractor, waterproofing subcontractor and applicator shall review Drawings and Specifications with an agent of the waterproofing materials manufacturer. Obtain manufacturer’s agreement that selected systems are proper, compatible, and adequate for application shown, and that details do not conflict with specified warranty.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer’s instructions. Protect from damage from weather, excessive temperature and construction operations. Remove damaged material in accordance with applicable regulations.

B. Deliver materials in sufficient quantity to ensure continuity of work.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements,” and Section 01 6600, “Material and Equipment.”

1.08 AMBIENT CONDITIONS

A. Temperature of air and surfaces to receive waterproofing shall be within the range recommended by system manufacturer for product type used.

B. Specified waterproofing system performs best when applied at air temperature above 50 degrees F. Schedule installation at this temperature or above. Do not apply at a temperature lower than that permitted by manufacturer's printed instructions.

PART 2 - PRODUCTS

2.01 PRIMARY MEMBRANE MATERIALS

A. General: Materials used in conjunction with the membrane waterproofing system shall be manufactured by or acceptable to the membrane waterproofing material manufacturer for use on this Project.

B. Sheet Membrane: Flexible waterproof membrane combining a high performance cross laminated, HDPE carrier film with a unique super sticky self-adhesive rubber bitumen compound; "Bituthene System 4000" by Grace Construction Products.

2.02 ACCESSORY MATERIALS

A. Mastic: Rubberized asphalt-based mastic; "Bituthene" Elastomeric Mastic."

B. Liquid Membrane: Two-component, 100 percent solids modified urethane, cold-applied; "Bituthene Liquid Membrane."

C. Drainage Composites (Protection Board Where Noted on the Drawings): "Hydroduct" by Grace Construction Products as specified, or equal.

1. Drainage Composite: Preformed 0.433 inch (11 mm) thick geocomposite drainage sheet system comprising a hollow studded polystyrene core, covered on one side with a nonwoven, needle punched polypropylene filter fabric and on the other side with a smooth polymeric film "Hydroduct 220."

2. Collection Composite: Low and high profile drainage core, a high performance geotextile and high strength backing film with a core profile is 0.44 inches (11 mm) at the top to tie into the drainage composite system and 1 inch on the bottom to provide a high- flow section to transport water to the drainage exit; "Hydroduct Coil 600."

D. Termination Bar: Stainless steel in required profile and as specified in Section 07 6200, "Sheet Metal Flashing and Trim."

E. Termination Seals and Accessories: As shown and specified in Section 07 9200, "Joint Sealants."

F. Concrete Fasteners: Powder shot steel pin having a 3/4-inch minimum diameter washer.

G. Tapes:

1. Membrane:

a. Lap Tape: Reinforced, two-sided, pressure-sensitive adhesive tape for use at membrane overlaps.
b. Seam Tape: Non-reinforced, two-sided, adhesive tape for used within integrally taped seam of membrane.

2. Drainage Composite: Two-sided, highly aggressive adhesive tape, 1 inch wide and wound in 200-foot rolls with a 1.5 inch wide release sheet; "Hydroduct Tape" by Grace Construction Products.

H. Additional Materials: Acceptable to manufacturer of sheet membrane waterproofing and required by existing conditions to make the repairs shown and specified..

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing subgrade has been removed and existing waterproofing exposed to depth required to initiate repairs. See additional requirements for concrete removal specified in Section 02 4113, "Selective Demolition."

3.02 PREPARATION OF SURFACES

A. Prepare concrete substrate as specified and required by the waterproofing system manufacturer.

B. Clean, sand blast surface and prime substrate according to manufacturer's application instructions.

1. Recoat areas not waterproofed if contaminated by dust.

2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.

C. Thoroughly clean exposed existing membrane in accordance with manufacturer's recommendations for adequate tie-in of new to existing membrane.

3.03 APPLICATION - GENERAL

A. General: Apply materials in accordance with manufacturer's instructions and guide specifications.

B. Install membrane horizontally cut to required width.

1. New membrane shall overlap existing membrane a minimum of 2 inches.

2. Overlap vertical all seams at least 2-1/2 inches.

3. Press membrane into place using heavy hand pressure.

4. Roll all membrane with a hand roller.

5. Patch tears and inadequately lapped seams in accordance with manufacturer's instructions and as specified.

6. Apply a 2-inch wide trowel bead of mastic or liquid membrane, centered on edge of the membrane, to vertical and horizontal terminations.

C. Drainage Composite:

1. Install drain mat with adequate lap of the geo-textile fabric and tape.

2. Apply to waterproofing securing with specified tape and methods recommended by manufacturer.

3. Install to 6 inches above new Basement Floor slab elevation, unless otherwise shown.

4. Rolls onto wall and apply a continuous strip of tape near the top and another strip near the bottom.

5. Leave the release sheet on the tape until just before applying the drainage composite.

6. Permanently secure the membrane at top with a stainless steel termination bar, sealant, and backer rod. Fasten termination bar at 8-inches on center.

7. Install collection composite coil extending up from top of exposed existing aggregate base so as to provide a continuity of drainage from new drainage mat into exiting gravel. Install with narrow end at top to tie in to drainage mat.

D. Install 22-gauge stainless steel "Z" metal flashing fabricated to required dimensions to protect the upper edge of the membrane, overlap drainage composite. Provide flashings as required and as detailed elsewhere on Drawings.

1. Secure to concrete with specified fasteners.

2. Provide a minimum 4-inch side lap and apply two beads of sealant at each lap.

3. Sheet metal flashing shall conform to requirements specified in Section 07 6200, "Sheet Metal Flashing and Trim."

3.04 FIELD QUALITY CONTROL

A. Prior to application of overlying drainage composites, Owner's Representative shall review installation and completed membrane work. Membrane shall not be covered prior to review by Owner's Representative.

B. Manufacturer's Field Services: Contractor shall have the manufacturer's representative inspect installation and completed work and provide certification in writing, as part of specified warranty, waterproofing and drainage mats have been installed in accordance with manufacturer's recommendations.

1. Provide unobstructed access to waterproofing work for inspection.

2. Correct defects and irregularities as advised by manufacturer's representative.

END OF SECTION 07 0116

SECTION 07 1355

PRE-APPLIED INTEGRALLY BONDED MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pre-applied sheet membrane waterproofing that forms an integral bond to poured concrete for the following vertical applications prior to placement of concrete foundation walls:

   a. Membrane applied against shotcrete lagging at foundation walls.
   b. Membrane applied to lagging at elevator pit walls.

2. Drainage composite.

B. Related Requirements:

1. Concrete Formwork: Section 03 1000; wood lagging/shoring and plywood at blindside walls.

2. Cast-In-Place Concrete: Section 03 3000; prefabricated waterstops.

3. Shotcrete: Section 03 3713.

4. Repair of Membrane Waterproofing: Section 07 0116.

5. Fluid-Injected Composite Sheet Waterproofing: Section 07 1356.

6. Earthwork: Section 31 0000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. Closeout Submittals shall be submitted in accordance with Section 01 7836, “Guarantees,” and Section 01 7839, “As-Built Documents.”

B. Coordination:

1. Coordinate the work of trades performing work in and around the waterproofing that precedes, follows, or penetrates the waterproofing including responsibility for installation of penetration seals.

2. Coordinate installation requirements of concrete reinforcing steel at horizontal surfaces with waterproofing work including restriction on use of chair supports.

C. Pre-installation Meeting: Prior to installation of waterproofing, and associated work, Contractor, Owner’s Representative, manufacturer's representative, waterproofing installer, shall meet at the Project

site to coordinate related requirements and waterproofing work. Installers of other work in and around waterproofing that precedes, follows, or penetrates waterproofing, including mechanical and electrical installers, shall also attend the pre-installation conference.

1. Notify participants at least 10 working days before conducting meeting.

2. Review material selections and procedures to be followed in performing the work.

3. Review in detail job conditions, schedule, construction sequence, application requirements, and quality of completed installation.

4. Record discussions of conference and any conflict, incompatibility, or inadequacy, and furnish a copy of record to Owner's Representative, and each participant.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Project specific details based on manufacturer's approved details showing penetrations, terminations, and key plan showing typical location of each detail for conditions not shown on the Drawings. Manufacturer's standard details shall be modified, as required, to represent actual project conditions. Provide project specific details as coordinated with adjacent work and Contractor's lagging.

B. Product Data:

1. Manufacturer's descriptive data for each proposed product including accessory materials.

2. Installation instructions for each product and system.

3. Sample warranty.

C. Samples: HDPE membrane, rubberized asphalt sheet membrane, tape, waterstops, and termination bar.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of applicator qualifications.

B. Certification from manufacturer confirming applicator's status as an approved installer, and confirming prior experience in the application of the specified products with the manufacturer's on-site review.

C. Pre-installation meeting report.

1.05 CLOSEOUT SUBMITTALS

A. Specified warranty.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Applicator shall have documented experience in installation of specified products and shall be acceptable to manufacturer.

B. Single Source Responsibility:

1. To assure a complete and coordinated monolithic envelope, resistant to hydrostatic pressure between subgrade construction and earthwork, all below grade systems shall be installed under the direction supervision of the same waterproofing subcontractor.

2. Contractor and applicator shall review Drawings and specifications with an agent of the waterproofing materials manufacturer. Obtain manufacturer's agreement that selected systems are proper, compatible, and adequate for application shown, and that details do not conflict with specified warranty.

3. Materials used in conjunction with the membrane waterproofing system shall be manufactured by or acceptable to the membrane waterproofing material manufacturer for use on this Project.

C. First In-Place Mockup: Install first 100 square feet of each application condition to demonstrate execution quality. If Owner's Representative determines mockups do not comply with requirements, reapply waterproofing until mock-ups are approved.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials away from sparks or flames, protected from rain and physical damage, and within temperature range recommended by manufacturer.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.08 ENVIRONMENTAL CONDITIONS

A. Temperature of air and surfaces to receive waterproofing shall be within the range recommended by system manufacturer for product type used.

B. Do not allow water to collect on membrane. Remove water damaged membrane, and replace with new material.

C. Waterproofing shall not be left exposed to the weather for a period longer than that recommended by the manufacturer, or 60 days maximum. Coordinate installation of covering materials accordingly.

1.09 WARRANTY

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and are in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Contractor: Furnish a single-source 10-year written "no dollar limit" warranty agreeing to repair or replace waterproofing system that does not remain watertight during the warranty period. By terms of warranty, also agree to remove and replace other work, as required, which has been connected to or superimposed on the substrate material to be replaced.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer and System: Primary membrane products specified as the Basis of Design to establish required level of performance and quality are by Grace Construction Products. Products by CETCO, or equal non-listed manufacturers shall meet the specified design and performance criteria and shall be submitted for approval in accordance with Section 01 6250, “Product Options and Substitutions.”

2.02 PRIMARY MEMBRANE MATERIALS

A. Sheet Membrane at Below Grade Blind Vertical Surfaces: Three layer composite sheet consisting of a 0.016 inch (0.4 mm) high-density polyethylene (HDPE) film, 0.015 inch (0.38 mm) layer of synthetic adhesive, and 0.001 inch (0.03 mm) of protective coating; "Preprufe 160R" Membrane by Grace Construction Products, or equal.

B. Sheet Membrane at Below Grade Horizontal Surfaces: Pre-applied, self-adhering, preformed membrane, minimum 0.046 inch thick with a 0.03 inch (8 mm) high-density polyethylene (HDPE) film and coated on one side with a layer of synthetic adhesive; "Preprufe 300R" Membrane by Grace Construction Products, or equal.

2.03 ACCESSORY MATERIALS

A. Liquid Elastomeric Membrane: Two-component, 100 percent solids modified urethane, cold-applied; Grace "LM2."

B. Rubberized Asphalt Sheet Membrane: Flexible waterproof membrane combining a high performance cross laminated, HDPE carrier film with a unique super sticky self-adhesive rubber bitumen compound; "Bituthene System 4000" by Grace Construction Products..

C. Drainage Composites: "Hydroduct" by Grace Construction Products as specified, or equal and as compatible with integrally bonded membrane system.

1. Drainage Composite: Preformed 0.433 inch (11 mm) thick geocomposite drainage sheet system comprising a hollow studded polystyrene core, covered on one side with a nonwoven, needle punched polypropylene filter fabric and on the other side with a smooth polymeric film “Hydroduct 220.”

2. Collection Composite: Low and high profile drainage core, a high performance geotextile and high strength backing film with a core profile is 0.44 inches (11 mm) at the top to tie into the drainage composite system and 1 inch on the bottom to provide a high- flow section to transport water to the drainage exit; “Hydroduct Coil 600.”

D. Tapes:

1. Membrane:

a. Lap Tape: Reinforced, two-sided, pressure-sensitive adhesive tape for use at membrane overlaps in horizontal and vertical applications and at detail treatments.
b. Seam Tape: Non-reinforced, two-sided, adhesive tape for used within integrally taped seam of horizontal and vertical membrane.

2. Drainage Composite: Two-sided, highly aggressive adhesive tape, 1 inch wide and wound in 200-foot rolls with a 1.5 inch wide release sheet; “Hydroduct Tape” by Grace Construction Products.

E. Fasteners:

1. Wood Substrates: Case-hardened steel with flute shank, and having a 1-inch minimum length and a 1-inch minimum diameter cap.

2. Concrete Substrates: Powder shot steel pin having a 3/4 inch minimum diameter washer.

3. Staples: Steel with a 1-inch minimum crown and a 3/4 inch minimum leg.

4. Nails: Galvanized, annular threaded shank, #12 gage with integral 15/16 inch cap and in length sufficient for intended use.

5. Other Fasteners: As appropriate to substrate material.

F. Sealant at Termination Seals and Other Treatments Where Required: One or two part polyurethane conforming to ASTM C920, Type M, Class 25, Grade NS and Section 07 9200, "Joint Sealants."

G. Penetration Seal: Modular, mechanical seal of interlocking rubbing links; "Link-Seal" by Thunderline Corp., "Pipe Linx" by Calpico, Inc., or accepted equal.

H. Grout: Non-ferrous, non-shrink type conforming to ASTM C827.

I. Termination Bar: Stainless steel, minimum 14 gage (0.07 inch).

1. Provide 1/2 inch hemmed edges at sides.

2. Provide prepunched holes to accept fasteners at 8 inches on-center staggered top and bottom.

J. Provide additional materials as required and recommended by manufacturer.

K. Protection Board: 1/4-inch asphaltic rigid protection board as approved by manufacturer and complying with ASTM D6506.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check that surfaces to receive waterproofing are free of dirt and debris, voids greater than 1/2 inch, spalled areas, loose aggregate, and sharp protrusions, with no coarse aggregate visible.

B. Verify that junction of horizontal and vertical surfaces is a clearly defined sharp right angle.

C. Check that pipes, vents, drains, and other penetrations of surface are covered to prevent entry of waterproofing material.

3.02 PREPARATION OF SURFACES

A. Prepare substrate as specified and required by the waterproofing system manufacturer.

B. Place grout around penetrations. Penetrations shall be rigidly fixed within the substrate prior to application of the waterproofing membrane.

C. Mud Slab: Fill gaps or voids greater than 1/2 inch. Remove standing water prior to membrane application.

D. Other Work:

1. Installation of other work passing through or concealed by waterproofing shall be complete and approved before starting work of membrane installation.

2. Ensure sleeves, curbs, and projections which pass through waterproofing are properly and rigidly installed.

E. Surfaces to receive liquid elastomeric membrane shall be dry, without any appearance of dampness.

F. Proceed with installation only after unsatisfactory conditions have been corrected. Starting of membrane application implies the Contractor has verified that the substrates are satisfactory for waterproofing application.

3.03 MOLDED SHEET DRAINAGE PANEL INSTALLATION

A. Install drainage composites in accordance with manufacturer's instructions including seaming, lapping filter fabric, corners, and top termination. Position with filter fabric of each composite against earth retention surface.

B. Install collection composite coil extending up from bottom of aggregate base as shown. Narrow end shall be at top to tie into drainage composite.

C. Mechanically fasten to lagging, and secure with tape at shotcrete, prior to installation of pre-applied waterproof membrane.

D. Top Termination:

1. Terminate the drainage composite as shown.

2. Wrap the filter fabric over the top of the core. Use supplemental filter fabric if required.

3. Install securement bar by fastening at 8-inches on center maximum.

E. Do not leave drainage composites exposed to weather for more than 2 weeks before backfilling.

F. No portion of membrane shall be left exposed upon completion.

G. Connect to storm system piping as required.

3.04 BLINDSIDE WALL APPLICATION

A. General:

1. Confirm that vertical surfaces to receive waterproofing system conform to manufacturer's requirements as applicable to the earth retaining system prior to commencing work.

2. Ensure that membrane starter strip is installed to retaining system prior to placement of concrete over the horizontal membrane.

3. Install waterproofing system in accordance with manufacturer's procedures, recommendations and specific project application instructions as applicable to the work.

4. Place membrane in a manner to ensure minimum handling. Fit closely to, and seal around penetrations and other projections.

B. Apply 12 inch wide rubberized asphalt membrane sheets vertical through the transitions formed by corners, jogs, and other conditions in the earth retention system so as to effect a double membrane layer at all transitions. Use sufficient widths to effect complete coverage of the transitions.

C. Membrane Installation: Apply fully adhered membrane with the HDPE film facing the prepared earth retention system.

1. Remove the release liner and hold sheet membrane in place with fasteners along the top edge only using large head nails. Seal penetrations.

2. Use 8-foot maximum lengths to avoid the need for additional nailing at the side laps and other locations.

3. Apply the HDPE sheet in sections coordinated with the construction of the foundation wall against the HDPE so as to permit removal of the fasteners and cutting away of the fastened portion of each section prior to forming the end lap with the next higher waterproofing section.

4. Allow sufficient material to effect temporary terminations at the top of the earth retention system.

5. Apply succeeding sheets by overlapping the previous sheet 3 inches along the uncoated edge of the membrane.

6. At locations where a selvage edge is not present such as field cut seams and at all end laps, provide a 6 inch overlap. Apply liquid elastomeric membrane within laps of all sheets without selvage edges, including end laps.

7. Inside and outside corners shall be pre-folded to create a sharp crease in the membrane to ensure a snug fit.

    a. Position side laps a minimum 12 inches from vertical corners, jogs, and other transitions.
    b. Firmly press the primary HDPE sheet membrane over the underlying 12-inch wide sheet. Do not allow the membrane to “tent” away from the substrate. Installed membrane shall be smooth and without bagginess.

8. Seams:

    a. Seams shall be installed such that the HDPE is lapped in a weatherboard fashion.
    b. Apply 8-inch wide rubberized asphalt sheet membrane to earth retention side behind all laps.
    c. Apply 4-inch strip of tape over all laps. Tape laps shall be 4 inches. Do not butt the ends of the tape.
    d. Immediately secure laps by firmly roll-pressing with hand-held EPDM/rubber roller for a tight seal.
    e. Remove the release liner from the lap tape.

9. Mechanical fasteners shall be covered with a buttering of liquid waterproofing membrane covered with tape.

10. Closely following membrane placement, clean membrane surface of dust, soil and other contaminants.

11. Installed membrane shall be smooth, free of fish-mouths, and without bagginess.

12. Installed membrane shall be protected from concrete overpour from installation of adjacent concrete.

D. Penetrations:

1. Waterproof using HDPE membrane, lap tape, and liquid waterproofing membrane as applicable and as shown on the Drawings.

    a. Confirm that grout or other suitable materials has been placed around penetrations through the earth retaining system as required to ensure a sound substrate for the waterproofing membrane.
    b. Place and fit the HDPE sheet membrane closely to penetrations.
    c. Primer metal penetrations in accordance with the primer manufacturer's requirements and allow to dry.
    d. Apply lap tape to join sheet membrane to penetrations in a watertight fashion.
    e. Wrap penetrations with lap tape placed approximately 1/2 inch above the membrane surface.
    f. Place liquid waterproofing to form a watertight cove between the tape and the membrane.
    g. Install modular mechanical seals in sleeved penetrations.

2. Verify which penetrations, if any, need to be accessed after construction of the foundation wall for completion of the waterproofing treatment, and ensure that sufficient access to the membrane is provided.

3. Verify which penetrations will not need to be accessed after concrete placement and ensure that final detailing procedures are accomplished prior to concrete placement.

E. Make tie-back anchors, soil nails, and other in-wall penetrations waterproof using rubberized asphalt sheet membrane, HDPE sheet membrane, lap tape, and liquid elastomeric waterproofing membrane as applicable and as shown on the Drawings.

1. Clean metal surfaces as required to receive liquid elastomeric waterproofing membrane.

2. Primer metal penetrations in accordance with the primer manufacturer's requirements and allow to dry.

3. Place a 2-foot square target piece of rubberized asphalt sheet membrane over drainage composite fitted closely to the in-wall penetration.

4. Apply liquid elastomeric waterproofing membrane at the outer border of the target piece.

5. Place the HDPE composite sheet waterproofing in the standard specified fashion and fitted closely to the in-wall penetration.

6. Place a second target piece of rubberized asphalt sheet over the HDPE sheet also fitted closely to the in-wall penetration.

7. Apply liquid elastomeric waterproofing membrane to the inner border of the target piece extending onto the in-wall penetration element.

8. Place a final target piece of HDPE sheet waterproofing over the rubberized asphalt sheet and bedded into the liquid elastomeric membrane prior to curing of the liquid membrane.

9. Apply lap tape at the outer border of the HDPE target piece.

10. Roll the tape and remove the release liner.

11. Place a final application of the liquid membrane fully covering the in-wall penetration.

F. Effect temporary termination at the top of the earth retention by folding excess material and tacking in place.

G. Protect membrane system from damage.

3.05 BELOW SLAB-ON-GRADE APPLICATION

A. General:

1. Install waterproofing system in accordance with manufacturer's procedures, recommendations and specific project application instructions as applicable to the work.

2. Place membrane in a manner to ensure minimum handling. Fit closely to, and seal around penetrations and other projections.

3. When slab is poured in sections, extend membrane at least 12 inches beyond slab edge so that it can be properly overlapped at subsequent pours.

B. Apply two layers of specified protection board over stable, compacted, and smoothed subgrade. Stagger joints between layers.

C. Apply membrane with HDPE side down loose laid over protection boards extending vertically 12 inches along the perimeter of the slab area.

1. Overlap edge and end seams at least 3 inches; stagger end laps minimum of 12 inches.

2. Remove release liner from membrane.

3. Closely following membrane placement, clean membrane surface of dust, soil and other contaminants.

4. Apply seam tape within laps of all sheets without selvage edges, including end laps.

5. Apply lap tape over all laps.

6. Immediately secure laps by firmly roll-pressing with hand-held EPDM/rubber roller for a tight seal.

7. Remove the release liner from the lap tape.

8. Closely following membrane placement, clean membrane surface of dust, soil and other contaminants.

D. Install a base layer of self-adhering rubberized asphalt membrane along the perimeter, with the adhesive side facing the installer, under the field membrane, to provide for reinforced tie-in to the vertical wall membrane.

1. Double thickness of membrane to be a minimum 24 inches wide and centered along the slab bottom edge.

2. Extend lower layer of membrane above perimeter slab from work a minimum of 12 inches.

3. Effect lap treatments using seam tape [as shown on the Drawings and] as follows.

a. Provide a 12 inch strip of rubberized asphalt sheet membrane behind all laps.
b. At locations where a selvage edge is not present such as field cut seams and at all end laps, provide a 6 inch overlap and install in a full bed of liquid elastomeric membrane to provide a 6 inch wide seal.
c. Install 4 inch wide strip of tape centered over all laps and roll firmly into place with an approved roller. Carefully remove and dispose release liner from tape.

E. Penetrations: Waterproof using HDPE membrane, lap tape, and liquid waterproofing membrane as applicable and as shown on the Drawings and as required by manufacturer.

1. Confirm that grout is satisfactorily placed at penetrations through granular or soil substrate.

2. Cut waterproofing membrane as close to penetration as possible.

3. Prime metal penetrations in accordance with the primer manufacturer's requirements and allow to dry.

4. Apply lap tape to pipe penetration extending from membrane on mud slab to 4 inches up penetration.

5. Install liquid elastomeric membrane extending minimum 2 inches vertically on tape and minimum 3 inches on horizontal membrane.

6. Install lap tape over liquid elastomeric membrane extending 2 inches beyond liquid membrane on horizontal surface and 2 inches above lap tape around penetration.

7. Install butyl waterstop around penetration.

F. Protect membrane from damage from rebar. Concrete or sharp metal chairs are not permitted. Repair horizontal membrane in accordance with the following:

1. For scratch on white coating exposing underlying white surface of HDPE carrier sheet: install tape at areas where the white coating of the membrane is damaged, including boot scuff marks and abrasions by rebar.

2. For damage or puncture of sheet membrane:

a. Install patch of membrane set in liquid elastomeric membrane. Patch shall extend 3 inches in every direction beyond extent of damaged area.

b. Install tape centered over the edge of the patch.
c. If the damaged area does not have 5 inches of sound material around it, inject liquid elastomeric membrane into puncture until liquid membrane backs out and then proceed with patch as space allows.]

G. Examine in-place materials and repair damaged areas immediately before placing concrete.

3.06 FIELD QUALITY CONTROL

A. Examine in-place materials and repair damaged areas immediately before concrete placement.

1. Ensure that concrete directly contacts the adhesive face of the membrane.

2. At punctures, tears, slices, and scuffs in membrane, install a patch of HDPE membrane extending 6 inches below edge of damage. Use seam tape. Apply lap tape to edges.

B. Contractor shall ensure that waterproofing contractor is present during concrete placement to monitor work over the membrane and repair any damage to membrane prior to being covered with concrete.

C. A representative of waterproofing system manufacturer shall inspect installation and completed work and certify acceptance, in writing, as part of specified warranty.

D. In addition, the Owner may engage an independent waterproofing consultant to observe the work during installation to ascertain compliance with the specified requirements and to obtain samples. Provide safe access to work areas and information necessary for Owner's waterproofing consultant to accomplish observation and testing.

END OF SECTION 07 1355

SECTION 07 1413
HOT FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fabric reinforced, hot fluid-applied, modified asphalt membrane waterproofing under topping slab at Terrace.

2. Protection boards and drainage composites.

B. Related Requirements:

1. Quality Control: Section 01 4500.

2. Cast-in-Place Concrete: Section 03 3000.

3. Sheet Metal Flashing and Trim: Section 07 6200.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Pre-installation Meeting: Prior to installation of waterproofing and associated work, Contractor, Owner's Representative, manufacturer's representative, waterproofing installer, and other appropriate installers shall meet at the Project site to coordinate related requirements and waterproofing work. Notify participants at least 5 working days before conducting meeting.

1. Review material selections and procedures to be followed in performing the work.

2. Review in detail job conditions, schedule, construction sequence, application requirements, quality of completed installation, product limitations, testing procedures and acceptance criteria.

3. Review surface preparation, substrate condition and pre-treatment, forecasted weather, sheet metal flashings, installation procedures, testing and inspection procedures, installation layout, protection, and repairs.

4. Contractor shall record discussions of conference and any conflict, incompatibility, or inadequacy. Furnish a copy of record to each participant.

C. Coordination:

1. Coordinate site inspections by manufacturer's representative as determined at the pre-installation meeting.

2. Coordinate with Section 03 3000, “Cast-in-Place Concrete” to verify that curing compounds and form release products will not inhibit bonding of waterproofing to concrete.

3. Coordinate with related Sections including drainage and sheet metal work.

1.03 ACTION SUBMITTALS

A. Shop Drawings:

1. Plan layout of each area showing drain locations, slopes, and termination details.

2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, and other transitions and terminations.

B. Product Data:

1. Manufacturer's material specifications and installation instructions.

2. Material Safety Data Sheets (MSDS).

C. Samples: Drainage composite, flashing sheet, protection boards, and root barrier for planters.

1.04 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Certification from an independent testing laboratory that waterproofing material meets applicable ASTM standards.

2. Certification showing full-time quality control of production facilities and that each batch of material is tested to ensure conformance with manufacturers’ published physical properties.

3. Certification that all membrane components are supplied by a single manufacturer.

B. Evidence that membrane assembly is currently Class A listed with UL.

C. Statement of installer qualifications.

D. Statement of manufacturer qualifications.

E. Manufacturer’s Project Acceptance Document: Certification that manufacturer and installer will warrant the waterproofing system for the specific site, design, details, and application indicated for this Project.

F. Manufacturer’s statement of compatibility. Include letter from manufacturer certifying that all components of the waterproofing system installation, including both construction coat waterproofing (temporary) and the primary system waterproofing, are compatible and comply with all requirements of the Manufacturer’s warranty.

G. Manufacturer's written instructions for recommended maintenance practices and schedule.

1.05 CLOSEOUT SUBMITTALS

A. Results of flood testing.

B. Extended warranty.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: 5 years' minimum specialized experience in installation of specified products on projects similar in scope, who can comply with the manufacturer's warranty requirements, and shall be acceptable to manufacturer. Employ foreman who is fluent in English and to be on-site at all times during Work.

B. Manufacturer Qualifications: Company specializing in production of waterproofing systems with at least 10 years' documented continuous experience in the manufacture of hot rubberized asphalt waterproofing products, and employing experienced in-house technical and field observation personnel qualified to provide expert technical support.

C. Comply with recommendations of the NRCA Roofing and Waterproofing Manual, including any conditions not indicated on the Drawings.

D. Mockups:

1. First installed example of each installation condition shall serve as a mockup for review and approval by Owner's Representative of surface preparation, installation and application techniques, and interface with adjacent construction.

2. Manufacturer's representative shall verify surface preparation and installation methods.

3. If requested, make modifications to mockup without additional charge to Owner.

4. Do not proceed with remainder of installation until mockup has been approved.

5. Where appropriate and acceptable to Owner, approved mockup may become part of the completed Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling of materials to be in accordance with manufacturer's instructions. Melting equipment shall consist of double jacketed, oil bath melter with mechanical agitator. Avoid overheating of hot applied rubberized asphalt.

B. Deliver materials in original unopened packaging, clearly labeled with manufacturer's labels indicating name of manufacturer, product and all identifying numbers.

C. Store materials away from sparks or flames, protected from weather, prolonged sunlight, excessive temperature, physical damage, and within temperature range recommended by manufacturer. Do not exceed allowable structural capacity of structural slab. Do not double stack pallets during shipping or storage. Allow adequate ventilation.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.08 FIELD CONDITIONS

A. Ambient Conditions:

1. Temperature of air and surfaces to receive waterproofing shall be within the range recommended by system manufacturer.

2. Do not install waterproofing on damp or wet surfaces.

B. Do not allow petroleum, grease, oils, or fats to come into contact with membrane.

C. The deck must be properly cleaned and prepared, free of any and all contaminants.

D. Provide adequate protection for membrane after installation. Do not allow any foot or vehicular traffic on unprotected membrane. Do not allow any material or waste product to contaminate membrane. Contact Manufacturer to determine performance impedance, if any, caused by contamination of the membrane.

1.09 WARRANTY

A. Contractor: Supply the Owner with a 5-year workmanship warranty.

1. Work related to waterproofing membrane, flashings, or metal work found to be defective or not in accordance with Contract Documents within five years of Substantial Completion, the Contractor shall remove and replace at no cost to the Owner.

2. The obligation of the warranty shall run directly to the Owner with a copy to the membrane manufacturer.

B. Manufacturer: Upon completion and acceptance, manufacturer shall provide a written 20 year material warranty. Issuance of Manufacturer's warranty will require the following.

1. Waterproofing system products and drainage course products, and subsequent assembly products shall have been provided by a single manufacturer.

2. Installation of waterproofing products and drainage course products and subsequent products by Manufacturer's Approved Installer.

3. Contractor to perform 48 hour flood test on all horizontally installed products, except construction coat.

4. Warranty must be validated by Manufacturer confirming acceptance of installation, including independent inspection reports, in accordance with all applicable instructions.

5. Manufacturer's warranty shall be independent from any other warranties made by the Contractor under requirements of the Contract Documents and may run concurrent with the other warranties.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Waterproofing: Membrane assembly including but not limited to substrate construction coat, primer, monolithic rubberized asphalt waterproofing membrane with reinforcing, separator/protection course, drainage mat, filter fabric, flashings, and drainage mat, and protection/drainage board as indicated on plans and required by the manufacturer to obtain specified warranty. Except as otherwise specified, all membrane components shall be supplied from a single source manufacturer.

B. All products shall be compatible with one another and with other specified products with which they may come in contact.

C. System shall meet UL Class A requirements.

2.02 FLUID-APPLIED MEMBRANE

A. Product and Manufacturer: Hot, fluid-applied, fabric reinforced, rubberized asphalt membrane: "Monolithic Membrane" MM6125-FR by American Hydrotech, Inc., or equal.

1. Total Membrane Thickness: 215 mils.

2.03 WATERPROOFING SYSTEM ACCESSORIES

A. Surface Conditioner: Manufacturer's standard.

B. Flashing: Uncured neoprene rubber sheet, 60-mil nominal thickness; "Flex Flash UN." Use for change of plane and for other conditions shown on Drawings.

C. Reinforcing: Spunbonded, nonwoven, polyester filter fabric; "Flex Flash F."

D. Adhesives and Sealants:

1. Contact Adhesive for Bonding Flashing Together: "Splicing Cement."

2. Contact Adhesive for Bonding Flashing to Substrate: "Bonding Adhesive."

3. Sealant at Flashing Seam Edges: "Lap Sealant."

E. Protection Board: 1/8 inch thick, semi-rigid, waterproof board composed of a rubberized asphalt core, reinforced with a non-woven fiberglass mat and sandwiched between two protective polypropylene layers; “Perma-Board” by American Hydrotech.

F. Flexible Protection Layer: 85 mil rubberized asphalt sheet with synthetic fiber reinforcing; “Hydroflex 30.”

G. Protection Sheet: 3/16 inch (4.5mm) thick, semi-rigid, waterproof board composed of a rubberized asphalt core, reinforced with a non-woven fiberglass mat and sandwiched between two protective polypropylene layers; “Perma-Board,” or equal.

H. Drainage Composite: 0.40 inch thick, three dimensional, crush proof drainage core with filter fabric bonded to the top surface of the core dimples: “Hydrodrain 700.”

I. Rubberized Asphalt Sheet Membrane: Flexible waterproof membrane combining a high performance cross laminated, HDPE carrier film with a unique super sticky self-adhesive rubber bitumen compound; "Bituthene System 4000" by Grace Construction Products, or equal.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Check that surfaces to receive fluid-applied waterproofing are acceptable to receive the waterproofing assembly as defined by the system manufacturer's requirements.

B. Owner's Representative, Contractor, and installer shall examine substrates and conditions for compliance with requirements, including other conditions affecting performance of the system.

1. Examine Terrace edges, flashing, openings, substrates, and junctures at other construction for suitable conditions where the system will be installed.

2. Ensure that work done by other trades is complete and ready for systems to be installed.

3. Verify compatibility with and suitability of substrates.

4. Application of systems indicates acceptance of surfaces and conditions.

C. Notify Owner's Representative in writing of conditions which may adversely affect the system installation or performance. Do not proceed with installation until these conditions have been corrected and reviewed by the Owner's Representative.

3.02 PREPARATION

A. Protect adjacent surfaces and landscaping against damage or soiling.

B. Follow preparation recommendations of fluid-applied waterproofing materials manufacturer.

1. Remove paint, oils, rust, and other contaminants from exposed metal; and prime.

2. Pretreat structural joints in substrate.

3. Thoroughly sweep substrate to receive waterproofing. Blow substrate clean using compressed air to remove any remaining loose debris.

4. Cover penetrations to prevent entry of waterproofing material.

5. Mask off adjoining surfaces not to receive fluid-applied waterproofing.

C. Apply a test patch of membrane to each type of substrate, to check adhesion and as a final check to determine if substrate has been properly cleaned. Submit results of adhesion test in a report to Owner's Representative.

3.03 JOINTS, CRACKS, AND TERMINATIONS

A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to CAN/CGSB-37.51, "Application of Rubberized Asphalt, Hot-Applied, for Roofing and Waterproofing," and waterproofing manufacturer's written instructions.

1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D4258.

2. Adhere uncured neoprene sheet to substrate in a layer of hot, rubberized asphalt. Extend uncured neoprene sheet at least 4 inches on each side of joints and cracks and beyond deck drains, corners, and penetrations.

B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, integrate waterproofing membrane with expansion joint assemblies or other construction as shown on the Drawings so as to provide an uninterrupted waterproofing system.

C. At terminations, extend uncured neoprene sheet along the height of curbs as shown on the Drawings.

3.04 FLASHING INSTALLATION

A. Install uncured neoprene sheets at terminations of waterproofing membrane according to CAN/CGSB-37.51, "Application of Rubberized Asphalt, Hot-Applied, for Roofing and Waterproofing," and waterproofing manufacturer's written instructions.

B. Prime substrate with asphalt primer.

1. Apply surface conditioner, using a hand-held sprayer, evenly at a rate of 300 to 600 SF per gallon, depending on surface texture. Surface conditioner shall "Tan" the surface, not blacken it.

2. Allow sufficient time for surface conditioner to dry thoroughly prior to membrane application.

3. Do not apply primer to areas of work not to be addressed the same day.

C. At wall-to-slab transitions and other transitions in plane, install elastomeric flashing sheet. Adhere to deck and wall substrate in a layer of hot, rubberized asphalt.

D. Extend flashing sheet up walls or parapets at least 4 inches above topping slab, and at least 4 inches onto deck to be waterproofed.

E. At inside planter walls, extend continuous flashing up to grade. Terminate with a termination bar.

F. At drain bowls, install elastomeric flashing sheet over the bowl. Turn one inch into the bowl. Lap at least 6 inches beyond edge of drain body into waterproofing system.

G. Under posts, provide continuous uncured neoprene flashing.

3.05 MEMBRANE APPLICATION

A. Apply rubberized asphalt membrane according to CAN/CGSB-37.51, "Application of Rubberized Asphalt, Hot-Applied, for Roofing and Waterproofing," and waterproofing manufacturer's written instructions.

B. Heat rubberized asphalt in an oil-jacketed or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt waterproofing.

C. Heat membrane until it can be drawn free flowing at a temperature range between 350 degrees F and 400 degrees F.

D. Start application with manufacturer's technical representative and Owner's Representative present.

E. Apply primer, at manufacturer's recommended rate, over prepared substrate, and allow to dry as specified in Paragraph 3.3 B. above.

F. Apply hot rubberized asphalt membrane at a rate to provide a continuous, monolithic coat of at least 90 mils (approximately 2.3 mm), into which is embedded a layer of spunbonded polyester fabric reinforcing sheet.

1. Follow with another continuous monolithic coat of membrane at an average thickness of 125 mils (approximately 3.2 mm).

2. Total membrane thickness shall be 215 mils average (approximately 5.5 mm).

3. Overlap reinforcing sheet one to 2 inches, with membrane between sheets.

G. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by system manufacturer.

H. Cover waterproofing with protection board or root barrier, as indicated, with overlapped joints while rubberized asphalt is still hot and before membrane is subject to traffic.

I. Install protection course with butted joints over separator sheet, immediately following water tests.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's representative shall inspect installation of waterproofing assembly on the first day of work and on a periodic basis thereafter as necessary to ensure compliance with manufacturer's instructions and effect the required warranty.

B. Owner's waterproofing consultant may be retained to observe membrane installation.

C. In addition, the Owner may retain a testing agency, in accordance with Section 01 4500, "Quality Control," to inspect the installation and perform testing on waterproofing.

1. Inspection shall include thickness measurement of waterproofing, using wet film thickness gage.

2. Testing agency will interpret tests and state in each report whether tested work complies with or deviates from specified requirements.

3. Where readings indicate thickness less than specified, Contractor shall apply additional waterproofing material to produce required thickness.

D. Contractor shall conduct a water test on completed waterproofing installation in accordance with ASTM D5957.

1. Verify with Project Structural Engineer that the structure can withstand the dead load weight of the water test prior to commencement of water test. If not, then confer with the manufacturer for alternative testing procedures.

2. Notify Owner's Representative and Owner's Testing Agency, and manufacturer's representative a minimum of 5 working days in advance of test.

3. Flood testing shall occur after membrane has cured.

4. Flood testing shall consist of standing water, with at least 2 inches of water at all flashing conditions and a minimum of 48 hours. Plug drains and provide necessary barriers to contain flood water.

5. Should any leak or ponding appear that would violate specified requirements, repair and retest, as above, until work is watertight and acceptable.

6. Ponding is defined as the presence of any water that remains on membrane surface more than 48 hours after test.

7. Accommodation of water drainage and run-off during testing is the responsibility of and should be coordinated by the general contractor with the entity conducting testing.

3.07 DRAINAGE COMPOSITE

A. Install drainage composite/protection board immediately after inspection and successful completion of testing of waterproofing.

B. Butt drain core edges and overlap filter fabric 2 to 3 inches, minimum, in the direction of flow.

1. Drainage composite may be loose laid for horizontal applications with overburden installation following. Minimize foot traffic on exposed drainage composite.

2. Secure filter fabric edge flap over roll lap joints with construction adhesive or manufacturer supplied tape.

3. Starting at the low points or drains lay the drainage composite/protection board in full continuous sheets in a shingle pattern. Stagger all end laps.

4. Take precautions to prevent penetration of waterproofing.

5. Cut drainage board to fit close to all perimeter, protrusions and obstructions.

3.08 PROTECTION AND CLEANING

A. Protect completed fluid applied waterproof coating and hot rubberized asphalt membrane after installation. Do not permit traffic on unprotected hot rubberized asphalt membrane.

B. Clean spillage and soiling from adjacent surfaces, using cleaning agents and procedures recommended by manufacturer of surface.

C. Coordinate with other Sections for coordination of overlying materials.

END OF SECTION 07 1413

SECTION 07 2117
THERMAL BOARD AND BLANKET INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for:

1. Semi-rigid board at metal panel rainscreen.
2. Blanket insulation.
3. Rigid insulation at exterior of below grade walls.
4. Firesafing at edge of slab conditions.
5. Foam insulation at exterior wall crevices and spaces requiring a thermal seal.

B. Related Requirements:

1. Alternates: Section 01 2300; alternates affecting the work of this Section.
2. Delegated Design: Section 01 3325
3. Joint Sealants: Section 07 9200; foam insulation at exterior wall crevices and spaces requiring a thermal seal.
4. Glazed Aluminum Curtain Walls: Section 08 4413; installation of firesafing.
5. Plumbing: Division 22; plumbing pipe insulation.
6. Mechanical: Division 23; mechanical pipe and duct insulation.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

B. Coordinate design and spacing of zee furring securing rainscreen insulation with attachment requirements of metal panel system specified in Section 07 4243, “Metal Wall Panels.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and installation recommendations for each type of insulation required.

1. Provide Underwriter's Laboratory approval numbers for required fire ratings.

2. Approval of other laboratories is contingent upon acceptance by applicable authorities.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. EQ 4.1: Printed statement of volatile organic compounds (VOCs) for field-applied adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

C. Delegated-Design Services: Provide engineering calculations for zee furring used for securing exterior board insulating and attachment of metal panel system substantiating the members, spacing, fastening, and details shown on the shop drawing. Calculations shall be signed and sealed by the engineer in responsible charge retained by the Contractor. Engineer shall be a California licensed civil or structural engineer.

1.04 QUALITY ASSURANCE

A. Thermal resistance factors (R-values) listed are aged values tested in accordance with ASTM C518 at 75 degrees Fahrenheit and 50 percent relative humidity for at least six months.

B. Regulatory Requirements:

1. Insulation shall be certified by manufacturer to comply with state standards for insulating materials.

2. Insulation shall comply with Flame Spread Rating and Smoke Density requirements of CBC.

C. Mockups:

1. Provide exterior board insulation and attachment system for evaluation of fabrication workmanship as part of the partial building mockup as specified in Section 01 4339, “Mockups.”

2. In addition to off-building mockup, first area or example of each type of installation shall serve as a mockup for review of workmanship by Owner's Representative. Do not proceed with installation until mock-up is approved.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Clearly identify manufacturer, contents, brand name, applicable standard, and R-value.

B. Store materials off ground, protected against weather, condensation, and damage.

C. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Sustainability Requirements:

1. Insulation shall be manufactured with 100 percent acrylic binders and no formaldehyde.

2. Interior adhesives and sealants shall comply with SCAQMD Rule 1168 for VOC content when calculated according to EPA Method 24, be CA 01350 compliant, and contain no added formaldehyde.

2.02 BLANKET INSULATION

A. Faced Miner-Fiber Blankets: Lightweight fiberglass, Kraft faced, formaldehyde free, conforming to ASTM C665 Type II, Class C, Category 2; Owens Corning "EcoTouch Insulation with Pure Fiber Technology," or equal.

1. Surface Burning Characteristics: ASTM E84:

a. Batt:

1) Smoke Developed: 50 or less.
2) Flame Spread: 25 or less.

b. Facing: No requirements.

2. Thickness and Insulating Values:

a. Walls: Nominal 5-1/2 inches, R-21.
b. Soffits and Floors over Unheated Spaces: Nominal 12 inches, R-38.

3. Recycled Content: Not less than 50 percent.

4. Certification: "GREENGUARD" certified to be formaldehyde free.

2.03 BOARD INSULATION

A. Rigid Mineral Fiber Board: Non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface complying with ASTM C612, Type IVB; “CavityRock MD” by Roxul Inc., Milton, Ontario, 800-265-6878; or equal.

1. Thickness: 1 inch.

2. Recycled Content: Not less than 16 percent.

3. Noncombustible in accordance with NFPA Standard 220 when tested in accordance with ASTM E136.

4. Fire Resistive Requirements: ASTM E84.

   a. Smoke Developed: 0.
   b. Flame Spread: 0.

5. Insulating Value per Inch of Thickness: R-4.2.

6. Moisture Absorption: 1 percent maximum when tested in accordance with ASTM C1104.

7. Fungi Resistance: Zero mold growth when tested in accordance with ASTM C1338.

8. Corrosive Resistance:

   a. Steel to ASTM C665: Pass.
   b. Stainless steel to ASTM C795: Conforms.

9. Fire Resistive Requirements: ASTM E84.

   a. Smoke Developed: 5.
   b. Flame Spread: 165.

B. Polystyrene Board Below Grade Walls: Extruded-foam board complying with ASTM C578, Type IV; Dow Chemical Company "Styrofoam Square Edge," or equal.

1. Thickness: Nominal 2 inches.

2. Minimum Compressive Strength, ASTM D1621: 25 psi.

3. Water Absorption: 0.3 percent by volume, maximum in accordance with ASTM C272.

4. Insulating Value per Inch of Thickness: R-5.0.

2.04 FIRESAFING

A. Mineral Fiber Firesafing/Backing Material: UL listed semi-rigid mineral fiber, noncombustible, conforming to ASTM C612, Classes 1 and 2; "Thermafiber Safing Insulation" by Themafiber, Inc., or equal.

1. Density: 4 pounds per cubic foot.

2. Noncombustible per National Fire Protection Association (NFPA) Standard 220 when tested in accordance with ASTM E136.

3. Thermal Conductivity: 0.25 to 0.23 k-value per ASTM C518.

4. Surface-Burning Characteristics:

   a. Flame Spread: 15 (10 to 25 with foil facing).
   b. Fuel Contributed: 0 (5 with foil facing).
   c. Smoke Developed: 0.

5. Pre-consumer Recycled Content: Not less than 75 percent.

B. Safing Clips: Z-Shaped, 20 gage sized to comply with UL or OPL/Intertek design.

C. Other Facing and Backing Materials: As recommended by fire safing manufacturer and required by UL assembly noted on the Drawings.

2.05 ACCESSORIES

A. Sill Sealer: Self-adhesive air and moisture barrier; "Triple Guard Energy Sill Sealer" by Protector Wrap, or equal.

B. Fasteners for Mechanical Attachment of Insulation:

1. String Wires for Batts: Minimum 18 gage galvanized steel wire.

2. Zee Furring at Rigid Board at Metal Panels: Galvanized steel, ASTM A653/A653M, with G90 coating designation; structural quality.

C. Adhesives: **Low VOC type** AS recommended by insulation manufacturer for insulation and fastener types and substrates involved.

D. Additional Fastenings, Straps, and Accessories: As acceptable to insulation manufacturer and required to secure insulation in place.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas scheduled to receive insulation to ensure protection against inclement weather and other hazards and to verify that work of preceding trades is completed.

B. Examine space allocated for batt insulation for proper depth to receive material.

C. Proceed with installation when conditions are satisfactory.

D. Prior to closing walls and soffits, obtain Owner's Representative's observation of insulation installation.

3.02 INSTALLATION OF THERMAL BLANKETS

A. Install faced blankets with facing to building interior.

B. Install to fill all typical and odd spaces completely in framing where required, other than providing air space where indicated.

C. Install snugly between framing members. Provide straps to prevent sagging at vertical applications exceeding 8 feet, and netting at horizontal applications, to prevent sagging. If faced batts have tabs, tape tabs to metal studs to prevent sagging.

D. Trim to required height and width in place.

E. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations. Split blankets around wires as required.

F. Shim space between framing and curtain wall and door jambs shall be filled solid with unfaced batt or foam-in-place insulation. Fill spaces completely to a uniform monolithic density without voids.

3.03 INSTALLATION OF BELOW GRADE INSULATION

A. Install extruded polystyrene insulation over ~~waterproofing~~ **drainage composite** on exterior of basement wall at locations shown.

B. Adhere panels ~~to the cured waterproofing~~ with adhesive **or mechanical fasteners** as recommended by board manufacturer. Do not use mechanical fasteners that **may** penetrate waterproofing.

C. Rest bottom edge of foam insulation on top of footing**, or as detailed,** and extend up to below finished grade as shown.

3.04 INSTALLATION OF RIGID INSULATION AT METAL PANELS

A. Install over approved self-adhering sheet membrane weather barrier specified in Section 07 6500," Flexible Flashing and Underlayment.

B. Retain with zee shaped galvanized sheet metal secured back to metal support system as shown.

C. Comply with additional installation recommendations of the insulation board manufacturer.

D. Do not install overlying metal panel system until insulation has been reviewed and approved by the Owner's Representative.

3.05 INSTALLATION OF FIRESAFING

A. Install at openings where floor slabs meet exterior walls as shown and specified in Section 08 4413, "Glazed Aluminum Curtain Walls."

3.06 PROTECTION

A. Coordinate with other Sections for prompt installation of finishes.

B. Where coordination with other Sections is not practical, protect insulation by temporary covering or enclosure.

END OF SECTION **07 2117**

SECTION 07 2616
BELOW-GRADE VAPOR RETARDER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Vapor retarder under concrete slab-on-grade.

B. Related Requirements:

1. Cast-in-Place Concrete: Section 03 3000.

2. Earthwork: Section 31 0000.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. E1745: “Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.”

2. E1643: “Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.”

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.04 ACTION SUBMITTALS

A. Product Data: Manufacturer's literature for vapor retarder with test result data indicating conformance with paragraph 8.3 of ASTM E1745.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Vapor Retarder: "Stego Wrap Vapor Barrier -15-MIL" by Stego Industries, LLC, “Moistop Ultra 15” by Fortifiber, or equal meeting the following:

1. Permeance as tested before and after mandatory conditioning in accordance with ASTM E1745: Less than 0.01 Perms (grains/(hr ft2 hr Hg).

2. Other Performance Criteria:

a. Strength: ASTM E1745 Class A.
b. Thickness: 15 mils minimum.

B. Vapor-Retarder Tape: Nominal 4-inch-wide self-adhering type as provided or recommended by vapor retarder manufacturer and designed to maintain vapor retarder integrity; "Stego Tape."

C. Pipe Boots: Fabricated from vapor barrier material and pressure sensitive tape in accordance with manufacturer's instruction; "Stego Pre-Cut Pipe Boots."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check that areas to receive vapor retarder are clean and dry.

B. Check that pipes, vents, drains, and other that would penetrate membrane are completed.

3.02 INSTALLATION UNDER SLAB-ON-GRADE

A. Install vapor retarder over prepared and compacted base course in accordance with manufacturers' instructions and ASTM E1643.

B. Lap 6 inches, and tape edges.

C. Turn up membrane at edges, and secure to foundations or footings with tape, or as shown on the Drawings.

D. Seal penetrations of vapor retarder with tape to create air-tight seal between penetrating objects and vapor retarder. Use manufacturer's preformed pipe boots for pipe penetrations 4 inches and smaller.

E. Repair tears and punctures in vapor retarder immediately before concealment by other work. Cover with tape or another layer of vapor retarder.

END OF SECTION 07 2616

SECTION 07 4243
METAL WALL PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for pressure-equalized rain screen panel system installed over rigid insulation, self-adhering sheet underlayment weather barrier, solid sheathing, and metal support framing including the following as detailed on the Drawings:

1. Miscellaneous aluminum angles, plates, and channels.

2. Connection hardware for attachment of aluminum wall panels to building structure.

B. Related Requirements:

1. Alternates: Section 01 2300; alternates affecting the work of this Section.

2. Delegated Design: Section 01 3325.

3. Mockups: Section 01 4339.

4. Structural Metal Stud Framing: Section 05 4100; light gage metal supports.

5. Gypsum Sheathing: Section 06 1643.

6. Thermal Board and Batt Insulation: Section 07 2117.

7. Sheet Metal Flashing and Trim: Section 07 6200.

8. Flexible Flashing and Underlayment: Section 07 6500.

9. Joint Sealants: Section 07 9200; perimeter joint sealants.

10. Metal Louvers: Section 08 9110; metal louvers within metal panel system.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, “Guarantees,” and Section 01 7839, “As-Built Documents.”

B. Coordinate installation of other exterior wall finishes including engineering of metal panel system subgirt and zee metal design and layout with the rigid insulation installed behind metal panel system.

C. Pre-Submittal Meeting:

1. Contractor shall schedule a meeting with the Owner's Representative, Owner's Design Professional, and applicable subcontractors to discuss design intent, concerns and expectations, coordinate specification and shop drawings issues, and finalize system design parameters and details prior to completion of the submittals documents.

2. Notify participants at least 7 calendar days before conducting meeting.

D. Pre-Installation Meeting: Prior to commencement of aluminum panel work, schedule a meeting at mutually agreeable time to include Owner's Representative, Contractor's field superintendent, aluminum panel installer, and other interested parties to review methods and procedure to be used to achieve end results.

1.03 ACTION SUBMITTALS

A. Shop Drawings: CAD generated shop drawings showing layout, profiles and product components, including anchorage, accessories, and finish.

1. Include details showing thickness and dimensions of the various system parts, fastening and anchoring methods, locations of joints and sealants and location and configuration of joints necessary to accommodate thermal movement.

2. Show concealed drainage, baffles, and weeps.

3. Coordinate with shop drawing requirements of other Sections whose work adjoins panels.

B. Product Data: Manufacturer's specifications, standard detail drawings, and installation instructions for aluminum metal wall system, system components, and accessories.

C. Samples:

1. Metal panel for verification samples for finish and each selected color, 8-inch by 8-inch, in thickness specified.

2. Panel assembly samples not less than 24 inches square, showing 4-way joint.

D. Sustainable Design (LEED):

1. MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
   a. Include statement indicating costs for each product having recycled content.

2. MR5: Documentation for products regionally extracted, processed, and manufactured.
   a. Include statement indicating costs for each product.

E. Delegated-Design: Prepare and submit engineering calculations for metal wall panel assembly to verify compliance with performance and design criteria, and acceptance by the authorities having jurisdiction.

1. Calculations shall include attachment system and subgirt system anchored back to metal stud framing.

2. Include analysis data.

3. Calculations shall be signed and sealed by the engineer in responsible charge retained by the Contractor. Engineer shall be a California licensed civil or structural engineer

1.04 INFORMATIONAL SUBMITTALS

A. Statement of fabricator/installer qualifications.

B. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

C. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.

D. Manufacturer's field reports, as applicable.

E. Minutes of pre-installation meeting.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.06 QUALITY ASSURANCE

A. Industry Standards: Comply with applicable provisions of SMACNA Manual.

B. Qualifications:

1. Fabricator/Installer: A firm experienced in producing exterior aluminum panels similar to that indicated for this Project, with a record of successful in-service performance, and acceptable to panel manufacturer.

C. Source Limitations: Contractor shall engage a single firm to assume undivided responsibility for producing exterior aluminum panels similar to that indicated for this Project. Responsibility shall include all components of the exterior panel system including attachment to sub-construction, panel-to-panel joinery, panel to dissimilar material joinery, and gaskets and sealant associated with the panel system.

D. Mockup:

1. Before installing wall panels, construct a mockup to demonstrate workmanship, visual effect, and qualities of materials and execution.

2. Mockup shall be of sufficient size to indicate panel support assembly, coping, corner details, and interface with curtain wall system.

3. If partial building mockup is to be provided as specified in Section 01 4339, "Mockups," a separate metal panel mockup is not required.

E. Acceptance and Approvals: Manufacturer shall obtain wall panel system acceptance and approval from the local building official having jurisdiction, for installation on the exterior of the structure.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels to Project site completely identified in accordance with numbering system used on shop drawings or erection diagrams.

B. Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.08 WARRANTY

A. Contractor: Furnish a written 5-year warranty, countersigned by installer and aluminum panel manufacturer, agreeing to replace aluminum wall panels and flashings which have failed as results of defects in material or workmanship.

1. By terms of warranty, also agree to remove and replace other work, as required, which has been connected to or superimposed on the material to be replaced.

2. Upon notification of defects within warranty period, make necessary repairs and replacements at Owner's convenience.

B. Manufacturer: Furnish to Owner coating manufacturer's written extended warranty for baked on high-performance coating against flaking, fading, peeling, and other visible defects for 20 years.

PART 2 - PRODUCTS

2.01 SYSTEM MANUFACTURER

A. Wall Panel System: Keith Wall Systems Company Ltd., Elward Systems Corporation, or equal.

2.02 SYSTEM DESCRIPTION

A. System Type: Rout and return panel – dry joint system. No visible fasteners. Panel system utilizing continuous field applied joint sealant between panels is not acceptable.

B. System shall have no telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.

C. System shall comply with the applicable recommendations of AAMA CW-RS-1, "Rain Screen Principle and Pressure Equalized Wall Design," and "Metal Curtain Wall Manual."

D. Panel system shall be fabricated so no restraints can be placed on the panel which might result in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change.

2.03 DESIGN AND PERFORMANCE CRITERIA

A. General:

1. The metal panel rain screen system is a delegated design which requires a complete system designed and engineered to meet the requirements of the Contract Documents and to provide a complete weatherproof enclosure for the building.

2. The system shall be designed, engineered, fabricated, and installed by the Contractor to meet or exceed the minimum structural and weather resistance requirements specified herein as demonstrated by engineering calculations and field testing. The requirement for design includes the requirement for cooperative coordination with the Owner's Representative to develop the final accepted metal panel cladding system and their connections and supports.

3. Drawings are diagrammatic. The details shown are intended as a guide for the aesthetic and interfacing requirements of the various components of the exterior wall to and with other work; details are intended to establish basic dimensions of the module and the sight lines, jointing and profiles of members. The Contractor is responsible for the design and engineering of the system within these aesthetic parameters. The Drawings shall not be considered as an engineering design or adequate to meet the engineering design requirements.

4. The Drawing details do not show all required conditions or modifications. Conditions not detailed shall be developed by the Contractor and included on the shop drawings to the same level of aesthetics and in compliance with performance criteria as indicated for detailed areas and as stipulated in these Specifications.

5. Metal wall panel assembly shall comply with the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

6. If comparable tests are not available to verify conformance, new tests shall be performed by an independent laboratory acceptable to the Owner's Representative.

B. Structural Performance:

1. Design wind pressure shall be calculated using wind speed required by code and indicated on the Structural Drawings, but not less than not less than 20 pounds psf and 30 psf on parapet and corner panels.

2. Wind load testing, conducted in accordance with ASTM E330, shall verify conformance to the following deflection requirements:

   a. Normal Deflection: Deflection of secured perimeter framing member not to exceed L/175 or 3/4 inch, whichever is less, normal to plane of the wall; deflection of individual panels not to exceed L/60.
   b. Anchor Deflection: At connection points of framing members to anchors, anchor deflection in any direction not to exceed 1/16 inch.
   c. At 1-1/2 times design pressure, permanent deflection of framing members shall not exceed l/240 of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16 inch.

C. Deflection – Structural Support Frame: System shall be designed to accommodate anticipated wind and gravity load deflection of supporting structural frame based on the following criteria from the Project Structural Engineer:

1. Design system to accommodate the vertical live load deflection of the primary structure of not less than dimension indicated on the Structural Drawings.

2. Design system to accommodate the inter-story drifts as noted on the Structural Drawings.

D. Seismic Racking: There shall be no failure or deterioration of the system when the unit is laterally racked to 3/4-inch in both directions and repeated for three cycles.

E. Thermal Movements: Allow for free horizontal and vertical thermal movement, due to expansion and contraction of components over a temperature range from minus 20 to plus 180 degrees F.

1. Buckling, opening of joints, undue stress on fasteners, failure of sealants, or any other detrimental effects of thermal movement will not be permitted.

2. Fabrication, assembly, and erection procedures shall take into account the ambient temperature range at the time of the respective operation.

F. Weep Drainage: Clear internal paths of drainage in order to drain trapped moisture to the exterior, discharging weep water in a manner avoiding staining of architectural finishes, and collecting in puddles.

G. Fastening: Panel assembly shall be fastened to in a manner which transmits all loads to the main supporting structure without exceeding the capacity of any fastener.

2.04 METAL PANELS

A. Aluminum Wall Panels:

1. Aluminum Extrusions: ASTM B221, alloy 6063-T6 and/or 6061-T6.

2. Aluminum Sheet: Tension-leveled, smooth aluminum, ASTM B209, Aluminum Association specification sheet 3003-H14/3105-H14 for painted finish.

a. Thickness, Typical: Not less than 0.125 inches (1/8 inch). Provide thickness of not less than 3/16 inch at panels located within 8 feet of Grade Level or where accessible to direct pedestrian contact.
b. Profile: Flat, formed to sizes and shapes shown.

B. Production Tolerances, as Applicable to Panel Configuration:

1. Panel Depth: As shown.

2. Width: Plus 0.08 inch.

3. Length: Plus 0.22 inch.

4. Bow: Maximum 0.8 percent of any 72-inch panel dimension.

5. Squareness: Maximum 0.2 inch.

6. Edges of sheets shall be square.

7. Maximum deviation from panel flatness shall be 1/8 inch in 5 feet in any direction for assembled units, non-cumulative. Oil canning is not acceptable.

2.05 ACCESSORIES

A. Attachment System Components:

1. Provide internal drainage system that allows individual panels to be installed and removed without disturbing adjacent panels.

2. Include subgirts, extruded aluminum angles, plates, channels, panel stiffeners, and other extrusions of sizes and dimensions as shown. Exposed aluminum components shall be finish painted to match metal panels.

3. Finish of Joint Extrusion: Match finish and color of panels, unless otherwise selected by the Owner's Representative.

4. Extrusions, formed members, sheet, and plate shall conform to ASTM B209 and the recommendations of the manufacturer.

B. Fasteners: Fasteners shall be stainless steel. Expose no fasteners on panel faces. Expose no fasteners on other portions of panel system except where unavoidable and then match finish of adjoining metal.

C. Gaskets within the panel system shall be in accordance with manufacturer's standards to meet performance requirements.

D. Perimeter sealants interfacing with adjacent construction shall be coordinated with Section 07 9200, "Joint Sealants." Color shall match color of adjacent panels, and as approved by the Owner's Representative.

E. Corrosion Isolation: Bitumastic paint of alkali-resistant type with minimum 15-mil dry-film thickness.

2.06 FABRICATION

A. General:

1. Fabricate to profiles and layout indicated on Drawings.

2. Fabricate wall panels and accessories at factory to greatest extent possible.

3. Finish shall be shop applied.

4. Work to be fabricated with straight lines, square corners or smooth bends, free from twists or warps, kinks, dents and other imperfections which may affect appearance or serviceability.

5. System shall provide flush appearance from the exterior with no surface fasteners or other irregularities and with no reveal other than the module joint width.

B. Joint Width: 3/8-inch, or as indicated on the Drawings.

C. Panels shall be aligned with no lap or reveal other than joint width to permit expansion and contraction.

D. Thickness: Metal wall panels and details of assembly and support shall provide sufficient strength and stiffness to resist distortion of finished surface.

E. Exposed edges and ends of metal wall panels shall be dressed smooth, free from sharp edges.

F. Weep holes, nominal 3/8-inch in diameter, shall be provided where required to provide proper drainage.

G. Openings for penetrations through panels shall be provided and coordinated with other work.

1. Holes to accommodate work of other Sections shall be provided in the panel prior to finishing.

2. The perimeter of holes greater than 12 inches by 12 inches shall be reinforced.

H. Fabricate flashing materials from 0.0620 inch minimum thickness aluminum sheet finished to match the adjacent panel system where exposed.

2.07 FINISHES

A. Finish on Exposed Exterior Surfaces **- Typical**: High-performance fluoropolymer coating containing minimum 70 percent polyvinylidene fluoride (PVDF) resin and meeting or exceeding all the requirements of AAMA 2605.

1. Coating: Two-coat system; PPG "Duranar," or equal as standard with metal panel manufacturer.

2. Colors: Three, custom, solid, white and light gray tones as selected by the Owner's Representative.

a. Location of each color shall be as shown.
b. Coordinate with assemblies specified under other Sections where a color and appearance match is required including metal wall louvers.

B. Anodized Finish - Where Shown: Architectural Class I clear anodic coating conforming to AA-M12C22A41.

~~B.~~**C.** The finished surfaces of panel shall have a removable plastic film applied prior to fabrication, which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

~~C.~~**D.** Perimeter extrusions shall be factory-finished to match panels.

~~D.~~**E.** Touch-up Paint: Provide pressurized aerosol cans for each finish paint color, prepared by original applicator, for use by Owner to touch up field damage to finish coating surface.

1. Touch-up paint shall be made from same batch used for factory finish, to assure proper color match.

2. Touch-up paint is for Owner's future use only.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, adjoining construction, and conditions under which Work is to be installed.

B. Verify that substrates are dry and clean.

C. Verify dimensions. Obtain field measurements for work required to be accurately fitted to other construction. Be responsible for accuracy of such measurements and precise fitting and assembly of finished work.

D. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ensure that metal surfaces to receive assembly components are properly painted, clean, and free of corrosion prior to commencing installation.

B. Contact between aluminum and dissimilar metals shall receive protective coating as specified to prevent electrolytic action and corrosion.

3.03 PANEL INSTALLATION

A. General: Install exterior metal panel to structural supports by hidden mechanical fasteners in accordance with manufacturer's instructions and reviewed shop drawings.

B. Support system shall be attached to the structural framing backup to transmit load designs.

C. Adjustable angles, clips, tees, and associated bolts, anchors and other fixings shall be used to compensate for fabrication and erection tolerances of primary structure.

D. Framing and other components shall be straight to match plane of panel as required to meet the installed panel tolerances with straight, sharply formed edges.

E. Installed panels shall not deviate from overall plane or alignment by more than 1:100. Joints shall be not less than their dimensioned width at any location along their full length and shall not be wavy, out of line or of different width from panel to panel.

F. Install flashing to divert all moisture to the exterior.

G. Cut openings required for other trades. When field cutting is undertaken, take care to ensure cuttings are concealed in finished work.

H. Do not obstruct air space.

I. Flashings:

1. Install in longest length possible, provide for expansion and contraction, secure with concealed fasteners and leave joints water tight.

2. Space fasteners maximum of 12 inches on center.

3.04 FIELD QUALITY CONTROL

A. Tolerances:

1. Joints shall not be less than their dimensioned width or more than five percent greater than their dimensioned width at any location along their full length and shall not be wavy, out of line or of different width panel to panel.

2. Installed panels shall not deviate from overall plane or alignment more than 1/16 inch in 3 feet.

3. Adjacent panels shall not deviate from plane and alignment by more than 1/32 inch along their length.

B. Manufacturer's Field Services: As the work progresses, the manufacturer's representative shall carry out field quality control inspections for compliance with the standards specified herein, the manufacturer's specifications and the final reviewed shop drawings.

3.05 ADJUSTING AND CLEANING

A. Repair panels with minor damage so that repairs are not discernible at a distance of 10 feet to the satisfaction of the Owner's Representative. Remove and replace panels damaged beyond repair.

B. Remove protective film immediately prior to completion of metal panel work.

C. Ensure that weep holes and drainage channels are unobstructed and free of dirt and sealants.

D. Clean aluminum of smears, spots, and other markings in accordance with manufacturer's instructions prior to acceptance.

E. Replace damaged aluminum wall panels and components. Field repair of panels, including factory-applied finish, is not permitted.

END OF SECTION

SECTION 07 5100
BUILT-UP BITUMINOUS ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Built-up asphalt roofing system with granular cap sheet.

2. Insulation and cover board integral with roofing system.

3. Walkway units.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Pre-installation Meeting: Prior to installation of roofing, Contractor, Owner's Representative, manufacturer's representative, roofing installer, and other installers whose work may affect quality of roofing shall meet at the Project site to review material selections and procedures to be followed in performing the work.

1. Notify participants at least 5 working days before conducting meeting.

2. Include review of information submittal documenting procedures to be followed for site access, staging areas, protection of building and surrounding areas, and scaffolding.

3. Record discussions of conference and furnish a copy of record to each participant.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Roof plan showing installation layout for insulation to achieve required slopes and drains.

B. Product Data:

1. Manufacturer's published specifications for products to be used in roofing system and installation instructions.

2. Sample copy of standard roofing system manufacturer's warranty.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. SS 7.2: Product Test Reports for roof materials documenting roof materials comply with Solar Reflectance Index requirement.

1.04 INFORMATIONAL SUBMITTALS

A. Procedures to be following for site access, staging areas, protection of building and surrounding areas, and scaffolding.

B. Material Safety Data Sheets for materials unless specifically exempted in the OSHA HazCom Standard 29 CFR 1910.1200.

C. Statement of installer qualifications including verification by roofing system manufacturer that installer is approved, authorized, or licensed by manufacturer to install specified roofing system.

D. Inspection report by representative of roofing system manufacturer.

E. Certificates signed by roofing manufacturer certifying that the roofing system complies with specified performance requirements.

F. Minutes of pre-installation meeting.

G. Results of field testing.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranties as specified.

B. Manufacturer's recommendations for proper maintenance of the roofing system including inspection frequencies, penetration addition/modification policies, temporary repairs, and leak call procedures.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:

1. Trained and approved by manufacturer of roofing materials.

2. Workers shall be skilled and experienced in installing the type of roof specified.

3. Trained and approved by manufacturer of roofing materials, and eligible to receive specified manufacturer’s warranty.

4. Installer shall maintain a full-time supervisor/foreman at the jobsite during times roofing work is in progress.
   a. Foreman shall have a minimum of 5-years' experience as foreman on similar projects.
   b. Foreman shall be fluent in English.

B. Contractor-Applicator-Manufacturer Review: Contractor and applicator shall review the Drawings and Specifications with agent of primary built-up roofing materials manufacturer and obtain written agreement, without exception, that selected systems are proper, compatible, and adequate for application shown and that conditions and details do not conflict with manufacturer's roofing and flashing warranty.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers, with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store roll goods on end at all times.

C. Protect stored liquid material from direct sunlight. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

D. Protect roof insulation from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturers written instructions for handling, storing, and protecting during installation.

E. Comply with fire and safety regulations. Provide newly tagged fire extinguishers of the proper type and size in the rooftop work area.

F. Store bulk asphalt in heated tanker at not greater than 325 degrees F.

1.08 FIELD CONDITIONS

A. Proceed with roofing work only when current and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

B. If installation is interrupted, provide watertight seals at perimeter of work and at penetrations. Water entry and resulting damage to Building, its contents, or to partially completed roofing work is the responsibility of the Contractor.

C. Protect existing adjacent building roofs and decks from construction activity.

1.09 WARRANTY

A. Contractor: Provide written 5 year warranty for roofing system, countersigned by installer, agreeing to repair or replace roof that leaks water, deteriorates, or otherwise fails to perform as required within warranty period as a result of failure of materials or workmanship, at no expense to the Owner.

1. By terms of warranty, also agree to remove and replace other work, as required, that has been connected to or superimposed on substrate material to be replaced.

2. Warranty shall include entire installation and roofing membrane assembly, including base flashing, with no dollar limit.

B. Manufacturer: Provide executed copy of roofing system manufacturer's standard 20-year "Membrane System Warranty," with a no-dollar-limit penal sum.

1. Warranty shall be signed by an authorized representative of roofing system manufacturer on a form published with the manufacturer's product literature as of the date of the Contract Documents.

2. Warranty shall cover both labor and material necessary to provide watertightness, including that required to repair roof leaks caused by structural movement or standing water on roof membrane.

PART 2 - PRODUCTS

2.01 BUILT-UP ROOFING SYSTEM

A. Manufacturer and System: Five-ply glass-fiber-type felt with asphalt bitumen and mineral surface cap sheet over non-nailable deck; Johns-Manville "5GIC-CR" or equal.

2.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Roofing system, base flashing, and interface with other specified items shall be watertight; shall not permit passage of liquid water; and shall withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another and with other specified materials, under conditions of service and installation required.

C. Membrane, base flashings, and component materials shall meet requirements of FM 4450 and FM 4470 as part of a roofing system and shall be listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable.

D. Installed system shall meet FM 1-90 Windstorm Classification rating.

E. Exterior Fire-Test Exposure: Class A; ASTM E108, for installation and slopes indicated. Roofing system shall have specified fire-test-response characteristics as determined by testing identical products in accordance with specified test method by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction.

F. Comply with CBC Chapter 15 with minimum slope of 1/4 inch per foot.

G. Sustainable Design Performance Requirements:

1. Membrane cap sheet shall be “Energy Star” labeled by the Environmental Protection Agency.

2. Roofing system shall have a Solar Reflectance Index (SRI) or not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.

2.03 MEMBRANE MATERIALS

A. General: Materials shall be products of or be as accepted or recommended by selected roofing system manufacturer and shall conform to specified requirements, as applicable.

B. Roofing Membrane Plies: Asphalt-coated glass fiber mat; ASTM D2178, Type VI; Johns Manville "GlasPly Premier," or equal.

C. Roofing Membrane Cap Sheet: ASTM D3909, asphalt-impregnated and -coated, glass-fiber cap sheet, with white**,** coarse mineral-granule top surfacing and fine mineral surfacing on bottom surface; Johns Manville "GlasKap CR," or equal.

2.04 FLASHING MATERIALS

A. Backer Sheet: ASTM D2178, Type VI, asphalt-impregnated, glass-fiber felt Johns Manville "GlasPly Premier," or equal.

B. Flashing Sheet: ASTM D 6221, Grade G, Type I, composite polyester- and glass-fiber-reinforced; Johns Manville "DynaFlex," or equal. Provide Johns Manville "DynaFlex-CR" where exposed.

2.05 AUXILIARY ROOFING MEMBRANE MATERIALS

A. Roofing Asphalt: ASTM D312, Type III, unless otherwise recommended by roofing manufacturer.

B. Asphalt Primer: ASTM D41.

C. Cants: Preformed fiberboard, ASTM C208.

1. Vertical Height above Roof Plane: 3 inches minimum and 4 inches maximum.

2. Maximum Face Incline: 45 degrees to roof plane.

D. Mechanical Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and provided by the roofing system manufacturer.

E. Walkway Units: Preformed planks consisting of asphalt fibers and fillers, a granule surface, and a reinforced carrier sheet; Johns Manville "Dyna Tread Plus," or equal.

1. Size: 1/2 inch x 32 inches x 32 inches.

2. Color: White/white.

F. Seam Coating: VOC compliant, one-part, acrylic elastomeric for asphalt bleed-out coverage and aesthetic touch ups on cool roof coated cap sheets; Johns Manville "JM CR" Seam Coating, or equal.

G. Nailers: Pressure-treated wood, #2 quality or better conforming to FM Loss Prevention Sheet 1-49 and Section 06 1053, "Miscellaneous Rough Carpentry." Creosote and asphaltic treatments are not acceptable.

2.06 INSULATION AND COVER BOARD

A. Thermal Rigid Insulation: Faced, closed-cell glass-fiber-reinforced polyisocyanurate board conforming to ASTM C1289, Class 1; Johns Manville "E'NRG'Y 3," or equal.

1. Thickness: As shown and required to achieve an average R-38 insulating value, 1-inch minimum.

2. Flame-Spread Rating: Maximum 25, ASTM E84.

3. Maximum Board Size: 4 feet x 4 feet.

4. Compressive Strength: 20 psi minimum, ASTM D1621.

5. Each panel shall be stamped with Factory Mutual approval symbol and UL Classification Label.

6. Slopes for Tapered Panels: Minimum 1/4 inch per foot, unless otherwise required by roofing manufacturer.

B. Sump Insulation: Rigid expanded perlite board having particles blended with selected binders and fibers and conforming to ASTM C728; Johns-Manville "Tapered Fesco-Board," or equal.

1. Slope: 1/2 inch per foot, unless otherwise required by roofing manufacturer:

2. Minimum Thickness: 1/2 inch, unless otherwise required by roofing manufacturer to meet FM requirements.

3. "Starter" and "Edge" strips: Tapered to a feather edge and sized to suit application.

C. Cover Board: ASTM C728, perlite board, 3/4 inch thick, seal coated; Johns Manville “Fesco Board,” or equal acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Protect adjacent construction from damage during roofing operations.

3.02 INSTALLATION OF INSULATION BOARD

A. Install insulation in order with roofing system manufacturer's written instructions and FM requirements for installing roof insulation.

B. Where more than one layer is required, install with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction.

C. Trim insulation and provide tapered edge strips, where necessary, at roof drains to preclude use of a cover board and so that completed surface is flush and does not restrict flow of water. Form a slight saucer around each roof drain.

D. Install insulation with long joints of insulation in a continuous straight line, with end joints staggered between rows, abutting edges, and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

E. Mechanically attach insulation to deck with approved fasteners and plates as required for FM Windstorm Classification rating, as shown on reviewed shop drawings, and at rate according to the insulation manufacturer’s recommendations for fastening rates and patterns.

1. Each insulation board shall be installed tightly against the adjacent boards on all sides.

2. Ensure that insulation is neatly fitted around all roof penetrations, to parapets, and to rising walls.

3. Insulation boards to rest evenly on the roof deck/substrate so that there are no significant and avoidable air spaces between the boards and the substrate.

4. Fasteners shall have minimum penetration into structural deck as required by roofing membrane manufacturer.

3.03 NAILING STRIPS

A. Provide nailers, minimum 3-1/2 inches wide by depth of insulation, at ridge and at approximately 20 feet face to face. Coordinate with installation of insulation boards.

B. Nailers shall be installed at right angles to the roof slope.

C. Securely attach to deck with mechanical fasteners to resist a pullout force of 200 pounds.

3.04 INSTALLATION OF INSULATION COVER BOARD

A. Apply over insulation with joints staggered from joints in underlying insulation and secure with adhesive or FM approved fasteners passing through insulation.

B. Butt board edges and ends loosely.

C. Fasteners and adhesive shall be used in strict compliance with the roof system manufacturer's installation recommendations, Factory Mutual Global (FMG) Loss Prevention Data Sheet 1-29 and in accordance with FMG Class I-90 approval requirements.

1. If set with adhesive, walk boards into place to ensure full contact with adhesive. Continue to walk boards in place until adhesive has set.

3.05 ROOFING INSTALLATION

A. General:

1. Install roofing, as shown on the Drawings and reviewed submittals, in accordance with manufacturer's recommendations.

2. Coordinate installation with such related work as sheet-metal flashing.

3. Install roofing system specification 5GIC-CR in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

4. Do not apply hot bitumen under conditions that would cause foaming.

5. Do not exceed temperature limitation recommended by roofing materials manufacturer for heating bitumen.

a. Apply bitumen at its Equiviscous Temperature (EVT) for method of application being used, plus or minus 25 degrees F.

b. Do not heat to or above flash point for more than four hours.
c. Do not exceed finish blowing temperature.
d. Provide a clearly visible thermometer on each kettle or delivery truck used to heat bitumen.

6. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel as required for manufacturer's warranty.

7. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.

a. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement with joints and edges sealed.
b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
c. Remove and discard temporary seals before beginning work on adjoining roofing.

B. Install four ply sheets starting at low point of roofing system.

1. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.

2. Install each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing system manufacturer, to form a uniform membrane without ply sheets touching.

3. Each felt shall be nailed to each wood nailer. Locate nail 3/4 inch from the leading edge of each felt as it is installed.

C. Install lapped granulated cap sheet starting at low point of roofing system in a solid mopping of hot roofing asphalt applied at rate required by roofing system

1. Offset laps from laps of preceding ply sheets and align cap sheet without stretching.

2. Lap in direction to shed water.

3. Extend cap sheet over and terminate beyond cants.

4. Apply specified seam coating to touch up bitumen/adhesive overruns on the finish ply surface and to provide an aesthetically acceptable uniform appearance.

5. Cap sheet shall terminate at a nailer.

a. At point of termination, place 5 nails across the 36-inch width of the endlap of the cap sheet and into the nailer.
b. First nail shall be spaced 3/4 inch from the leading edge of the cap sheet and remaining 4 nails spaced approximately 8-1/2 inches on center with nails staggered across width of nailer to reduce possibility of cap sheet tearing along the nail line.

D. Flashing:

1. Install sheet flashings and preformed flashing accessories, adhering to substrates according to roofing system manufacturer's written instructions.

2. Install membrane backing ply minimum 4 inches beyond cant, sheet metal flange, and similar conditions as required by manufacturer or as shown on the Drawings, whichever is greater.

3. Install membrane flashing minimum 4 inches beyond backing ply or as required by manufacturer or as shown on the Drawings, whichever is greater.

4. Install sheet flashings and preformed flashing accessories, adhering to substrates according to roofing system manufacturer's written instructions.

5. Sheet Metal Flashing: As specified in Section 07 6200, "Sheet Metal Flashing and Trim." Coordinate installation where metal flashing interfaces with roofing membrane in order to prevent metal from pulling free or buckling and to provide seal for preventing moisture from entering the roofing system or Building.

E. Roof Drains: Flash drain using Johns Manville “PermaFlash” system, or equal. Clamp roofing membrane, flashing, and stripping into roof-drain clamping ring. Install stripping according to roofing system manufacturer's written instructions.

F. Walkway Courses: Install at walkways and other locations where shown.

1. Set pads over cap sheet surfacing, in 5 spots of flashing cement, approximately 5-inches square in size.

2. Allow uniform 1 inch wide gap between adjacent pads, for drainage. Cut pads as required to allow for drainage at valleys and waterways.

3. Lay out so that end pieces are not less than one-half full length.

3.06 FIELD QUALITY CONTROL

A. Upon completion of installation, a representative of roofing membrane manufacturer shall inspect in order to verify that roofing system has been installed in accordance with manufacturer's approved specifications and details.

B. Testing:

1. Notify Owner’s Representative and manufacturer's representative at least 3 working days in advance of testing.

2. Promptly after completing installation of roofing membrane and prior to application of aggregate surfacing provide the following water testing:

a. Water-test all roof areas and parapet by applying flood coat of water along high areas so that water flows over them.
b. Conduct a 72-hour flood test around each roof drain according to ASTM D5957 (modified).

3. Should any leak or ponding appear that would violate specified requirements, repair and retest, as above, until work is watertight and acceptable.

4. Ponding is defined as any water that remains on membrane surface more than 24 hours after test, unless roofing manufacturer has a less stringent requirement.

C. Remove and replace system components where inspection or test results indicate that work does not comply with specified requirements.

END OF SECTION 07 5100

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for sheet metal for maintaining weather and water resistance of building enclosure, edge metal, flashing, and trim including the following:

1. Rain drainage including gutters, fascias, downspouts and scuppers.
2. Parapet coping.
3. Gravel stops.
4. Roof flashing not provided under Divisions 22 through 28 or roofing Sections.
5. Manufactured sheet metal accessories including:
    a. Reglets, pressure and termination bars.
6. Sealant work related to sheet metal flashing and trim.
7. Requirements for miscellaneous sheet metal integral with products and systems included under other Sections.

B. Related Requirements:

1. Delegated Design: Section 01 3325
2. Metal Wall Panels: Section 07 4243.
3. Flexible Flashing and Underlayment: Section 07 6500.
4. Joint Sealants: Section 07 9200.
5. Aluminum-Framed Storefronts: Section 08 4313.
6. Glazed Aluminum Curtain Walls: Section 08 4413; flashing and supplemental aluminum sheet or plate fabrications for curtain wall.
7. Metal Louvers: Section 08 9110.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. A653/A653M-13: "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process."

2. A666-10: "Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet."

3. A755/A755M-11: "Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products."

4. A792/A792M-10: "Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process."

5. B32-08: "Specification for Solder Metal."

6. B209-10: "Specification for Aluminum and Aluminum-Alloy Sheet and Plate."

B. Factory Mutual Global (FMG): "Loss Prevention Data Sheets," 1-49.

C. National Roofing Contractors Association (NRCA): "The NRCA Roofing and Waterproofing Manual."

D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA): "Architectural Sheet Metal Manual."

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Pre-installation Meeting: Prior to installation of sheet metal associated work, Contractor, Owner's Representative, and fabricator's field and office representatives responsible for work under this Section shall meet at the Project site to coordinate and discuss sheet metal practices applicable to this Project.

1. Notify participants at least 5 working days before conducting meeting.

2. Record discussions of conference and any conflict, incompatibility, or inadequacy. Furnish a copy of record to each participant.

3. At Contractor's option, agenda for sealant discussion may be included as part of pre-installation conferences required for other building assemblies and specified under other Sections.

C. Coordinate with shop drawing, mock-up, and warranty requirements of other Sections installed in conjunction with work of this Section.

1.04 ACTION SUBMITTALS

A. Shop Drawings: Fully detailed, large-scale drawings for fabrication and installation layout of sheet metal flashing and trim including plans, elevations, and keyed details. Distinguish between shop and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in project.

2. Details for forming sheet metal flashing and trim including profiles, shapes, seams, and dimensions.

3. Details for securing, joining, supporting, and anchoring sheet metal flashing and trim including fasteners, cleats, clips, and other attachments.

4. Details for expansion-joint covers including showing direction of expansion and contraction.

5. Details showing interface and relationship to adjacent materials.

6. Details of special conditions.

B. Products Data: Manufacturer's literature describing self-adhesive flashing, and other manufactured items.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. MR 5: Documentation for products regionally extracted, processed, and manufactured.

1) Include statement indicating costs for each product.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

4. Anodized Aluminum Samples: Samples to show full range to be expected for specified finish.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification of fabricator.

B. Verification of certification of coating applicator by coating manufacturer.

C. Record of pre-installation conference, if not included under other Sections.

1.06 CLOSEOUT SUBMITTALS

A. Extended warranty.

B. Touch-up paint as specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

C. Deliver sheet metal flashing materials and fabrications undamaged. Project sheet metal flashing, trim materials, and fabrications during transportation and handling.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.08 FIELD CONDITIONS

A. Coordinate with installer where work is to be performed on a daily basis so that protection of personnel, equipment, and materials below work area are properly protected.

B. Proceed with installation only when existing and forecasted weather conditions permit system to be installed according to manufacturer's written instructions and warranty requirements.

C. Installation shall not proceed if an unusual condition is discovered or that will preclude work to be performed in accordance with the Drawings and Specifications. Contractor shall immediately report this finding to the Owner's Representative for discussion and resolution.

D. Roofing and waterproofing surfaces shall be kept clean and free of debris. Scrap metal, fixings, and other materials shall be removed at the end of each work day to prevent damage to the roofing and waterproofing systems.

1.09 WARRANTY

A. Contractor: Provide written ~~2~~ 5 year warranty agreeing to repair or replace work that fails in materials or workmanship. Failure includes failure to perform as specified and/or deterioration of finish or construction in excess of that to be expected under normal weathering.

B. Manufacturer: Furnish to Owner coating manufacturer's written extended warranty for baked on high-performance coating against flaking, fading, peeling, and other visible defects for 20 years.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE REQUIREMENTS

A. Industry Standards:

1. Conform to applicable provisions of the "Architectural Sheet Metal Manual" of the Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA Manual), except where more stringent requirements are specified or shown.

2. Conform to applicable provisions of NRCA "Roofing and Waterproofing Manual."

3. Comply with applicable provisions of the loss prevention data books and materials approval publications of FM Global (FM).

B. Installed flashing and sheet metalwork shall be weathertight. Coordinate with work of other Sections for weathertight installation at interface with other materials and systems.

C. LEED Performance Criteria:

1. Recycled-content Materials: Stainless steel and aluminum flashing, reglets, and termination bars shall contain a minimum of 25 percent recycled content by weight, calculated by adding the post-consumer recycled content percentage to one-half of the pre-consumer recycled content percentage.

2.02 MANUFACTURERS AND PRODUCTS - GENERAL

A. Manufacturers and products, where listed, are intended to set a level of expected quality, appearance and performance and are not intended to limit or restrict products from other manufacturers and/or suppliers capable of meeting the requirements of this Specification.

B. Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacturer, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

C. Provide materials that are compatible with one another under conditions or service and application required, as demonstrated by testing and field experience.

D. Provide sheet metal flashing and trim that allows for thermal movement resulting from the maximum ambient and surface temperatures expected by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

2.03 MANUFACTURED ROOF SPECIALTIES

A. Manufactured Reglets: 24-gage galvanized [stainless] steel; Fry Reglet Corp. "Springlok" Flashing System, or equal.

1. Finish: Manufacturer's gray epoxy primer; exposed portions shall be field finish painted as specified in Section 09 9000, "Painting and Coating."

2. Provide the manufacturer's following accessories.

a. Flashing Retainer where counterflashing is not provided by manufacturer.
b. Manufactured mitered and sealed corners.

2.04 SHEET METAL

A. General:

1. Thickness: As required by SMACNA for specific conditions and as shown on Drawings but not less than 24-gage.

2. Thickness at continuous cleats shall be minimum 20-gage.

B. Metallic-Coat Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, Z275 (G90) coating designation; structural quality.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, Class AZM150 coating designation, Grade 275 (Class AZ50 coating designation, Grade 40); structural quality; "Zincalume," "Galvalume," or "Zintro-Alum" manufactured under license from BIEC International, Inc., Vancouver, WA.

C. Aluminum: ASTM B209, alloy 3003, 0.032 inch thick, except as otherwise indicated.

D. Stainless Steel Sheets: ASTM A240 or ASTM A666, 300 Series, type best suited for purpose.

2.05 ACCESSORIES

A. Self-Adhesive Flexible Sheet Underlayment and Related Flexible Flashings: As specified in Section 07 6500, "Flexible Flashing and Underlayment."

B. Fasteners: Hot-dip galvanized or 300 series alloy stainless steel.

1. Provide rivets of minimum 3/16 inch diameter, sheet metal screws, machine screws, self-tapping screws, and stove bolts of types and sizes best adapted to conditions of use.

2. Pop rivets ~~may~~ **shall** be used for metal-to-metal connections when future disassembly is not required and where not exposed to view.
   a. Open-end type may be used for all applications, except where watertight connections are required, in which case, use closed-end type.
   b. Use pop rivets made from same type material as metals to be fastened.
   c. Joints using pop rivets shall be soldered.

3. Fasteners exposed to view shall be reviewed with Owner's Representative. Finish exposed fasteners to match adjacent surface.

4. Provide stainless steel/EPDM washers at exposed fastener locations.

5. Provide neoprene washers integral with fastener at locations exposed to weather.

C. Solder:

1. For Stainless Steel: ASTM B32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

2. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

~~3. For Lead: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead.~~

D. Flashing Cement: ASTM D4586.

E. Lead Flashing: ~~4 pound sheet of common desilverized pig lead. Use only at ferrous roof penetrations.~~**Not permitted.**

F. Slip Sheet: Rosin-sized, unsaturated building paper, 4 to 6 pounds per 100 square feet; FS UU-B-790, Type I, Grade A.

G. Pressure Bars and Termination Bars: Stainless steel or aluminum, sizes and types shown on the Drawings.

H. Sealant: As specified in Section 07 9200, "Joint Sealants."

I. Neoprene Pads: Shore 80 hardness, minimum 3.2mm (1/8 inch) thick.

J. Draw Bands: Type 316 stainless steel sheet with Type 316 stainless steel screws.

2.06 FABRICATION

A. Fabricated Metal Flashing, Rain Drainage, and Trim:

1. Shop-fabricate flashing, trim, expansion joints, and similar items from metals noted on the Drawings to comply with profiles and sizes shown and in accordance with standard details shown in "Architectural Sheet Metal Manual" by SMACNA.

2. Finished work shall be strong and rigid, neat in appearance, and free from defects.

3. Surfaces shall be smooth and free from warping or buckling.

4. Seams and joints shall be kept to a minimum.

5. Width of Seams:

a. Flat Lock Seam: 1/2 inch wide.
b. Lapped Seam, Soldered, Subject to Stress: 1 inch wide.
c. Lapped Seam, Soldered, not Subject to Stress: 1/2 inch wide.
d. Lapped Seam, Expansion Joint, Filled with Sealant Tape: 4 inches wide.
e. Where lapped expansion provision cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant within concealed joints.

6. Metal sheets in straight runs shall be made up of lengths of not less than 8 feet.

7. Joints exposed to view, such as fascias, gravel stops, gutters, copings, and flashing at openings and curtain wall, shall be flush butt joints separated by a 3/8-inch space with backing plate bedded watertight in sealant. Other joints shall be lapped unless otherwise shown on Drawings.

8. Gutters:

   a. Fabricate in profile and configuration indicated on the Drawings.
   b. Fabricate gutters in sections at least 8 feet long, except where shorter lengths are required.
   c. Provide basket- or bulb-type strainers fabricated from 12-gage or heavier aluminum hardware cloth.

9. Fabricate sheet metal flashing and trim in thickness or weight necessary to comply with performance requirements, but not less than that specified for each application and metal.

10. Obtain field measurements for accurate fit before proceeding with shop fabrication.

11. Conceal fasteners and expansion provision where possible on exposed to view sheet metal flashing and trim, unless otherwise indicated.

12. Fabricate cleats and attachment devices from the same material as accessory being anchored.

13. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet metal Manual" and by FMG "Loss Prevention Data Sheet" 1-49 for application **and at perimeter edges**, but not less than thickness of metal being secured. **Cleats shall be continuous as perimeter edges.**

14. Exposed edges of sheet metal flashing shall be folded and hemmed **1/2 inch**.

15. Fabricate inside and outside corners, intersections, and complex flashing conditions in shop with folded, constructed, mechanically fastened, and soldered joints.

B. Install specified slip sheet over preservative-treated wood that would otherwise be in direct contact with sheet metal.

C. Provide miscellaneous aluminum flashing, finished to match curtain wall system specified in Section 08 4413, "Glazed Aluminum Curtain Walls."

D. Metal Pan Flashing at Wall Openings: Turn up at ends to create a dam, 2 inches minimum. Solder seams. Coordinate with installer of windows, louvers, or other items to be installed at openings.]

E. Soldering:

1. Clean and flux metal prior to soldering.

2. Sweat solder completely through seam width.

3. Make exposed soldering full flowing and smooth with finish surfaces.

4. Wash acid flux with an appropriate neutralizer solution after soldering, and remove soldering flux on exposed and painted surfaces.

5. All soldered joints shall be mechanically fastened.

F. Expansion and Contraction:

1. Provide for thermal expansion and contraction and building movement in completed work without overstressing materials, breaking connections, or producing wrinkles and distortion in finished surfaces.

2. Provide expansion joints at locations shown or as required by SMACNA's "Architectural Sheet metal Manual."

~~2.~~**3.** Make water- and weathertight throughout.

~~3.~~**4.** Where subject to thermal expansion and contraction, attach members with clips to permit movement without damage, or provide slotted or oversize holes with washers.

~~4.~~**5.** Make lock seam work flat and true to line. Sweat full of solder, except where installed to permit expansion and contraction.

a. Lap flat lock seams. Lap seams where soldered according to pitch.
b. Make seams in direction of flow.
c. Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges as specified

~~5.~~**6.** Space movement joints at a maximum of 8 feet with no joints allowed within 24 inches of a corner or intersection.

2.07 FACTORY FINISHES

A. General:

1. All components shall be processed in one production lot to ensure color and appearance matching.

2. See Section 09 9000, "Painting and Coating," for field-applied coatings.

B. Paint: High-performance fluoropolymer coating containing minimum 70 percent polyvinylidene fluoride (PVDF) resin and meeting or exceeding all the requirements of AAMA 2605.

1. Coating: Two-coat system; PPG "Duranar," or equal as standard with metal panel manufacturer.

a. Colors: As specified in Section 08 4413, "Glazed Aluminum Curtain Walls." Coordinate for color matching.

2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish.

3. Coating shall be applied by an applicator approved and certified by the coating manufacturer.

4. Touch-up Paint: Provide for each color, prepared by original applicator, for use by Owner to touch up field damage to finish coating surface.

a. Touch-up paint shall be made from same batch used for factory finish, to ensure proper color match.
b. Touch-up paint is for Owner's use only.

C. Anodized on Aluminum: Architectural Class I clear anodic coating conforming to AA-M12C22A41.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrates are smooth and clean to extent needed for sheet metalwork.

B. Verify that nailers, cants, and blocking to receive sheet metal are installed and suitable to receive sheet metalwork.

C. Before installing sheet metal, verify shapes and dimensions of surface to be covered.

D. Notify the Owner's Representative of any discrepancies between the Drawings and field conditions, and of any elements that required repair.

E. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer or applicator. Starting work within a particular area will be construed as acceptance of surface conditions.

3.02 INSTALLATION

A. General:

1. Comply with details and profiles indicated on Drawings and SMACNA "Architectural Sheet Metal Manual" recommendations for installation of the work.

2. Coordinate installation with other work that comprises entire system of weatherproofing, waterproofing, and rain drainage.

3. Conceal fastenings, except as otherwise indicated.

4. Conceal reinforcement within finished assembly.

5. Unless otherwise noted, separate dissimilar metals with suitable coating. Coating shall be invisible in finished work, except for ends of sections.

6. Install work watertight, without waves, warps, buckles, fastening stresses, distortion, "oil canning," and true to line and surface, allowing for expansion and contraction.

7. Torch cutting of sheet metal flashing and trim is not permitted.

B. Flashings:

1. Install flashings and counterflashings where shown or required to provide watertight protection.

2. Install specified self-adhesive flashing [as specified in Section 07 6500, "Flexible Flashing and Underlayment," under coping and elsewhere as shown.

3. Counterflashing:

a. Coordinate installation of counterflashing with installation of roofing and waterproofing membrane termination.
b. Extend counterflashing 4 inches over roofing or waterproofing.
c. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant.
d. Secure in a waterproof manner by means of anchor and washer spaced at 36 inches centers maximum.

4. Pipe or Post Counterflashing Flashing:

a. Install counterflashing umbrellas with close-fitting collar with top edge flaired for elastomeric sealant extending minimum of 4 inches over ~~lead~~ **metal** flashing or waterproofing membrane.
b. Install stainless steel draw band and tighten.

5. Roof Slab Penetration Flashing:

a. Coordinate installation of roof penetration flashing with installation of roofing and other items penetrating roof.
b. Provide separate ~~lead~~ **metal** flashing cap at top of penetration.

6. Penetration Flashing Through Base Flashing: Provide prefabricated collar flashing soldered watertight with minimum 4 inch flanges.

C. Gutters:

1. Install level with downspouts outlets at opposite ends of gutter as shown.

2. Lap joints at least 6 inches and secure thoroughly and seal watertight.

3. Expansion joints in gutters shall be butt type. Install only at midpoint in run of gutter.

4. Fasten or secure to structure in such a way as to permit free movement for expansion and contraction.

D. Downspouts:

1. Install exposed downspouts in sections not less than 8 feet long except where shorter length is required.

2. Set downspouts plumb and to configuration shown on Drawings.

3. Join lengths of downspout by telescoping end of upper length 3/4 inch minimum into lower length.

4. Provide straps to secure both ends of joining lengths.

E. Conceal fasteners, except those specifically indicated on the Drawings to be exposed.

F. Apply sealants as specified in Section 07 9200, "Joint Sealants."

3.03 FIELD QUALITY CONTROL

A. Maximum Deviation from Alignment When Erected: 1/4 inch in 20 feet, non-cumulative.

3.04 CLEANING AND TOUCH-UP

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers' written installation instructions.

B. Touch up field abrasions and damage to factory-painted finish so that repairs are not discernible and are acceptable to the Owner's Representative. Touch-up shall be unnoticeable in completed installation. Remove and replace metal components where damage is beyond repair.

C. Clean finished surfaces in accordance with manufacturer's instructions. Clean and neutralize flux materials. Clean off excess solder.

END OF SECTION 07 6200

SECTION 07 6500
FLEXIBLE FLASHING AND UNDERLAYMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for:

1. Self-adhering sheet membrane underlayment at exterior wall cladding.

2. Self-adhering sheet flashing at perimeter openings, under copings, and other locations where shown.

B. Related Requirements:

1. Delegated Design: Section 01 3325

2. Gypsum Sheathing: Section 06 1643.

3. Sheet Metal Flashing and Trim: Section 07 6200.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination:

1. Coordinate with other Sections for continuity of waterproofing of building envelope at interface of flashings and underlayment installed by various trades.

2. Coordinate with installers of anchorage for wall panels and other work anchored to substrate or otherwise penetrating self-adhering membranes, to ensure that all penetrations are sealed.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's descriptive data for proposed product, installation instructions, use limitations of materials, and recommendations for proposed installation.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

1.04 DELIVERY, HANDLING, AND STORAGE

A. Store materials away from sparks or flames, protected from rain and physical damage, and within temperature range recommended by manufacturer.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.05 FIELD CONDITIONS

A. Temperature of air and surfaces to receive underlayment shall be within the range recommended by system manufacturer.

B. Substrate surfaces shall be dry at application.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. LEED Performance Criteria:

1. Field-applied adhesives, sealants, paints and coatings used for interior applications shall meet the volatile organic compound (VOC) and chemical component limitations as defined under Section 01 3560, "Special Environmental Requirements."

2.02 MATERIALS

A. Self-Adhering Underlayment at Exterior Wall Sheathing (Referred to on the Drawings as "W.P. Membrane"): 40-mil-thick composite of high-density, cross-laminated, polyethylene film, coated on one side with rubberized asphalt, with disposable release sheet; "Perm-A-Barrier Wall Membrane" by Grace Construction Products, or equal.

B. Self-Adhering Sheet Flashing Underlayment (Referred to on the Drawings as “SASF” – Self Adhering Sheet Flashing): 30-mil-thick composite of aggressive butyl rubber based adhesive backed by a layer of high density cross laminated polyethylene; "Grace Ultra" by Grace Construction Products, or accepted equal.

2.03 ACCESSORIES

A. Sealant for Flexible Flashing and Underlayment: Sealing mastic as provided or recommended by membrane manufacturer.

B. Primer: “Perma Barrier WB” by Grace Construction Products, or accepted equal.

C. Liquid Membrane: Two-component, 100 percent solids modified urethane, cold-applied; "Bituthene Liquid Membrane."

D. Foil Tape (Referred to on the Drawings as “SASF” – Self Adhering Sheet Flashing): Butyl rubber with a 2 mil thick aluminum foil backing; “Polyken 626-35” by Berry Plastics Corp. Use at locations where flashing is in direct contact with sealants.

E. Mechanical Fasteners: Washer-type, as recommended by membrane manufacturer for attachment to substrate.

F. Additional Accessories: Provide as recommended by manufacturer for conditions of installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check to ascertain whether surfaces to receive sheet membrane flashing or underlayment are free of dirt, debris, sharp protrusions, and irregularities at joints.

B. Correct deficiencies.

C. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Where priming is required, prime substrates with primer suitable for each substrate and recommended for this use by membrane manufacturer.

1. Prime concrete if bottom of membrane overlaps and is adhered to concrete foundation or slab. Prime only areas that can be covered with membrane on the same day. Re-prime areas not covered with membrane within 24 hours.

2. Prime other substrates as recommended by manufacturer for installation of sheet membrane.

B. At external corners or gaps in sheathing, install liquid membrane to smooth and ease gaps, and to round corners.

C. Concrete Surfaces:

1. Sack or patch concrete with voids or gaps greater than 1/4 inch.

2. Grind down formwork ridges, pour offsets, and other surface differences greater than 1/4 inch.

3.03 INSTALLATION OF SELF ADHERING FLASHING AND UNDERLAYMENT

A. Install at locations specified and as shown on Drawings. Coordinate the installation of the self-adhesive membranes with the waterproofing and roofing systems to ensure continuity of self-adhesive underlayment with other waterproofing assemblies.

B. At vertical surfaces, apply strips horizontally. Provide minimum 3-1/2 inches of side lap.

C. Cut membrane from roll to required lengths, and apply in continuous strips.

D. Comply with manufacturer's recommendations and specified requirements for overlapping or side and end seams.

1. If dimension is not shown on the Drawings, provide minimum 3 inch lap between self-adhesive underlayment and adjacent waterproofing or roofing systems.

2. At perimeter terminations turn up side dams a minimum of 4 inches and fold to form watertight inside corners with seams sealed.

E. Flashing at Openings: As shown on the Drawings in accordance with details and recommendations of manufacturer.

1. Fold and lap flashing to prevent water from migrating behind underlayment.

2. Provide sealant at any "pinholes."

F. Press membrane into place using heavy hand pressure, or roll with a wall or countertop roller.

G. Patch tears and inadequately lapped seams.

H. Provide mechanical fasteners where recommended by membrane manufacturer. Fastener heads shall be sealed with liquid membrane.

I. Seal joints caused by pipes, conduits, electrical boxes, anchors, and similar items penetrating membrane with liquid membrane to create an airtight seal between penetrating objects and membrane. Apply liquid membrane to seal termination edges.

J. At transition to hot fluid-applied roofing and waterproofing system, self-adhesive underlayment shall be fully bed in liquid membrane at lap.

K. Seal all top edges of self-adhesive membrane terminating on a vertical surface with liquid membrane.

L. Inspect membrane for continuity. Patch tears, fishmouths, damage, and inadequately lapped seams in accordance with manufacturer's instructions.

M. Apply overlying materials within allowable exposure time limits specified and stated in manufacturer's instructions.

END OF SECTION 07 6500

SECTION 07 7233
ROOF HATCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Prefabricated roof hatches with operable hardware and counterflashing.

2. Safety posts and rooftop guardrails for hatches.

B. Related Requirements:

1. Metal Fabrications: Section 05 5000; access stair.

2. Built-up Bituminous Roofing: Section 07 5100.

3. Painting and Coating: Section 09 9000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details including plans, elevations, and sections.

1. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components.

2. Show method of attaching accessories to roof or building structure.

B. Product Data: Manufacturer's drawings and printed literature, indicating construction, joinery, finishes, size, shape, thickness, and alloy of materials; hardware; and relationship to adjoining work. Include manufacturer's installation instructions for special installation criteria.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturer's certification verifying guardrail compliance with specified OSHA standards.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranties as specified.

1.06 QUALITY ASSURANCE

A. Standards: Comply with the following:

1. SMACNA "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

2. NRCA "Roofing and Waterproofing Manual" details for installing units.

3. Occupational Safety and Health Administration (OSHA) Standards contained in 29 CFR 1910.23 and 1910.27.

1.07 WARRANTY

A. Manufacturer:

1. Hatches: Provide manufacturer’s 5-year warranty for access hatches against defects in material and workmanship

2. Safety Guardrail: Provide manufacturer’s 25-year warranty for hatch safety guardrail system against defects in material and workmanship.

3. Safety Post: Provide manufacturer’s 5-year warranty for safety post system against defects in material and workmanship.

PART 2 - PRODUCTS

2.01 ROOF HATCHES

A. Manufacturers: Babcock-Davis products as specified, The Bilco Company, Nystrom, or equal.

B. Size: Ships stair access Type BRHP, 36 x 54 inches.

C. Cover: 11 gage (0.090-inch) aluminum, mill finish.

1. Provide glass fiber insulation one inch thick in cover, fully covered and protected.

D. Curb: 12 inches high, fabricated from 11 gauge (0.090-inch) aluminum.

1. Form curb with 3-1/2-inch flange.

2. Provide an integral metal cap flashing of same gage and material as curb; continuously weld at corners to ensure watertightness.

3. Provide 1-inch rigid fiberboard insulation at exterior of curb.

a. Cut insulation short at top, and provide a treated wood nailer 1-inch thick, matching thickness of insulation, by 3-1/2 inches high for securing of roof membrane.
b. Securely fasten insulation and nailer to metal curb of hatch.

E. Hardware:

1. Heavy pintle hinges.

2. Compression-spring operators enclosed in telescopic tubes.

3. Latch: Type 304 stainless steel slam latch with turn handle and inside/outside padlock hasps.

4. Type 316 stainless steel automatic hold-open arm with vinyl grip handle that automatically locks door when opene.

5. Neoprene or EPDM draft seals.

2.02 ACCESSORIES

A. Automatic Safety Post for Ships Stair Access Hatch: Telescoping tubular aluminum section operated by stainless steel springs, with automatic lock in fully extended position, and release lever to disengage the post and allow it to be returned to its lowered position; Babcock-Davis "BSP" Series as specified, The Bilco Company, Nystrom, or equal.

1. Post: High strength square tubing, 1-1/2 inches by 1-1/2 inches by 1/8 inch. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.

2. Mounting: Directly to the top two rungs of fixed ladder.

3. Balancing Spring: A stainless steel constant force mechanism to provide smooth, easy, controlled operation when raising and lowering the safety post.

4. Mounting Hardware: Zinc plated steel.

5. Tubular post shall lock automatically when fully extended. Release lever shall disengage the post to allow it to be returned to its lowered position

6. Finish: Mill.

B. Hatch Safety Guardrail at Ships Stair Access Hatch: Babcock-Davis "SRGC" Series as specified, The Bilco Company, Nystrom, or equal OSHA compliant system.

1. Top Rail, Mid Rail and Upright Posts: A53 Grade B galvanized steel pipe, 1-1/4 inch inside diameter.

2. Self-Closing Gate Where Shown: A53 Grade B galvanized steel pipe, 1-1/4 inch inside diameter, U bolt with hinge attachment, and galvanized mounting bolts and nut hardware.

3. Fittings: Manufacturer's standard aluminum magnesium alloy, cast with set screw pipe mount.

4. Mounting Brackets to Counterflashing: 3/16-inch zinc plated steel fastened to steel backing plate.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.

2. Coordinate installation with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other related construction.

3. Anchor securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Set hatches plumb, level, and true to line without warp or rack in accordance with details of NRCA "Roofing and Waterproofing Manual," unless otherwise indicated or required by manufacturer. Flash to produce a watertight and weathertight installation.

C. Install automatic safety post and rooftop guardrail in accordance with manufacturer’s recommendations.

1. Guardrail shall be secured to curb using manufacturer’s mounting brackets and fasteners; penetrations through metal flashings and roof membrane are not permitted.

2. Top of guardrail shall be set at 42-inches above finished roof surface.

D. Test-operate hatches and guardrail gate. Clean and lubricate joints and hardware. Adjust for proper operation.

END OF SECTION 07 7233

SECTION 07 8400
FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Through-penetration firestop systems including:

a. Penetrations in fire-resistance-rated walls.
b. Penetrations in horizontal assemblies.
c. Penetrations in smoke barriers.

2. Fire-rated joint systems including:

a. Joints in or between fire-resistance-rated constructions.
b. Joints at exterior curtain-wall/floor intersections.
c. Joints in smoke barriers.

B. Related Requirements:

1. Thermal Board and Blanket Insulation: Section 07 2100.

2. Glazed Aluminum Curtain Walls: Section 08 4413.

3. Gypsum Board Shaft-Wall Assemblies: Section 09 2116; fireproofing at shaft wall assemblies.

4. Gypsum Board: Section 09 2900; gypsum wallboard fireproofing at structural members.

5. Divisions 21 through 28: Infrastructure systems requiring firestopping.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

B. Coordination:

1. Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed in accordance with specified requirements.

2. Sequence work to permit firestopping to be installed after completion of penetrating item installation but prior to covering or concealing of openings.

1.03 ACTION SUBMITTALS

A. Shop Drawings:

1. Manufacturer's UL-approved assembly drawings are acceptable as shop drawings if they reflect actual job conditions.

2. For job conditions where no clearly defined UL-approved assembly exists, provide an engineering judgment from manufacturer. Where requested by Owner's Representative, submit drawings showing each condition to document proposed systems, materials, anchorage, methods of installation, and type of construction assembly being penetrated.

   a. Engineering judgments shall follow requirements set forth by the International Firestop Council.
   b. Proposed system shall be acceptable to local governing authorities.

B. Product Data:

1. Manufacturer's specifications and installation instructions for all materials and prefabricated devices, providing descriptions sufficient for identification at the jobsite.

2. Instruction details shall reflect actual job conditions.

3. Where available, include aging data for intumescent products.

4. Where available, include L rating indicating tested air leakage for products used in through-penetration systems.

C. Sustainable Design (LEED):

1. General:

   a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
   b. Sustainable design submittals are in addition to other submittals.
   c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

   a. IEQ 4.1: Printed statement of volatile organic compounds (VOCs) for field-applied adhesives and sealers applied inside the weatherproofing.

      1) Include statement indicating costs for each product.

   b. IEQ 4.2: For field applied coatings inside the weatherproofing, include manufacturers' product data, including chemical components, and printed statement verifying compliance with required VOC content.

      1) Include statement indicating costs for each product.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturer's letter of certification or certified laboratory test report stating that materials or combination of materials meet requirements specified in ASTM E814 and are so classified in UL's Building Materials Directory.

B. UL Certificates of Compliance.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Firestopping installation shall meet requirements of Underwriters Laboratories Inc. (UL) Test UL 1479, "Fire Tests of Through-Penetration Firestops," or ASTM E814 and UL 2079.

2. Materials shall meet requirements of NFPA 101, "Life Safety Code" and NFPA 70, "National Electrical Code."

B. Installer Qualifications: A specialty contractor experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

1. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

2. Installer shall be certified under FM 4991.

C. At Contractor's option, work under this Section may assigned to a single qualified installer or be divided among various trades, subject to limitation that same products for each firestopping system are used throughout and each installer meet qualification requirements specified in this Section.

D. Fire-Test-Response Characteristics: Firestopping shall comply with the following requirements and those specified under "System Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, ITS-Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested in accordance with ASTM E814 under conditions in which positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Systems shall comply with the following requirements:
   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
   b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by ITS-Warnock Hersey, or by another qualified testing and inspecting agency.

3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics in accordance with UL 2079 under conditions in which the positive furnace pressure differential is at

least 0.01 inch of water, as measured 0.78 inch from face exposed to furnace fire. Systems shall comply with the following requirements:

a. Fire Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

E. Mockups:

1. Concealed Locations: Seal one floor, one wall opening, and one fire-rated partition under firestopping system manufacturer's supervision to show completed system and to verify installation method and procedure.

2. Exposed Locations: Prepare and seal a typical penetration to be sealed with foam firestopping.
   a. Exposed surface shall be made smooth and suitable to receive a paintable surface.
   b. Installation shall be reviewed by the Owner’s Representative.
   c. Modify mockup as necessary until appearance is accepted.

3. Accepted mockups shall serve as a standard of workmanship and appearance for all penetrations remaining exposed in completed construction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened packages or containers clearly identifying manufacturer's names, brand designations, product descriptions, applicable standards, lot numbers, and test or rating labels.

B. Store materials off ground, protected against weather, condensation, and damage.

C. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.07 FIELD CONDITIONS

A. Do not install materials when temperatures exceed manufacturer's recommended limitations for installation. Maintain minimum temperatures before, during, and for 3 days after installation of materials.

B. Provide masking and drop cloths during installation to prevent firestopping materials from contaminating adjacent surfaces.

PART 2 - PRODUCTS

2.01 SYSTEM PERFORMANCE CRITERIA

A. General:

1. Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and passage of smoke and other gases.

2. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E84.

3. Materials shall be compatible with each other and with other specified items with which they may come in contact and shall not cause corrosion of penetrating items.

4. Materials shall be free of solvents, asbestos, or PCBs, and shall be nontoxic to human beings at all stages of application and during fire conditions.

5. Firestopping shall remain sufficiently flexible after installation to accommodate expected vibration and movement between penetrating items and rated building components or assemblies or between adjacent building components or assemblies at joint systems, without affecting adhesion or integrity of system.

6. Materials shall not shrink noticeably after installation.

7. Caulk, foam, mortar, and putty materials shall be autobonding to permit changes to penetrating items.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings as determined in accordance with ASTM E814 but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined in accordance with ASTM E814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where firestop systems protect the following types of penetrations:

1. Penetrations located outside of wall cavities.

2. Penetrations located outside fire-resistive shaft enclosures.

3. Penetrations located in construction containing doors required to have a temperature-rise rating.

4. Penetrating items larger than a 4-inch-diameter nominal pipe or 16 square inches in overall cross-sectional area.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per UL 2079, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. Provide firestopping assemblies that do not deteriorate when exposed to view, traffic, moisture, and physical damage.

1. Provide moisture-resistant, through-penetration, firestop systems at piping penetrations for plumbing and wet-pipe sprinkler systems.

2. Provide firestop systems capable of supporting floor loads, either by installing floor plates or by other means at floor penetrations with annular spaces over 4 inches wide and exposed to possible loading and traffic.

3. Provide through-penetration firestop systems not requiring removal of insulation at penetrations involving insulated piping,

4. Rating of firestopping materials or system shall in no case be less than rating of rated floor or wall assembly.

2.02 FIRESTOPPING MATERIALS

A. General:

1. Materials listed below are not necessarily all-inclusive, nor are all materials listed necessarily required to be used.

2. Although several manufacturers are listed for each type of firestopping and listed manufacturers also vary for each Type, Contractor shall develop systems for firestopping using approved systems from a single manufacturer unless products for required systems are not available from the selected manufacturer.

B. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E136, with flame-spread and smoke-developed ratings of zero per ASTM E84; “USG Firecode Compound” by United States Gypsum Co., "Gold Bold Sta-Smooth FS 90 Fire-Shield Compound," or accepted equal.

C. Firestop Mortar: Prepackaged dry mix of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar; Hilti FS 637 “Firestop Mortar," or accepted equal.

D. Non-intumescent Firestop Sealant: One-part, non-hardening (permanently flexible), silicone elastomer; Hilti CP 601S “Elastomeric Firestop Sealant," or accepted equal.

E. Intumescent Firestop Sealant: Hilti "FS-One," or accepted equal.

F. Mastic Firestop Sealant: Single component, water based, mastic grade; Rectorseal "Metacaulk 1100" or accepted equal.

G. Firestop Foam: Two-component silicone elastomer; Hilti CP 620 "Fire Foam," or accepted equal.

1. After dispensing, foam shall be fully expanded in 5 minutes and fully cured in 24 hours. Approximate density 16 pcf, with uniform cell structure.

2. Forming and Damming Materials, As Required: Mineral fiberboard or as selected by installer.

3. Primer, sealant, and solvent cleaner as recommended by foam manufacturer.

H. Intumescent Fire Blocks: Hilti "FS-657" or accepted equal.

I. Flexible Firestop Spray Coating: Sprayable water-based coating; designed to form a flexible seal over mineral fiber firesafing; Hilti CP 672 "Speed Spray," or accepted equal.

J. Intumescent Putty and Putty Pads (for Use at Electric Boxes): Hilti CP 617 “Firestop Putty Pads" in required lengths and CP 618 “Firestop Putty Sticks," or accepted equal.

K. Intumescent Pipe Wrap: Hilti CP 645, 648E or 648S "Firestop Wrap Strip," or accepted equal.

L. Intumescent Sheet: Self-supporting board or panel. Hilti CP 675T “Firestop Board with Accessories,” or accepted equal.

M. Intumescent Sleeves, Collars, and Plastic Pipe Devices: Shop or field fabricated; heavy gauge galvanized steel with intumescent liner; Hilti CP 643N and 644 “Firestop Collar," or accepted equal.

N. High Temperature Firestop Calk: Single component; The Carborundum Company "FyrePutty, Tremco "FYRE-Shield," or accepted equal.

O. Intumescent Pillows/Bags: Not permitted.

P. Electrical Box Treatment: 3M "Fire Barrier Moldable Putty Pads," Hevi-Duty Nelson Products "FSP Firestop Putty Pads," International Protective Coatings Corp. "Flamesafe FSP 1077 Firestop Pads," or accepted equal.

2.03 FIRESAFING, ACCESSORIES AND OTHER MATERIALS

A. Mineral Fiber Firesafing/Backing Material:

1. Unfaced Mineral Fiber: 4 pcf, suitable for friction fit in voids. Melt point 2000 degrees F minimum, ASTM C24. Ceramic or cementitious-blend fiber is also approved. Do not use glass fiber.

2. Foil Faced Mineral Fiber: Same as unfaced mineral fiber but with aluminum foil facing on one side.

3. Noncombustible per NFPA Standard 220 when tested in accordance with ASTM E136.

4. Thermal Conductivity: 0.25 to 0.23 k-value per ASTM C518.

5. Surface-Burning Characteristics:

a. Flame Spread: 15 (10 to 25 with foil facing).
b. Fuel Contributed: 0 (5 with foil facing).
c. Smoke Developed: 0.

B. Cast-in Firestop Devices: Hilti CP 680N and CP 682 “Firestop Cast-in Device,” CP 681 “Tub Box Kit,” and “Aerator Adaptor,” or accepted equal.

C. Other Facing and Backing Materials: As recommended by firestopping manufacturer. Use fire resistive material where possible.

D. Accessories:

1. Provide joint fillers, packing, and other accessory materials required for installation of firestop sealants, as applicable to installation conditions indicated.

2. Provide primers, sealers, and solvent cleaners as recommended by firestopping manufacturers for specific substrate surfaces.

3. Provide impaling clips, cinch shields, and similar items required for installation of backing material.

4. Provide protective covers or devices for soft firestopping and firesafing products that will be exposed in finished construction.

2.04 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas scheduled to receive firestopping to ensure protection against inclement weather and other hazards and to verify that work of preceding trades is completed.

B. Examine space allocated for firestopping for proper depth to receive material.

3.02 PREPARATION

A. Clean surfaces to receive firestopping. Remove dirt, grease, oil, loose materials, rust and other substances that may affect bond, installation, and fire resistance.

3.03 INSTALLATION - GENERAL

A. Install backing materials, forms, clips, and other items as required to hold firestopping and firesafing in place.

B. Firestopping or firesafing shall completely fill void spaces, regardless of geometric configuration.

C. Use mineral fiber to fill gaps at fire-resistive joint systems, as a backing material for firestop sealants and calks, and elsewhere as permitted by code. Pack mineral fiber snugly into voids. Install firestop sealant to cover backing material completely. Do not use unfaced mineral fiber by itself for firestopping purposes.

D. Use foam, sealant, mortar, or ceramic fiber putty to firestop duct, conduit, and metal pipe penetrations at fire-rated construction.

E. At sound-rated fire-rated construction, use only permanently resilient firestopping materials.

F. Firestop ceiling penetrations from exposed side only. Firestop wall penetrations on both sides.

G. Fill voids behind firestopping with mineral fiber backing material.

H. Firestop space between penetrating element and sleeve or collar. Also, seal space between sleeve, collar, or penetrating element and adjacent construction.

I. Installation of Firestopping Sealants:

1. Comply with manufacturer's printed instructions, except where more stringent requirements are shown or specified.

2. Comply with ASTM C1193 for installation of elastomeric joint sealants.

J. Use firestop mortar or high-temperature calk at penetrations by high-temperature items such as steam piping, flues, and chimneys.

K. Install protective covers or devices where applicable.

L. Maintain integrity over entire area to form a continuous fire stop.

M. Exposed sealant shall be trowelled smooth.

N. Where firestop sealant is used at sound-rated partitions, it shall be a non-intumescent type.

3.04 INTUMESCENT FIRESTOPPING

A. Use intumescent materials or devices where nonmetal and insulated piping penetrates fire-rated construction.

B. Where nonmetal pipe penetrations are too large to be firestopped by other means, use intumescent devices or pipe wrap in telescoping configuration.

1. If annular space is larger than 1/8 inch, backfill opening with firestop mortar.

2. Seal to penetrating element and to adjacent construction with intumescent or firestop sealant.

C. Intumescent materials are approved for use in lieu of or in addition to other firestopping products in other locations where appropriate.

3.05 ELECTRICAL BOXES AND UTILITY OUTLETS

A. Steel electrical outlet boxes on opposite sides of walls requiring protected openings shall be separated by a horizontal distance of 24-inches.

B. Steel electrical outlet boxes which occur in combination with outlet boxes of any size such that the aggregate area of unprotected outlet boxes exceeds 100-square inches in any 100-square feet of wall area shall be protected by an approved material or detail to decrease the aggregate area of unprotected utility boxes to less than 100-square inches in any 100-square feet of wall.

C. Steel electrical outlet boxes which exceed 16-square inches in area shall be protected with specified electrical box treatment.

D. Utility and electrical outlets or boxes shall be securely fastened to the stud or framing of the wall or ceiling assembly.

1. The opening in the gypsum board shall be cut so that the clearance between the box and the gypsum board does not exceed 1/8-inch.

2. In smoke partitions, fill the 1/8-inch gap with an approved fire-rated sealant.

E. See additional requirements specified in Section 09 8200, “Acoustical Insulation and Sealants.”

3.06 FIELD QUALITY CONTROL

A. Verify that firestopping is properly installed before concealing or enclosing firestopped areas.

B. Firestopping shall remain accessible until inspection and approval by governing authorities.

END OF SECTION 07 8400

SECTION 07 8720
ELEVATOR SMOKE-CONTAINMENT SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Smoke-containment system to be installed over elevator hoistway doors.

B. Related Requirements:

1. Decorative Metal: Section 05 7000; stainless steel wall panel at elevator door head.

2. Joint Sealants: Section 07 9200; paintable silicone sealant at inside and outside perimeter of auxiliary rails, cove bases and housing.

3. Non-Structural Metal Framing: Section 09 2216; metal backing.

4. Gypsum Board: Section 09 2900.

5. Painting and Coating: Section 09 9000.

6. Electric Traction Elevator: Section 14 2100.

7. Electrical: Division 26; 120V control circuit power including conduit, boxes, conductors, wiring devices, smoke detectors, and emergency power.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Pre-Installation Meeting:

1. Schedule and convene a pre-installation meeting prior to commencement of installation with representatives of the following in attendance: Owner's Representative, Contractor, smoke containment system sub-contractor, and electrical sub-contractor.

2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.

3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and manufacturers' installation instructions.

C. Coordinate interface of smoke detectors with the elevator smoke containment system.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Include the following:

1. Hoistway opening width and height, frame profile, projection from finished wall, face width, material, and finish.

2. Show mounting and relationship to adjacent construction, including elevator shaft and opening, floor, and improvements or projections on lobby wall within 12 inches of frame for hoistway opening, floor to ceiling. Include field-measured locations of elevator position indicator, hall call station, and signage.

3. Show required clearances for installation.

4. Show electrical work by Division 26 required for installation of system. Include smoke detector and auxiliary contacts, auxiliary contact line voltage, and connection to an auxiliary power source.

B. Product Data: Manufacturer's complete product data and installation instructions.

1.04 INFORMATIONAL SUBMITTALS

A. Verification of compliance with specified performance criteria and standards.

B. Verification of installer qualifications.

C. Minutes of pre-construction meeting.

1.05 CLOSEOUT SUBMITTALS

A. Report on field testing.

B. Certificates or operating permits as required by governing authorities.

C. Maintenance manual with operating and maintenance instructions, emergency information, spare parts list, and similar information.

D. Manufacturer's standard one-year warranty.

1.06 QUALITY ASSURANCE

A. Comply with the applicable requirements of the following:

1. NFPA 105, “Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives.”

2. ICC-ES AC77, “Acceptance Criteria for Smoke Containment Systems Used with Fire-resistance-rated Elevator Hoistway Doors and Frames.”

B. Smoke containment system shall be accepted and listed by the State Fire Marshal.

C. Installer Qualifications: Factory trained personnel.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Smoke-Containment System: "Model 200" by Smoke Guard Corporation, or accepted equal.

B. Label each smoke containment system with following information:

1. Manufacturers' name.

2. Maximum leakage rating at specified pressure and temperature conditions.

3. Label of quality control agency.

2.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Curtain shall automatically close when activated by smoke detector on ceiling of elevator lobby or fire alarm control panel. Curtain shall seal magnetically to frame for hoistway opening providing a virtually airtight seal at hoistway opening, thereby inhibiting smoke from a building fire from migrating vertically via the elevator shaft.

B. In open position, system shall not interfere with hoistway door operation.

C. Maximum Air Leakage Rate: Less than 3 cfm per square foot of door opening at 0.1 inch WG pressure at 400 degrees F, in accordance with CBC.

D. Release mechanism shall comply with UL Standard No. 864.

E. System shall be listed and labeled by an independent testing laboratory meeting the requirements of the ICC-ES.

2.03 MATERIALS

A. Screen: One mil thick, transparent, fiber-reinforced, polyamide plastic film that does not burn or melt.

1. Flexible multi-pole magnetic strips shall be attached to each longitudinal edge of film, using a continuous bead of low-modulus silicone adhesive.

2. Two 1/8 inch wide strips of 0.002 inch thick, synthetic elastomer, two-stage, laminating adhesive shall be attached to face of flexible magnets.

B. Housing: Provide a self-contained metal housing recessed in ceiling.

1. Construction: 20 gage cold rolled steel with dust cover and door with concealed hinges.

2. Include mounting plate.

3. Finish: Factory powder coat to match ceiling.

C. Rewind Motor: NFPA 70, 90v DC.

D. Release Mechanism: IAS (IAS is a trademark of International Accreditation Service) Accredited Testing Laboratory Labels for UL Standard 864.

E. Keyed Screen Rewind Switch to rewind curtain into housing. Coordinate switch location with Fire Marshal prior to installation.

F. Label indicating manufacturer's name, maximum leakage rating at specified pressure and temperature conditions, and label of quality control agency.

G. Accessories: Provide as required for a complete installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that frames for hoistway openings meet requirements for mounting smoke-containment system.

B. Verify that required electrical work is in place.

C. Verify that clearances are sufficient.

3.02 PREPARATION AND INSTALLATION

A. Submit and obtain approval from the Fire Department prior to system installation.

B. Install system in accordance with manufacturer's instructions, code requirements, and reviewed submittals.

C. Electrical: Make final smoke-detector and rewind-switch connection. Use conduit for wiring above fire-rated ceiling. Coordinate with Division 26, "Electrical."

D. Install housing.

1. Maintain 1/8 inch clearance at perimeter.

2. Finish housing as specified in Section 09 9000, "Painting and Coating." Do not paint housing door shut or fill hinge with paint.

3.03 FIELD QUALITY CONTROL

A. Field Test: Follow manufacturer's cycle test procedures.

B. Notify Owner's Representative, local Fire Marshal, alarm sub-contractor and elevator sub-contractor, and elevator service company, if retained by Owner, minimum one week in advance of scheduled testing.

C. Complete maintenance service record.

3.04 DEMONSTRATION

A. Verify that system is operational as required and recommended by code and governing authorities.

B. Demonstrate required testing and maintenance procedures to Owners' personnel.

END OF SECTION 07 8720

SECTION 07 9200
JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for:

1. Sealants at the following exterior locations:

a. Perimeter joints at exterior openings.
b. Perimeter joints between exterior wall surfaces and frames of doors and curtain wall.
c. Flashing panels at electrical and plumbing penetrations at exterior framed walls.
d. Sealant and waterproofing treatment for pipe penetration at uncured neoprene gasketing.
e. Rooftop equipment and flashing sealants not provided under other Sections.
f. Sealant not supplied by others, and as required for watertight assembly.

B. Related Requirements:

1. Delegated Design: Section 01 3325

2. Thermal Board and Batt Insulation: Section 07 2117.

3. Aluminum-Framed Storefronts: Section 08 4313.

4. Glazed Aluminum Curtain Walls: Section 08 4413.

5. Glazing: Section 08 8000; glazing sealants.

6. Acoustical Insulation and Sealants: Section 09 8200.

~~6.~~**7.** Divisions 22, 23, and 26 – Mechanical and Electrical: Sealants and flashing panels at electrical and pipe penetrations through exterior walls.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Pre-installation Meeting:

1. Review joint application procedures, compatibility tests, adhesion tests, and warranty requirements in a meeting involving installer, manufacturer or manufacturer's representative, building owner, acoustical consultant, Owner's Representative, green rater and contractor.

C. Coordination:

1. Use of different manufacturer's sealant types for application at exterior wall and glazing systems is not permitted. It is required that a single source for silicone sealants be used on this Project. The Contractor is responsible for coordinating compliance with this requirement where installation of sealants is delegated to various contractors installing the exterior envelope systems for the Project.

2. Contractor shall coordinate and be responsible for compatibility and performance between sealants and other materials, and related sections using sealants which may be in direct contact with work of this Section or adjacent to the other. Isolate and prevent of incompatibility between sealants in accordance with manufacturer's specifications, recommendations and instructions.

1.03 ACTION SUBMITTALS

A. Product data and installation instructions for each type of joint sealant required.

B. Sustainable Design (LEED):

1. IEQ 4.1: For field-applied adhesives and sealers inside the weatherproofing, include printed statement of volatile organic compounds (VOCs).

a. Include statement indicating costs for each product.

C. Samples: Manufacturer's standard color chart with physical samples of each color. Submit information on availability of custom colored sealants.

1.04 INFORMATIONAL SUBMITTALS

A. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Preconstruction Compatibility and Adhesion Test Reports from sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

C. Results of field adhesion testing including manufacturer's appropriate joint preparation and priming techniques.

1.05 QUALITY ASSURANCE

A. Qualifications: Sealant applicator shall specialize in the installation of joint sealants with a minimum of 2 years' experience.

B. Elastomeric joint sealants shall be produced and installed to establish and to maintain watertight continuous seals without causing staining or deterioration of joint substrates.

C. Preconstruction Compatibility and Adhesion Testing: Joint sealant manufacturer shall provide compatibility and adhesion testing for proposed products.

1. Submit samples of materials which will contact or affect joint sealants to joint-sealant manufacturers for use in their testing.

    a. Include shims, joint-sealant backings, secondary seals, and miscellaneous materials to be incorporated into the sealant joints.
    b. Submit in quantities required by manufacturer,

2. Sealant manufacturer shall use an independent testing agency for their testing, qualified according to ASTM C1021, to conduct tests.

3. Test Methods:

    a. Testing shall be in accordance with SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
    b. Manufacturer's standard test methods are acceptable to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
    ~~c. Non staining silicone sealant Type 1B shall also be immersion tested for compatibility with each selected stone to assure sealant will not cause discoloration of stone.~~

4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

6. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those to be used on this Project.

D. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as selected by Owner's Representative. Location may be off-building mockups if acceptable to Owner's Representative.

2. Conduct field tests for each kind of exterior sealant and joint substrate material indicated.

3. Notify Owner's Representative 7 days in advance of dates and times when test joints will be erected.

4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present, if available.

5. Test Method:

   a. Provide field adhesion hand pull tests per Dow Corning's "Field Adhesion Testing" criteria and in accordance with ASTM C1193.
   b. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

6. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

E. Sealant manufacturer shall confirm in writing the appropriate joint preparation and priming techniques required to obtain rapid, acceptable adhesion of the joint sealants to the joint substrates.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials intact and legible.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.07 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.

2. Below 40 degrees F.

3. When joint substrates are wet or retaining moisture.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.08 WARRANTIES

A. Manufacturer: Provide written ~~5~~ **20-**year material warranty for exterior sealants.

B. Contractor: Provide Owner with a written ~~2~~ 5-year warranty, co-signed by installer, agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Sustainability Requirements:

1. Interior adhesives and sealants shall comply with SCAQMD Rule 1168 for VOC content when calculated according to EPA Method 24, be CA 01350 compliant, and contain no added formaldehyde.

2.02 MATERIALS

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealants to match colors indicated by reference to manufacturer's standard designations.

C. Provide selections made by Owner's Representative from manufacturer's full range of standard colors for products of type indicated.

2.03 JOINT SEALANTS

A. Type 1A - Sealant for General Exposed Exterior Use: One part, neutral cure, gun-grade silicone complying ASTM C920 Type S, Grade NS, ASTM C1193, tested under ASTM C719, and that accommodates joint movement of not less than 25 percent in both extension and compression for a total of 50 percent; "790," 791," or "795" by Dow Corning Corporation, "Spectrem II" or "Spectrem III" by Tremco, "895" by Pecora Corporation, or equal.

B. Type 1B - Sealant for Use at Concrete and Other Porous Surfaces: One part, medium modulus, silicone polymer conforming to ASTM C920, Type S, Grade NS, Class 50 and formulated to reduce or eliminate dirt pickup, surface streaking, and substrate staining; Dow Corning "756 SMS," "SCS9000 SilPruf NB" by Momentive Performance Materials, or equal.

C. Type 1C - Flashing and Reglet Sealant: ASTM C920, Type S, Grade NS, Class 25; single component elastomeric accommodating joint movement of not more than 25 percent in both extension and compression for a total of 50 percent; "791" or 795, or "Contractors Weatherproofing Sealant" by Dow Corning Corporation, or equal.

D. Type 1D - Sealant in Contact with Self-Adhering Underlayment: One part, neutral cure, gun-grade silicone conforming to ASTM C920, Type S, Grade NS, Class 25; Dow Corning "758 Weather Barrier," or equal.

E. Type 2 - Self-Leveling Sealant at Horizontal Joints: ASTM C920, Type S, Grade SL; single component, chemical curing, non-staining, non-bleeding, non-sagging type at concrete expansion and control joints in, plaza and terrace decks and sidewalk joints; "890SL" by Dow Corning Corporation,

"Urexpan NR-200 " by Pecora Corporation, "THC-900" by Tremco, "Sikaflex 2C-FL" by by Sika, or equal.

F. Type 3 - Interior Nonwet Areas: One-component acrylic latex water-based sealant conforming to ASTM C834; "Tremco "Acrylic Latex," or equal.

G. Type 4 - Interior Wet Areas: One-part mildew-resistant silicone rubber conforming to ASTM C920, Type S, Class 25, Grade NS; Dow Corning "786," or equal.

2.04 JOINT SEALANT BACKING

A. General: Provide sealant backings and accessory materials, including primers, of material and type that are non-staining; are compatible with joint substrates, sealants, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Foam Joint Fillers: Preformed, compressible, resilient, non-staining, non-waxing, non-extruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth, prevent three-sided adhesion, provide a surface against which to tool, and otherwise contribute to producing optimum sealant performance:

1. Non-gassing, closed-cell polyurethane foam.

2.05 FLASHING PANELS

A. General: Flashing panels constructed of high-density polyethylene (HDPE) and low-density polyethylene (LDPE) with integral weatherproof seal constructed of a thermoplastic polymer (ASTM-D2240 and ASTM D412) for electrical and plumbing penetrations at exterior wall locations.; Quickflash Weatherproofing Products, Inc., or equal.

1. Sizes and types as required for particular condition.

2. Warranty: 10 years.

3. Installation: In accordance with manufacturer's instructions.

2.06 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from pre-construction joint sealant-substrate tests and field tests. Certify that primer will not permanently stain adjacent joint surfaces.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints, to mask off adjacent joint surfaces where sealant is not permanently intended to be applied.

D. Bondbreaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of

joint, to be used in areas where backer rod cannot fit and where three-sided adhesion is to be avoided. Provide self-adhesive tape where applicable.

E. Expanding Foam Sealant: Gun-dispensed, foam polyurethane or polyisocyanurate type conforming to ASTM C1620; Hilti "CF 810/812," or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance.

B. Verify that joint sizes and surfaces are free of defects and acceptable for installation of joint sealants.

C. Verify joint dimensions and shapes to ensure they are within the sealant manufacturer's guidelines. Resolve any variances prior to installation. Do not proceed with sealant installation until the unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer.

B. Thoroughly clean the areas that sealant will contact using a **non-toxic** de-greasing solvent such as ~~toluene or xylene~~ **cycloparaffinic or paraffinic solvents** and the two-rag wipe technique. IPA (isopropyl alcohol) is not a degreasing solvent. Sealant should have a minimum contact area of 1/4 inch.

C. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

D. Clean concrete and similar porous joint substrate surfaces by oil-free brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

1. Do not damage finished surface of materials while performing cleaning operations.

2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

E. Clean metal, glass, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

F. Masking Tape:

1. Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears.

2. Remove tape immediately after tooling without disturbing joint seal.

3.03 JOINT PRIMING

A. Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on pre-construction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations.

B. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Allow primer to dry. Do not prime areas that cannot be sealed the same day.

3.04 INSTALLATION OF SEALANT BACKINGS

A. Install joint fillers and bond breaker tape of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

B. Do not leave gaps between ends of joint fillers.

C. Do not stretch, twist, puncture, or tear joint fillers.

D. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

E. Tolerances:

1. Minimum Sealant Contact Area: 1/4 inch.

2. Minimum Joint Width: 3/8 inch.

3. Minimum Joint Depth: 1/4 plus or minus 1/8 inch, with the joint width at least twice the joint depth to allow the sealant its maximum movement capability.

3.05 INSTALLATION OF JOINT SEALANTS

A. General:

1. Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

2. Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated. Perform sealant pull testing as specified herein.

B. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

C. Tooling of Non-sag Sealants

1. Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint.

2. Remove excess sealants from surfaces adjacent to joint.

3. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

D. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

3.06 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to ASTM C794 using a hand pull test at the job site after the sealant is fully cured.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

a. Whether sealants filled joint cavities and are free of voids.
b. Whether sealant dimensions and configurations comply with specified requirements.
c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

6. Sealant manufacturer shall provide one announced and one unannounced quality control check/adhesion test with the sealant installer at the job site.

B. Evaluation of Field-Adhesion Test Results:

1. Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory.

2. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements.

3. Retest failed applications until test results prove sealants comply with indicated requirements.

C. Sealant Repair in Adhesion Test Area:

1. Repair the sealant pulled from the test area by applying new sealant to the test area using the same application procedure to repair the areas as was used to originally seal it.

2. Ensure that the original sealant surfaces are clean and that the new sealant is in contact with the original sealant.

3.07 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

B. Leave finished work in a neat, clean condition with no evidence of spillovers onto adjacent surfaces.

3.08 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion.

B. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 9200

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior hollow metal doors with vision lights, and frames for doors and vision lights.

B. Related Requirements:

1. Wood Doors: Section 08 1400.

2. Sound Control Door Assemblies: Section 08 3473

3. Door Hardware: Section 08 7100.

4. Glazing: Section 08 8000.

5. Painting and Coating: Section 09 9000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

B. Coordination: Hardware supplier shall furnish steel door and frame manufacturer with accepted hardware schedule, hardware templates, and samples of physical hardware where necessary to ensure correct fitting and installation. Preparation includes sinkages and cutouts for mortise and concealed hardware.

1.03 ACTION SUBMITTALS

A. Shop Drawings:

1. Cover each type of door, frame, and frame condition.

2. Include the following specific information:

a. Elevation of doors and frames.
b. Jamb and head details.
c. Hardware preparation locations and reinforcing details of doors and frames.
d. Complete door and frame descriptive nomenclature.
e. Material description and gages.
f. Meeting stile details.

g. Methods of anchorage.
h. Glass molding details.

3. Use same reference numbers for details and openings as those indicated on Drawings.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for products regionally extracted, processed, and manufactured.

1) Include statement indicating costs for each product.

C. Product Data: Manufacturer's technical data substantiating that products comply with specified requirements.

D. Schedule: Provide a schedule for hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.04 QUALITY ASSURANCE

A. Steel doors and frames shall comply with ANSI A250.8.

B. Work shall meet applicable requirements of the Hollow Metal Manufacturers Association (HMMA), a Division of the National Association of Architectural Metal Manufacturers (NAAMM).

C. Fire-Rated Assemblies: Wherever a fire-resistance classification is indicated, provide fire-rated steel doors and frames, investigated and tested as part of a fire door assembly complete with type of fire door hardware and vision lights to be used.

1. Identify each fire-rated door and frame with permanent, metal labels, in accordance with NFPA Standard 252 and CBC from approved testing and inspection agency, indicating applicable fire rating.

2. Construct and install assemblies in such a manner as to comply with NFPA Standard No. 80 and as specified herein.

3. Pairs of doors with vertical-rod panic exit devices shall be labeled without use of overlapping astragals.

4. Exit doors in an exit enclosure shall also have a maximum transmitted temperature end point not to exceed 450 degrees F (232 degrees C) above ambient at the end of 30 minutes of fire exposure when tested in accordance with CBC requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel doors and frames in such a manner as to prevent damage or deterioration.

B. Provide such packaging as cardboard or other containers, separators, banding, spreaders, and paper wrappings in order to protect items during transit and Project site storage.

C. Follow special storage and handling requirements of manufacturer.

D. Inspect products upon delivery for damage. Minor damage may be repaired, provided that refinished items are equal in all respects to new work and acceptable to the Architect. Otherwise, remove and replace damaged items as directed.

E. Store doors upright in a protected dry area on a raised platform at least 1 inch off the ground. Provide blocking between units so as to provide air circulation.

F. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames: Manufacturer member of the Hollow Metal Manufacturers Association (HMMA), Chicago, IL, 312-332-0405 capable of meeting the specified design and performance criteria.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Sustainable Design Requirements:

1. Qualifying Steel Products with Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

2. Metal doors and frames shall be manufactured within 500 miles of the Project. If possible, products shall be made from materials extracted, harvested, or recovered within 500 miles of the Project.

2.03 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A568 and ASTM A1011.

B. Cold-Rolled Steel Sheets: Commercial-quality carbon steel complying with ASTM A568 and A1008, exposed, matte finish, oiled.

C. Supports and Anchors: Fabricated of not less than 18-gage galvanized sheet steel.

D. Inserts, Bolts, and Fasteners: Manufacturer's standard units.

E. Shop-Applied Paint: Rust-inhibitive primer, either air dried or baked on, suitable as a base for specified finish paints.

F. Glass: Rated and non-rated as shown and scheduled on the Drawings and specified in Section 08 8000, "Glazing."

2.04 FABRICATION - GENERAL

A. Conform to requirements of SDI or NAAMM.

B. Fabricate steel doors and frames to required profiles and sizes by forming with edges straight and sharp.

C. Fit and fabricate accurately with corner hairline joints and all surfaces free from warp, wave, buckle, and other defects.

D. Welding:

1. In accordance with AWS standards for high-grade hollow metal work.

2. Grind exposed beads smooth.

E. Fabricate exposed faces of doors only from cold-rolled steel.

F. Fabricate frames from either cold-rolled or hot-rolled steel (at fabricator's option).

G. Finish Hardware Preparation:

1. Prepare steel doors and frames to receive mortised and concealed hardware, including cutouts, reinforcing, drilling, and tapping, in accordance with final Finish Hardware Schedule and templates provided by hardware suppliers.

2. Preparation shall be in accordance with ANSI/SDI A250.6.

3. Provide minimum gage hardware reinforcing in accordance with Table 4 of ANSI/SDI A250.8.

4. Concealed Overhead Closers, if Scheduled: Provide spaces, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames as applicable.

5. Reinforce steel doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware shall be done at Project site by hardware installer.

6. Locate finish hardware as shown on final shop drawings or, if not shown, in accordance with NBHA publication "Recommended Location for Builder's Hardware."

H. Shop Painting: Finish shall comply with ANSI A250.10, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

I. Stops and Moldings: Provide around vision lites.

1. Form corners of stops and moldings with mitered hairline joints.

2. Provide fixed stops welded on secure side of hollow-metal work.

3. Stops shall be flush design equivalent to NAAMM Standard HMMA 801, Type B.

4. Size and Location and Vision Lites: As shown and scheduled on the Drawings.

5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.05 STEEL FRAMES

A. Provide steel frames of the types and styles indicated on the Drawings.

B. Gages: 16 gage unless thicker gage is included in UL test procedure for rated frames.

C. Construction:

1. Shop-assemble and weld each frame into a single unit. Saw-miter or cope and tab frame miters, and continuously weld at return, face, rabbet, and stop.

2. Profile bottom of jamb to contour of concrete at change in floor elevation occurring within jamb width.

D. Door Silencers and Seals:

1. Except on frames to receive smoke, sound, or thermal seals, drill stops to receive rubber door silencers.

2. Locate three on strike jamb for single doors and four on head for pairs of doors.

E. Provide concealed reinforcement to receive mortise-type hardware.

1. Mortise, drill, and tap to template requirements.

2. Reinforce frames for closers.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk, flat Phillips or Jackson heads for exposed screws and bolts.

2.06 STEEL DOORS

A. ANSI/SDI Classification:

1. Interior Non-Fire-Rated: Level 2 and Performance Level B, Model 2, heavy-duty seamless construction.
   a. Face sheets shall be minimum 0.042 inches (18 gage).
   b. Core: Honeycomb or polystyrene, laminated to the inside of both face sheets.

2. Interior Fire-Rated: Level 2 and Performance Level B, Model 2, seamless construction.
   a. Face sheets shall be minimum 0.042 inches 18 gage) unless otherwise required for required rating.
   b. Core: Mineral fiber or as standard with manufacturer to meet scheduled fire rating.
   c. Rating: As scheduled.

B. Glazed openings shall be flush design equivalent to NAAMM Standard HMMA 801, Type B with removable stop on secure side of door.

1. Size and Location: As shown and scheduled on the Drawings.

2. Glass: As specified and scheduled.

C. Provide the following door clearances, except as otherwise specified and unless undercuts are shown on the Drawings.

1. 1/8 inch at head and jambs.

2. 1/2 inch to finished floor at bottom where there is no threshold.

3. 1/4 inch at bottom to top of threshold.

4. 7/16-inch at bottom to top of threshold or floor finish where there is a door bottom seal. Modify clearance as required for seal.

PART 3 - EXECUTION

3.01 INSTALLATION OF FRAMES

A. Install frames in accordance with ANSI/SDI A250.11.

B. Exercise care in setting of frames in order to maintain scheduled dimensions, hold head level, and maintain jambs plumb and square.

C. Secure anchorages and connections to adjacent construction.

1. Provide not less than three anchors and one floor clip per side for doors up to 7 feet high and four anchors and one floor clip per side for doors over 7 feet high.

2. Frames over 36 inches wide shall have one anchor at head.

3. Anchors shall be furnished to suit wall conditions and floor angles or clips welded to frame for fastening to floor.

D. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb and anchors are securely attached. Do not use shipping bars as spreaders.

E. Allow for expansion movement as required.

F. Install fire-rated frames in accordance with NFPA Standard No. 80.

3.02 INSTALLATION OF DOORS

A. Do not erect members that are observed to be warped, bowed, deformed, or otherwise damaged or defaced to such extent as to impair strength or appearance. Remove and replace members that have been damaged in process of erection.

B. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

C. Apply hardware in accordance with requirements specified in Section 08 7100, "Door Hardware."

D. Adjust operable parts for correct function.

3.03 ADJUSTMENT AND CLEANING

A. Prime Coat Touch-up: Items with damaged prime coat shall be sanded smooth and touched up with same primer as applied at shop.

1. Remove rust before above-specified touch-up is applied.

2. Touch-up shall not be obvious after application of finish coats as specified in Section 09 9000, "Painting and Coating.

B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel items undamaged and in complete and proper operating condition.

END OF SECTION 08 1113

SECTION 08 1216
INTERIOR ALUMINUM FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Interior aluminum frames for wood swing doors and sidelights.

B. Related Requirements:

1. Wood Doors: Section 08 1400.

2. Sound Control Door Assemblies: Section 08 3473.

3. Door Hardware: Section 08 7100.

4. Glazing: Section 08 8000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

1.03 ACTION SUBMITTALS

A. Shop Drawings: Elevation of each opening or wall elevation as applicable.

1. Show fabrication and installation not covered by manufacturer's standard product details including frame anchorage, and glazing.

2. Include a schedule of frames using same reference numbers for details, elevations, and openings as those on Drawings.

B. Product Data: Manufacturer's printed literature describing materials and components proposed for use on this Project. Include the following specific information:

1. Jamb and head details.

2. Material description and thickness.

3. Methods of anchorage.

4. Hardware preparation.

5. Fire tests.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

D. Samples for Verification of Anodized Finish:

1. 12-inch-long sections of extrusions or formed sections for specified finish and color for evaluation of appearance.

2. Provide glazing extrusions with vinyl gaskets.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications, if requested.

1.05 QUALITY ASSURANCE

A. Fire-Rated Assemblies: Provide fire-rated aluminum frames investigated and tested as part of a fire door assembly. Identify each fire-rated door and frame with permanent labels by approving agency indicating applicable fire rating.

B. Installer Qualifications: Documented experience in installation of aluminum frames, and authorized by manufacturer to install products specified in this Section.

C. Mockups: First installed example of each installation condition shall serve as a mock-up for review by Owner’s Representative of workmanship and visual effect.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle frames in such a manner as to prevent damage or deterioration.

B. Provide packaging such as cardboard or other containers, separators, banding, spreaders, and paper wrappings to protect items.

C. Follow special storage and handling requirements of manufacturer.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.07 FIELD CONDITIONS

A. Take field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 ALUMINUM DOOR AND GLAZING FRAMES

A. Manufacturers and Products: "200" Series by Wilson Partitions, or equal capable of providing components with recycled aluminum content as required for LEED Credit.

B. Style: Standard extruded type with throat opening as required for each wall thickness, integral retainer to receive 2 inch, full-width, snap-on trim for flush sight lines with no projecting glass stops and exposed fasteners.

1. Snap-on trim for sidelights and windows shall match snap-on trim for door component so as to provide a continuous appearance.

2. Provide with extended lip at strike jamb of doors.

C. Finish:

1. Type: Manufacturer's factory-applied thermal-stetting polyester powder coat complying with AAMA 2603.

2. Color: Custom, to match wall color.

2.02 SUSTAINABLE DESIGN CRITERIA

A. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

2.03 MATERIALS AND ADDITIONAL COMPONENTS

A. Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish; ASTM B221 for extrusions, ASTM B209 for sheet/plate.

B. Fasteners: Aluminum, nonmagnetic stainless, or other materials non-corroding and compatible with aluminum components. Do not use exposed fasteners.

C. Brackets and Reinforcements: High-strength aluminum where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A123.

D. Glass and Glazing: Conform to requirements specified in Section 08 8000, "Glazing."

1. See Drawings for glass Type required at each location.

2. Gaskets: EPDM as provided by or recommended by framing manufacturer.

E. Seals: Continuous.

1. Typical: Brushed wool pile or equivalent as standard with manufacturer.

2. At Rated Frames: Vinyl or as otherwise required by UL listing.

2.04 FABRICATION

A. General:

1. Take field measurements prior to fabrication.

2. To greatest extent possible, complete fabrication, assembly, before shipment to Project site. Disassemble components only as necessary for shipment and installation.

3. Maintain accurate relationship of planes and angles, with flush hairline fit of contacting members.

4. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metalwork in manner which prevents damage to exposed finish surfaces.

B. Reinforcing: Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance, and rigidity.

C. Accurately fit corners and joints. Joints shall be tight, with like members flush across joints.

D. Anchorage:

1. Provide suitable anchorage for each wall condition to include sill anchorage at doors, head anchorage at all openings 36 inches and wider, intermediate evenly space jamb anchors not to exceed 24 inches on center.

2. Frame fastenings and anchors shall be concealed.

E. Provide with fire rating where indicated on the Drawings.

2.05 HARDWARE

A. Comply with the requirements of Section 08 7100, "Door Hardware."

B. Machine aluminum frames for mounting of hardware.

C. Provide reinforcements at hinge locations, strikes, and closers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of components. Set units plumb, level, and true to line without warp or rack.

B. Install fire-rated frames in accordance with NFPA Standard No. 80.

C. Secure anchorages and connections to adjacent construction. Provide anchors to suit conditions.

D. Rated frames shall be installed and anchored in strict accordance with requirements of approving agency for rating indicated.

3.02 ADJUSTING AND CLEANING

A. Clean completed systems promptly after erection and after installation of glass taking care to avoid damage to finishes.

B. Remove dirt and other substances from aluminum surfaces.

END OF SECTION 08 1216

SECTION 08 1400
WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wood flush doors.
2. Vision lights.
3. Factory preparation for finish hardware.
4. Factory priming.

B. Related Requirements:

1. Hollow Metal Doors and Frames: Section 08 1113.
2. Interior Aluminum Frames: Section 08 1216.
3. Door Hardware: Section 08 7100.
4. Glazing: Section 08 8000.
5. Painting and Coating: Section 09 9000; site finishing of doors.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."
2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."
3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Door Schedule: Include the following minimum requirements:

1. Opening-identifying symbol. Use same identification as on Drawings.
2. Location and sizes of each door.
3. Door type and grade.

4. Glazing.

5. Face veneer and finish.

6. Swing.

7. Undercuts.

B. Product Data:

1. Manufacturer's door specification indicating core and edge materials, veneer, and the following additional information usually provided as a shop drawing or Schedule:

   a. Opening-identifying symbol. Use same identification as Door Schedule on Drawings.
   b. Size.
   c. Swing.
   d. Undercut.
   e. Location and extent of any required hardware blocking.

2. Shop-applied primer.

C. Sustainable Design (LEED):

1. General:

   a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
   b. Sustainable design submittals are in addition to other submittals.
   c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

   a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

      1) Include statement indicating costs for each product having recycled content.

   b. Credit MR 5: Documentation for regionally manufactured products.

      1) Include statement indicating costs for each product.

   c. Credit MR 7: Certificates of chain-of-custody signed by millwork manufacturer certifying that wood products were obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

      1) Include evidence that millwork manufacturer is certified for chain-of-custody by an FSC-accredited certification body.
      2) Include statement indicating costs for each certified wood product.

   d. Credit EQ 4.4: Composite wood and agrifiber materials manufacturers' product data stating that they contain no added urea-formaldehyde resins.

1) Include statement indicating costs for each product.

D. Samples:

1. Samples of each specified door facing, 12 inches square minimum.

2. Samples of door construction, 12 inches square minimum, cut from top or bottom corner of door. These samples may be used to illustrate each specified veneer finish.

1.04 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Special warranty.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain wood doors from single manufacturer.

B. Quality Standard: In addition to requirements specified, doors shall be manufactured in accordance with Section 9 of the "Architectural Woodwork Standards (AWS)," published jointly by WI, AWI, and AWMAC, and referenced WDMA Standards where noted.

C. Allowable Tolerances for Fabrication of Doors: In accordance with referenced AWS standard.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors at factory prior to shipping, using manufacturer's standard method.

C. Seal all four edges of site-finished doors after delivery if stored for more than 1 week at the Project site.

D. Label and identify doors for each opening to facilitate proper location using temporary, removable, or concealed markings. Correlate door identification with designation system used on shop drawings.

E. Store doors flat on level surface in clean, dry spaces. Do not expose doors to abnormal heat, dryness, and humidity.

F. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.08 WARRANTY

A. Door Manufacturer's Warranty:

1. Submit written agreement on door manufacturer's standard form signed by manufacturer, installer, and Contractor, agreeing to repair or replace defective doors which warp (bow, cup, or twist), which show telegraphing of core construction in face veneers, or which do not conform to tolerance limitations of specified quality standards.

2. Include reinstallation if required owing to repair or replacement of defective doors where defect was not apparent prior to hanging.

B. Warranty Period:

1. Interior Solid-Core Doors: Lifetime of the original installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Member of WI, AWI, or WDMA.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Sustainable Design

1. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

2. Certified Wood: Wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

B. Quality Standard: In addition to requirements specified, doors shall be manufactured in accordance with Section 9 of the "Architectural Woodwork Standards (AWS)," published jointly by WI, AWI, and AWMAC, and referenced WDMA Standards where noted.

C. Allowable Tolerances for Fabrication of Doors: In accordance with referenced AWS standard.

D. Fire-Rated Assemblies: Wherever a fire-resistance classification is indicated, provide fire-rated doors investigated and tested as part of a fire door assembly, complete with type of fire door hardware to be used.

1. Identify each fire-rated door with a label from an approved laboratory indicating applicable fire rating and other specified requirements.

2. Construct fire-rated doors in accordance with NFPA Standard 252.

3. Install assemblies to comply with NFPA Standard No. 80.

2.03 FABRICATION - GENERAL

A. Conform to requirements of regulatory agencies, referenced AWS standard, reviewed shop drawings, and Contract Documents.

B. Factory-cut openings, insofar as practicable.

C. Prefit and premachine doors. Coordinate preparation of doors with hardware requirements specified in 08 7100, "Door Hardware."

D. Undercut doors where indicated or required by submittals.

E. Seal raw edges immediately after cutting and fitting, including areas routed for hardware.

F. Provide the following door clearances, unless otherwise noted.

1. For non-rated doors provide clearances of 1/8 inch at jambs and heads, and 1/4 inch from bottom of door to top of floor finish, unless otherwise indicated on Drawings.

2. When threshold is shown or scheduled, provide 1/8 inch clearance from bottom of door to top of threshold.

2.04 FLUSH WOOD DOORS

A. Door Appearance Grade: Custom.

B. Performance Duty Level (WDMA): Heavy Duty.

C. Face Veneer, Doors to Receive Opaque Finish: Medium-density overlay (MDO).

D. Cross Banding: Hardwood veneer, 1/16 inch thick.

E. Vertical Exposed Edges of Stiles: Solid hardwood.

F. Sizes: As shown on the Drawings. Coordinate with installation to determine actual sizes and clearances.

G. Cores: Solid, 5-ply, type optional with manufacturer in accordance with WDMA Standard I.S. 1A and required for meeting MR 4, MR 7, EQ 4.4. Provide mineral core where required for fire rating.

H. Vision Light Frames: 20-gage cold-rolled steel, low profile type; Anemostat “LoPro,” or equal.

1. Rated frames shall bear fire rating label from approved testing laboratory.

2. Finish: Manufacturer's standard pretreatment and primer; units shall be field finished painted as specified in Section 09 9000, "Painting and Coating," to match door finish.

I. Glazing: As shown on the Drawings and as specified in Section 08 8000, "Glazing."

2.05 FINISHING

A. General:

1. Finishing shall conform to AWS “Premium” Grade requirements.

2. Shop applied coatings shall be applied in accordance with manufacturer's written instructions.

B. Preparation Requirements:

1. Seal the top and bottom edges of all doors and around all cutouts with two coats of varnish or sealer before the hardware is set into place.

2. All edges and factory-made cutouts shall be primed or sealed before factory-installed hardware is set into place.

C. Edge and Cut Sealer: Compatible with specified painter's finish.

D. Opaque Finish:

1. Provide factory priming.

2. Doors shall be field finish painted in accordance with Section 09 9000, “Painting and Coating.”

3. Color: As specified on the Drawings or, if not scheduled, as selected by Owner’s Representative.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that door frames are of type required for door and are installed as required for proper installation of doors.

B. Do not install doors in frames which would hinder door operation.

C. Condition doors to average prevailing humidity in installation area prior to hanging.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and requirements of AWS and WDMA Standards.

B. Door Bevel:

1. Nonrated Doors: Bevel 1/8 inch in 2 inches.

2. Rated Doors: Bevel as permitted by labeling agency.

C. Install fire-rated doors in fire-rated frames in accordance with requirements of National Fire Protection Association (NFPA) Standard No. 80.

D. Hardware: For installation see Section 08 7100, "Door Hardware."

E. Fit to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

3.03 ADJUST AND CLEAN

A. Replace or rehang doors which are hinge bound and do not swing or operate freely.

B. Protect installed wood doors from damage or deterioration until acceptance of work.

C. Refinish or replace finished doors damaged during installation as directed by the Owner’s Representative.

END OF SECTION 08 1400

SECTION 08 3100
ACCESS DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Access doors and panels as required for access to controls and valves behind finished surfaces.

B. The requirements of this Section supplement those included in other Divisions including.

1. Plumbing: Division 22 (15).

2. Mechanical: Division 25 (15).

3. Electrical: Division 26 (16).

C. Related Requirements:

1. Gypsum Board: Section 09 2900.

2. Tiling: Section 09 3000.

3. Painting and Coating: Section 09 9000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

B. Coordinate with other Sections for controls and valves which may be concealed and to minimize visibility in finished spaces.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Indicate locations of all required access doors. Locations shall be approved by Owner’s Representative prior to installation.

B. Product Data: Manufacturer's specifications and installation instructions for each type of door.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.

c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

1.04 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where required, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in UL "Classified Building Materials Index" for the rating indicated. Provide UL label on each access door.

B. Size Variations: Obtain Owner’s Representative's acceptance of manufacturer's standard size units, which may vary slightly from sizes shown, scheduled, or specified in Divisions 22, 23 and 26.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Metal Access Doors for Walls and Ceilings: Karp Associates, Inc. as specified, Milcor Inc., Nystrom Building Products, J. L. Industries, or equal.

B. Products specified as the Basis of Design to establish required level of performance, quality, and appearance are by Karp Associates, Inc. unless otherwise noted.

2.02 MATERIALS

A. Gypsum Board Partitions and Ceilings – Nonrated: Metal; Karp Model KDW, or equal.

1. Style: Flanged type for flush mounting with concealed frames.

2. Frame: 16-gage galvanized steel, except as otherwise specified.

3. Door: Not lighter than 14-gage galvanized steel, except as otherwise specified.

4. Hinges: Concealed spring, allowing opening to 175 degrees.

B. Gypsum Board Partitions - Nonrated, Tiled: Metal; Karp Model DSC-214M, or equal.

1. Trim Style: 3/4-inch wide, flush flange.

2. Frame: 16-gage stainless steel.

3. Door: Not lighter than 14-gage stainless steel.

4. Hinges: Concealed spring, allowing opening to 175 degrees.

C. Gypsum Board Partitions and Ceilings - Rated: Metal; Karp Model KRP-350FR, or equal.

1. Type: Manufacturer's fire-rated access doors with UL "B" Label.

2. Style: Textured 1-inch frame and bead to receive drywall joint compound installed in sufficient thickness to conceal flange.

3. Frame: 16-gage galvanized steel.

4. Door: 20-gage galvanized steel, insulated sandwich type at ceilings, self-latching.

5. Hinges: Allow opening to 175 degrees, self-closing.

D. Gypsum Board Partitions- Rated, Tiled: Metal; Karp Model KRP-250FR, or equal.

1. Type: Manufacturer's fire-rated access doors with UL "B" Label.

2. Style: 1-inch wide trim with welded corners, ground smooth.

3. Frame: 16-gage stainless steel.

4. Door: 16-gage stainless steel.

5. Hinges: Allow opening to 175 degrees, self-closing.

E. Finishes:

1. Metal Doors and Other Metal Surfaces: Factory-applied rust-resistant prime coat over phosphate coating on steel. Doors shall be field finish painted as specified in Section 09 9000, “Painting and Coating,” to match adjacent wall or ceiling finish.

2. Stainless Steel: No. 4 satin finish.

F. Locking Devices: Provide flush, key-operated cylinder lock for each access door; provide two keys per lock and key locks alike, unless otherwise scheduled. Coordinate keying with Section 08 7100, “Door Hardware.”

2.03 FABRICATION

A. General:

1. Provide access door assemblies consisting of an integral unit, complete and ready for installation.

2. Fabricate metal access doors of continuous welded-steel construction. Grind welds smooth and flush with adjacent surfaces.

3. Provide attachment devices and fasteners of type required for specific project conditions.

4. At sound-rated conditions use "fire-rated"-type doors.

5. Products specified in Divisions 22, 23 and 26 that meet the requirements of this Section are acceptable.

B. Sizes: As indicated, and as required for access and by regulatory agencies but not less than 10 inches by 10 inches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces in accordance with manufacturer's instructions for installation.

B. Install in approved locations required to give access to plumbing, mechanical, electrical, or similar devices concealed in walls or ceilings. If not specifically indicated on the Drawings, location shall be approved in advance by Owner's Representative.

C. Conceal frames with tape and joint compound at painted gypsum board partitions as specified in Section 09 2900, "Gypsum Board."

D. Adjust hardware and doors after installation for proper operation.

END OF SECTION 08 3100

SECTION 08 3473
SOUND CONTROL OPENING ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Acoustically rated, sound-retardant door assemblies, door and sidelight assemblies, and windows.

B. Related Requirements:

1. Hollow Metal Doors and Frames: Section 08 8113.

2. Door Hardware: Section 08 7100.

3. Glazing: Section 08 8000; glass and glazing for vision lights, sidelights, and windows.

4. Painting and Coating: Section 09 9000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination:

1. Hardware supplier shall furnish sound control door assembly manufacturer with accepted hardware schedule, hardware templates, and samples of physical hardware where necessary to ensure correct fitting and installation. Preparation includes sinkages and cutouts for mortise and concealed hardware.

2. Manufacturer shall verify seals and other specified hardware is compatible with acoustical rating.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Show elevations of doors and full-size details showing thickness, profiles, jointing, and assembly of various members, anchorage, and supports. Provide shop drawings showing all dimensions, edge conditions and accessories for sound-rated doors.

B. Product Data: Manufacturer's specifications, installation recommendations, and construction details, including fabrication, finishing, hardware, and other components.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

1.04 INFORMATIONAL SUBMITTALS

A. Provide Sound Transmission Class (STC, in accordance with ASTM E90 and E413) rating test reports from a qualified accredited testing agency as specified verifying STC rating and acoustical performance of assembly. Test reports shall contain the laboratory name, test report number and date of test. Provide test reports for complete single and double door assemblies.

B. Manufacturer’s field quality certification letter as specified.

1.05 CLOSEOUT SUBMITTALS

A. Special warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The manufacturer of sound-retardant doors shall have a minimum of 5 years' successful production acceptable to the Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Doors shall be protected from damage during transportation and stored under cover at the jobsite.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements,” and Section 01 6600, “Material and Equipment.”

1.08 FIELD CONDITIONS

A. Coordinate installation of doorframes with work included under other Sections.

B. Furnish necessary templates or actual assembles where necessary to ensure correct installation.

1.09 WARRANTY

A. Manufacturer: Provide manufacturer's written 5-year warranty for sound control assemblies against defects in materials and workmanship.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Sound control assemblies shall be identical to those tested at an independent acoustical laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) by the National Institute for Science and Technology (NIST) in accordance with ASTM E1408 and ASTM E413.

B. STC Rating: 47 minimum.

2.02 SOUND CONTROL ASSEMBLIES

A. Sound-Reduction Door: "Noise Lock" acoustic doors and frames with cam lift hinges and split frames as manufactured by Industrial Acoustics Co, Inc. (IAC), or equal.

1. Doors shall be manufacturer's complete package, frame, hardware, threshold, floor bottom gasket, and cam-lift hinges.

2. Door Leaf:

a. Size and Configuration: As scheduled on Drawings with door panel thickness of 1-3/4 inches.
b. Door Leaf and Door Stiffeners: 14 gauge cold rolled, galvannealed steel with an A60 coating weight, and filled with 6 pound density, sound absorbing, and damping elements.
c. No exposed welds or fasteners are to be on door faces.

3. Frame: 14 gauge cold rolled, galvannealed steel with an A60 coating weight and furnished "split" in 2 pieces, inside and outside, that are mitered and welded together.

4. Acoustic Seals:

a. General:

1) Door shall be held in closed position by magnetic force of perimeter seals.
2) Provide fire resistant type at UL rated openings.

b. Self-aligning magnetic compressible type at jambs, meeting stiles of double doors, and at the head of the door and frame. Seals are to be an integral part of the door frame. Single compression seals and/or seal-stops applied to flush frames are not acceptable.
c. Bottom of door leaf shall contain continuous, adjustable, gravity-activated seal that shall compress against the floor as the door is closed. Raised sills and threshold drop seals are not acceptable.

5. Jamb anchors: Corrosion resistant, spaced 12 inches on center maximum, and of type suitable for each wall assembly.

6. Glazing: As selected by manufacturer to meet specified acoustical performance of complete door assembly and requirements of Section 08 8000, "Glazing."

7. Hardware:
a. Hinges: Assembly manufacturers' cam-lift, butt-type, with substantiating laboratory test data certifying that hinges of identical design have been cycled a minimum of 125,000 times while supporting a door leaf weighing a minimum of 350 lbs.

b. Closers, Locksets, and Additional Hardware Requirements: As specified in Section 08 7100, “Door Hardware.”

8. Assembly and adjustment of door leaf, frame, acoustic seals, hinges and associated finish hardware shall take place at the factory to insure ease of installation, reliable operation and acoustic performance. The entire manufactured assembly shall be shipped to the job site ready to install and operate.

B. Windows and Sidelights: “Noise Lock” “C”-Class acoustic windows and frames with stops, glazing, sound-absorbing material, and concealed fasteners as manufactured by Industrial Acoustics Co, Inc., (IAC), or equal. Window assemblies are also to meet the minimum STC performance ratings specified for the door assembly.

1. Frame: Aluminum, as standard with manufacturer, with black trim.

2. Glass: Double pane, 1/4 inch (6 mm) interior lite and 1/4 inch (6 mm) exterior lite.

C. Painting: Surfaces shall shop primed and field finish painted as specified in Section 09 9000, "Painting and Coating."

2.03 FABRICATION

A. General:

1. Fabricate the work of this Section in strict accordance with the accepted shop drawings.

2. Using templates furnished by finish hardware supplier, make cutouts and reinforcing as required to accommodate items being furnished and installed under this Section and being furnished under other Sections of these Specifications for installation under this Section.

3. In addition to the specified in this Section, metal doors and frames shall comply with requirements of Section 08 1113, “Hollow Metal Doors and Frames.”

B. Metal work shall be rigid and free of defects, warp, or buckle.

1. Accurately form metal to required sizes and profiles.

2. Where practical, fit and assemble units in manufacturer's plant.

3. Fabricate sound control hollow metal work to tolerances indicated in ANSI/SDI A250.8 with minimum radius for thickness of metal.

C. Steel Finish: Hollow metal doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion, and shop primed to comply with ANSI A224.1, "Test Procedure and Acceptance Criteria for Primed Painted Steel Surfaces."

D. Aluminum Finish:

1. Type: Manufacturer’s factory-applied thermal-stetting polyester powder coat complying with AAMA 2603.

2. Color: Custom, to match wall color.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which the work of this Section will be performed. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install sound control assemblies plumb, rigid, properly aligned, and securely fastened in place in compliance with the Drawings and door/frame and seal manufacturers' written instructions to achieve the specified acoustical performance.

B. Install hollow metal frames in accordance with ANSI/SDI A250.11.

C. Fill sound-rated door frames as indicated by the manufacturer.

D. Coordinate all gaskets with other hardware to provide a continuous perimeter seal. Provide shim to mount automatic closers as required to clear gaskets.

E. Fit sound control hollow metal doors accurately in frames, within clearances specified below. Shim as necessary and comply with the following tolerances.

1. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

2. Between Bottom of Door and Top of Threshold: Standard bottom clearance as required by manufacturer.

F. Glazing: Comply with installation requirements of Section 08 8000, "Glazing." and with sound control assembly manufacturer's written instructions.

G. Install perimeter seals, fixed door bottom seals, and thresholds in accordance with manufacturer's written installation instructions.

H. Apply and adjust all gaskets to form an airtight seal with latching and closure forces in compliance with code requirements and the American Disabilities Act.

I. Prime Coat Touch-up: Immediately after acceptance of door and seal operation by Owner's Representative, items with damaged prime coat shall be sanded smooth and touched up with compatible primer. Touch-up shall not be obvious after application of finish coats.

J. Frame/Seal Assembly Joint of Hollow Metal Work: Provide a smooth fillet filler application to the joint between the push-side of the seal assemblies and the frame jambs and head prior to painting frame and seal assemblies.

3.03 FIELD QUALITY CONTROL

A. Check and readjust operating finish hardware items, leaving steel items undamaged and in complete and proper operating condition.

B. Check and readjust operating finish hardware items as required to maintain a light-tight condition at all points along the door panel perimeter after repeated door operation.

C. Upon completion and prior to its acceptance by the Owner, secure a visit to the job site by a qualified representative of the manufacturer of the acoustical assemblies to confirm that installation is in conformance with the manufacturer's recommendations.

D. Doors may be selected for in place verification testing of the acoustical performance (ASTM E336). Provide in place adjustments as required to achieve a Noise Isolation Class (NIC) rating (ASTM E413) five points less than the specified STC rating. Contractor shall remedy all defects without additional expense to the Owner.

3.04 PROTECTION

A. Protect installed work against damage from other construction work and until ready to receive final finish painting as specified in Section 09 9000, "Painting and Coating."

END OF SECTION 08 3473

SECTION 08 4213
ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for:

1. Aluminum and glass exterior swing entrances.

2. Hardware for aluminum framed entrances.

B. Related Requirements:

1. Delegated Design: Section 01 3325

2. All-Glass Entrances: Section 08 4226.

3. Glazed Aluminum Curtain Walls: Section 08 4413.

4. Door Hardware: Section 08 7100; pulls, cylinders, and additional entrance hardware requirements.

5. Glazing: Section 08 8000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination:

1. Coordinate installation of aluminum entrances with glazed aluminum curtain wall so as to produce a weatherproof and waterproof installation.

2. Coordinate with other applicable Sections for matching of general appearance, color, and finish of aluminum.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Show elevations, dimension, member profiles, details of interface with curtain wall framing, reinforcement, and glazing materials and methods.

1. Show deviations from Contract Documents.

2. Prepare drawings at 1/2-inch-to-1-foot scale for elevations and 3-inches-to-1-foot scale for details.

3. Indicate field measurements.

B. Product Data: Submit for doors and hardware items provided by door manufacturer. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Hardware Schedule:

1. Detailed hardware Groups/Sets for each opening shall be prepared by Contractor and submitted for aluminum-framed entrances.

2. Schedule shall be prepared under direct supervision of a member of the Door and Hardware Institute (DHI). Include verification of supervision on submittal.

3. Coordinate function requirements with the Owner's Representative prior to submission of Schedule.

4. Coordinate with the Hardware Schedule required under in Section 08 7100, "Door Hardware."

5. Review of Hardware Schedule shall not be construed as certifying that the list is complete.

D. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for products regionally extracted, processed, and manufactured.

1) Include statement indicating costs for each product.

E. Samples: 12-inch-long section of typical stile extrusions in required width and with specified finish.

1.04 INFORMATIONAL SUBMITTALS

A. Verification of compliance with specified performance criteria if not included with Product Data submittal.

B. Statement of fabricator/installer qualifications, if requested by Owner's Representative.

1.05 CLOSEOUT SUBMITTALS

A. Extended Warranty.

1.06 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: Documented experience on jobs of similar type and complexity, and approved by manufacturer.

B. Comply with AAMA "Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabricated units and component parts to Project site completely identified in accordance with numbering system used on shop drawings or erection diagrams.

B. Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

C. Store inside building, protected from weather and from construction activities.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.08 FIELD CONDITIONS

A. Field Measurements: Where entrances are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings.

1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.

2. Coordinate fabrication schedule with construction progress to avoid construction delays.

B. Established Dimensions: Where field measurements cannot be made without delaying work, establish dimensions, and proceed with fabrication without field measurements. Coordinate with other construction to ensure that actual dimensions correspond to established dimensions.

C. Do not install sealants when ambient temperature is less than 40 degrees F.

1.09 WARRANTY

A. Contractor: Provide Owner with a written 5-year warranty agreeing to repair or replace work that fails in materials or workmanship.

1. Failure includes:

a. Glass breakage in excess of expected accidental breakage.

b. Leakage or air infiltration in excess of specified requirements.
c. Faulty operation of doors or hardware.
d. Deterioration of finish or construction in excess of normal weathering.
e. Defects in hardware, weatherstripping, and other components of the work.

2. Warranty shall be signed by countersigned by manufacturer and installer.

B. Manufacturer: Insulating glass; as specified in Section 08 8000, “Glazing.”

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Swing Doors:

1. Door Thickness: 1-3/4-inch.

2. Design: ~~Narrow~~ **Medium** stile with nominal door stile face dimensions, including stops, as follows:

a. Vertical Stiles: ~~2~~ **3-1/2** inches.
b. Bottom Rail Height: 10 inches.
c. Top Rail Height: ~~2 1/2~~ **3-1/2** inches.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Provide entrances as part of a complete enclosure system which includes the following and complies with the performance requirements specified:

1. Doors complete with glass and glazing.

2. Anchors, fasteners, shims, and inserts as required to attach to structure and storefront.

3. Finish hardware.

B. Performance Requirements:

1. Resistance to corner racking shall be tested by the Dual Moment Load test as follows:

a. Test section shall consist of a standard top door corner assembly. Side rail section shall be 24 inches long, and top rail section shall be 12 inches long.
b. Anchor "top rail" positively to test bench so that corner protrudes beyond bench edge.
c. Anchor a lever arm positively to "side rail" at a point 19 inches from inside edge of "top rail." Attach weight support pad at a point 19 inches from inner edge of "side rail."
d. Test section shall withstand a load of 270 pounds on the lever arm before reaching the point of failure, which shall be considered a rotation of the lever arm in excess of 45 degrees.

2. Air Infiltration, ASTM E283:

a. Single Doors: Maximum of 0.50 cfm/square feet of unit.
b. Pairs of Doors: Maximum of 0.10 cfm/square feet of unit.

3. Expansion/Contraction: System shall provide for expansion and contraction within system components caused by a temperature range of 170 degrees F over a 12-hour period without causing detrimental effect to system components.

C. Sustainable Design Criteria:

1. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B221, alloy 6063-T5.

B. Fasteners: Aluminum, nonmagnetic, stainless steel or other materials which are non-corroding and compatible with aluminum components.

1. Provide reinforcement where fasteners are screwed into aluminum members of less than 1/8-inch thickness.

2. Do not use exposed fasteners.

C. Miscellaneous Concealed Metal Members: Aluminum or nonmagnetic stainless steel.

2.04 GLAZING

A. Glazing Gaskets: Full-Density EPDM conforming to NAAMM Standard SG-1.

B. Glazing Blocks, Spacers, and Accessories: As specified in Section 08 8000, “Glazing.”

C. Glass: Insulating, as shown on the Drawings and specified in Section 08 8000, “Glazing.”

2.05 HARDWARE - GENERAL

A. Weatherstripping: Manufacturer's standard and optional bottom gasketing as required to meet specified performance requirements.

B. Keying and Additional Hardware Requirements for Each Opening: As specified in Section 08 7100, "Door Hardware."

2.06 FABRICATION

A. General:

1. Perform all finishing prior to shipping to Project.

2. Whenever it is necessary to proceed with fabrication without actual field measurements, provide adequate fabrication and installation tolerances for proper fit.

3. Maintain accurate relationships of planes and angles, with hairline fit of contacting members.

4. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metalwork in such a manner as to prevent damage to exposed finish surfaces.

B. Corner construction shall consist of mechanical clip fastening and SIGMA deep-penetration plug welds at top and bottom of channel clip.

C. Provide SIGMA fillet welds along both top and bottom webs of rail extrusion.

2.07 FINISHES

A. Perform all finishing prior to shipping to Project site.

B. Protect against galvanic action where dissimilar metals are in contact, except in case of aluminum in contact with galvanized steel, zinc, or relatively small areas of stainless steel or nickel silver (white bronze). Protect by applying one coat of specified bituminous paint or zinc chromate primer or by application of an appropriate sealant or tape.

C. Exposed Aluminum: Architectural Class I clear anodic coating conforming to AA-M12C22A41.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions, drawings, specifications, and reviewed submittals. Erection shall be plumb, level, square, and in proper alignment and relationship to other work.

B. Glazing shall comply with requirements of Section 08 8000, "Glazing." Ensure proper seating of gaskets for continuous contact with glass around perimeter of glazed openings.

C. Adjust entrances for proper operation of each door and its mechanical hardware. Comply with additional hardware installation requirements specified in Section 08 7100, "Door Hardware." Coordinate with Owner’s security consultant.

D. Finished work shall be free of waves, buckles, dents, or other defects.

3.02 CLEANING AND TOUCH-UP

A. Leave manufacturer's labels in place, intact, and legible until installation is reviewed and accepted.

B. After initial inspection, remove labels, protective coating, and other foreign materials from glass and metal surfaces.

C. Clean glass and metalwork of smears, spots, and other markings. Comply with additional requirements for final cleaning specified in Section 01 7700, "Closeout Procedures.”

3.03 PROTECTION AND ADJUSTMENT

A. Institute protective measures through remainder of construction period to ensure that aluminum-framed entrances will be without damage or deterioration at time of acceptance.

B. Entrances with damage to anodized finish, as determined as unacceptable by the Owner’s Representative, shall be replaced at no additional cost to Owner.

END OF SECTION 08 4213

SECTION 08 4226
ALL-GLASS ENTRANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for:

1. All-glass entry doors with stainless steel top and bottom rails.

2. Hardware for all-glass entry doors.

B. Related Requirements:

1. Delegated Design: Section 01 3325

2. Aluminum-Framed Entrances: Section 08 4213.

3. Glazed Aluminum Curtain Walls: Section 08 4413.

4. Door Hardware: Section 08 7100; final cylinders, construction cores and final cores for this Specification section locking hardware devices.

5. Automatic Door Operators: Section 08 7113; electric operators, actuating devices, and safety sensors at designate all-glass entrance doors.

6. Glazing: Section 08 8000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 COORDINATION

A. General:

1. Check specified hardware for suitability and adaptability to details and surrounding conditions. Indicate unsuitable or incompatible items and proposed substitutions in hardware schedule.

2. Furnish subcontractors concerned with copies of final approved hardware schedule.

B. Convene coordination meeting between all opening vendors and installers at least two weeks prior to purchasing doors, frames, door hardware and electrical devices required for complete systems.

1. Required attendance includes but is not limited to, Owner's Representative, Contractor; hardware supplier and/or installer; door supplier and/or installer; frame supplier and/or installer; auto operator vendor and/or installer; and electrical.

2. Contractor shall be responsible for verifying that the door hardware accepted for installation is compatible for use with the doors and door-frames.

3. For auto operator interface with applicable door devices, auto operator vendor and/or installer shall have a written agenda and plan on how electrified devices will be installed to have a complete wired and operational auto operator system as specified in Section 08 7113, "Automatic Door Operators."

1.04 ACTION SUBMITTALS

A. Shop Drawings: Indicate layouts, elevations, door swing, interior and exterior side, and details.

B. Hardware Schedule: List door numbers, locations, hardware group numbers, key symbols, and name of each item and its manufacturer, catalog number, material, and finish.

1. Submit schedule in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Schedules which do not comply will be returned for correction before checking.

2. Submit in sufficient time for Architect's review and for supplier to place order with manufacturers in order to meet Project Schedule.

3. Hardware shall not be ordered until Hardware Schedule has been reviewed and returned.

4. Review of Hardware Schedule shall not be construed as certifying that the list is complete.

C. Product Data: Manufacturer's information on materials, components, and installation.

D. Samples: Material samples showing specified finish on door fittings and hardware.

1.05 INFORMATIONAL SUBMITTALS

A. Installer qualifications as specified.

1.06 CLOSEOUT SUBMITTALS

A. Extended warranty.

B. Inspection report as specified.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Approved by and under supervision of manufacturer, with not less than 5 years' experience installing all-glass entrance doors and hardware of type required for this Project.

B. Doors shall comply with applicable standards for accessibility.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle components in manufacturer's standard protective packaging.

B. Store components off the ground, in a protected location.

1.09 WARRANTY

A. Manufacturer: Provide Owner with manufacturer's standard form 2-year warranty in which manufacturer agrees to repair or replace components of all-glass door system, including operating hardware provided under this Section that fails in materials or workmanship within the warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design: System performance and profiles reflect the Owner's design intent and project requirements and are generally based on the "Glass Entrance System" by C.R. Laurence Co., Inc.

B. Products by both listed and non-listed manufacturers shall meet the specified design and performance criteria.

2.02 ALL-GLASS DOORS

A. Door Style: Tempered glass with continuous top and bottom rails

1. Rail Profile: 3-5/16 inch high, tapered with minimum 60-degree slope from horizontal, ADA compliant. Provide matching stainless steel rail end closures.

2. Metal and Finish on Exposed Metals: Stainless steel, satin finish.

B. Glass ("GL-7"): As provided by door manufacturer, clear, fully heat tempered, B-finish exposed edges, 3/4 inch thick, and complying with additional requirements specified in Section 08 8000, "Glazing."

2.03 LOW ENERGY AUTOMATIC OPERATORS

A. Provide on one door leaf at each entry. See Section 08 7113, "Automatic Door Operators."

2.04 ADDITIONAL HARDWARE

A. The Specifications are intended to cover all doors in the Project and establish a type and standard of quality, but it is the responsibility of the Contractor to furnish proper hardware for all openings and for a complete installation. Where Hardware Groups/Sets have different information, comply with the following s for clarification and detailed requirements. It is the Contractor's responsibility to provide all devices whether specified or not in Hardware Sets/Groups.

B. Exit/Panic Devices:

1. All exit/panic devices shall be by the same manufacturer.

2. Basis of Design: 1-1/4 inch diameter stainless steel; H-100 Panic Devices, DB-100 Deadbolt Housings, and DH-100 Dummy Handles by Blumcraft, a Division of C.R. Laurence Co., Inc., or equal.

    a. Provide panic device on interior of both doors.
    b. Door opposite automatic operator shall be less exterior pull.
    c. Provide cylinder dogging feature for exit devices.

3. Provide cylinders for exit devices with locking trim and cylinder dogging in accordance with 08 7100, “Door Hardware.” Provide cylinder dogging feature for exit devices.

4. Provide panic devices complying with Section 1008.1.9, Part 2, Title 24, CCR and the CBC.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that conditions are satisfactory for installation of tempered-glass doors.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and accepted shop drawings. Adjust door to operate smoothly.

B. When complete:

1. Doors shall be set square, plumb, and level.

2. Abutting edges of glass panels shall align within 1/8-inch acceptable glass fabrication tolerance.

3. Doors shall remain plumb during swing and shall operate smoothly, quietly, and free from binding. Adjust closers to meet maximum closure pressure required for accessibility.

4. Exposed surfaces shall be free from scratches, dents, tool marks, stains, discoloration, and other damage and defects.

3.03 CLEANING

A. Following completion of installation, clean both metal and glass surfaces of excess sealants, paint, and other adhering foreign materials. Use cleaning materials and procedures recommended by door manufacturer. Comply with additional requirements for final cleaning specified in Section 01 7700, "Closeout Procedures.”

END OF SECTION 08 4226

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for aluminum storefront framing system including:

1. Glazing.
2. Glazing gaskets.
3. Sills, trim, mullion extensions, and similar border and filler items.
4. Anchors, shims, fasteners, inserts, accessories and support brackets.
5. Supplemental internal reinforcing and secondary bracing.

B. Related Requirements:

1. Delegated Design: Section 01 3325.
2. Mockups: Section 01 4339.
3. Sheet Metal Flashing and Trim: Section 07 6200.
4. Joint Sealants: Section 07 9200; system perimeter sealant and backup materials.
5. Glazed Aluminum Curtain Walls: Section 08 4413.
6. Glazing: Section 08 8000.

1.02 REFERENCE STANDARDS

A. Storefront system shall comply with the following standards. When conflicts arise between standards and requirements of this Section, the more stringent shall apply.

1. Architectural Aluminum Manufacturers Association (AAMA).

a. 501-05: "Methods of Test for Exterior Walls."
b. 501.1-05: "Standard Test Methods for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure."
c. 503-08: "Voluntary Specification for Field Testing of Storefronts, Curtain Walls and Sloped Glazing Systems."
d. 609 & 610-09 (Combined Document): "Cleaning and Maintenance Guide for Architecturally Finished Aluminum."
e. 800-10: "Voluntary Specifications and Test Methods for Sealants."
f. 2605-11: "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."
g. TIR (Technical Information Report) A11-04, Maximum Allowable Deflection of Framing Systems for Building Cladding Components at Design Wind Loads."

2. American Society for Testing and Materials (ASTM): Standards as specified.

3. SSPC-Society for Protecting Coatings: SSPC-Paint 20, "Zinc-Rich Primers (Type I - Inorganic & Type II – Organic)."

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Pre-installation Meeting:

1. Contractor shall schedule a job conference to review storefront work after review and acceptance of show drawing submittal.

2. Notify participants at least 14 calendar days before conducting conference.

3. Conference shall be attended by Owner's Representative and by representatives of the Contractor, storefront installer, and other installers whose work may affect quality of installation.

4. The following major considerations shall be reviewed at the meeting:

   a. Drainage and flashing details, construction tolerances, interface with adjoining materials, and other related work.
   b. Field conditions, schedule, construction sequence, installation requirements, and quality of completed installation.

5. Record discussions of conference and any conflict, incompatibility, or inadequacy. Furnish a copy of record to each participant.

6. At Contractor's option, the agenda items for the pre-installation meeting for aluminum-framed storefronts may be included as part of the pre-installation meeting required under Section 08 4413, "Glazed Aluminum Curtain Walls," in lieu of conducting a separate meeting for the storefront system.

1.04 ACTION SUBMITTALS

A. Shop Drawings: Show elevations, dimension, member profiles, details of composite members, details of interface with other building construction, reinforcement, expansion provisions, method and location of attachment to structural system, and glazing materials and methods.

1. Show deviations from Contract Documents.

2. Prepare drawings at 1/2-inch-to-1-foot scale for elevations and 3-inches-to-1-foot scale for details.

3. Indicate field measurements.

4. Show entrances included as part of storefront system.

B. Product Data: Provide component dimensions describe components within assembly, anchorage and fasteners, glass, internal drainage details, hardware, and other components.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

D. Delegated Design: Submit structural calculations for storefront layouts over 10 feet high prepared by the engineer in responsible charge retained by the Contractor.

1. Calculations prepared by the design engineer retained by the Contractor shall be submitted to demonstrate compliance with CBC and specified performance requirements. Where specifications and code differ, the more severe requirements shall govern.

2. Indicate loads on which calculations are based.

3. Submit wind design calculations for various values, including positive and negative loading.

4. Cross-reference calculations to shop drawings.

5. Review of calculations by Owner’s Representative and Project Structural Engineer will not relieve Contractor of any responsibilities for providing systems of required strength.

E. Samples:

1. Aluminum Components: Typical 12 inch long extrusion, with specified finish.

2. Glass and Glazing Accessories: As specified in Section 08 8000, "Glazing."

1.05 INFORMATIONAL SUBMITTALS

A. Reports:

1. Results of field water leakage tests by independent inspector.

2. Manufacturer's reports from independent testing laboratory verifying conformance with AAMA and ASTM performance requirements specified if not included with product data.

3. Record of pre-installation meeting.

1.06 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.07 QUALITY ASSURANCE

A. Engineer in Responsible Charge, if Required: A professional engineer lawfully eligible in the State of California to design the element or component and to seal the design in accordance with state law and having a minimum of 10 years' experience in providing engineering services of the kind required.

B. Fabricator/Installer Qualifications: Company specializing in work of this Section, with not less than 10 years' experience on jobs of similar type and complexity, and approved by manufacturer.

C. Comply with AAMA "Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual."

D. Manufacturer's Field Representative: A technical field representative of the manufacturer shall be at project site, as a minimum, at start, during middle, towards end of each of storefront installation, and during field testing.

E. Mockup: First installed example of system shall serve as a mockup for review and approval by Owner's Representative of workmanship and visual effect.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabricated units and component parts to Project site, completely identified in accordance with numbering system used on shop drawings or erection diagrams.

B. Handle work of this Section in accordance with AAMA publication SFM-1, "Aluminum Storefront and Entrance Manual."

C. Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.09 FIELD CONDITIONS

A. Field Measurements: Where indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings.

1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.

2. Coordinate fabrication schedule with construction progress so as to avoid construction delays.

B. Established Dimensions: Where field measurements cannot be made without delaying work, establish dimensions, and proceed with fabrication without field measurements. Coordinate with other construction to ensure that actual dimensions correspond to established dimensions.

1.010 WARRANTY

A. Manufacturer: Provide written 2-year warranty agreeing to repair or replace work which fails in materials or workmanship. Failure includes failure to perform as specified and/or deterioration of finish or construction in excess of that to be expected under normal weathering.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design: System performance and profiles reflect the design intent and Owner's project requirements and are based on the specified product by Kawneer Company, Inc.

B. Products by both listed and non-listed manufacturers shall meet the specified design and performance criteria.

2.02 STOREFRONT SYSTEM

A. General: Details on the Drawings reflecting mullion profiles and dimensions are diagrammatic only.

B. System: Stick-fabricated, pressure-equalized, high thermally broken by means of two thermal breaks; "Trifab VersaGlaze 451UT" by Kawneer, or equal.

1. Mullions: 2 inch sightline by 4-1/2 inches deep.

2. Glazing: Center plane, 4-side captured.

3. Glass: Insulating as specified in Section 08 8000, "Glazing."

4. Systems shall be capable of accepting integrated operable windows.

C. Finish on Exposed Aluminum: As specified.

2.03 OPERABLE WINDOWS

A. Performance Class: Meeting or exceeding AW-60 or HC-80 in accordance with AAMA/WDMA/CSA 101/I.S.2/A44 for each operation shown.

B. Type: Thermally broken, heavy commercial windows designed and manufactured specifically for minimal sight lines and inclusion in the curtain wall system; Kawneer "Sealair" Architectural Windows, or accepted equal.

1. Series: "Storefront GLASSvent."

2. Operation: Awning.

C. Glass: Insulating, as specified in Section 08 8000, "Glazing.

D. Hardware: As standard with manufacturer and as follows.

1. Cast white bronze cam locking handles.

2. Stainless steel 4-bar hinges.

3. Provide supplemental chain operator for high level windows above 7'-0"; Teal Products, or equal.

E. Finish on Exposed Aluminum: As specified.

F. The frame and ventilator shall be factory fabricated and assembled.

2.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. System Description: Provide a complete exterior enclosure system complying with the performance requirements specified, including the following:

1. Aluminum framing system.

2. Glass and glazing.

3. Glazing gaskets and accessories.

4. Extruded and sheet accessory pieces, including sills, border, and filler pieces.

5. Flashings.

6. Anchors, fasteners, shims, and inserts for attachment to structure.

7. Integral gutter.

8. Integral operable windows.

B. General Design Requirements: Comply with recommendations of AAMA publication SFM-1, "Aluminum Store Front and Entrance Manual," except where more stringent requirements are specified or required by applicable codes.

C. Design Criteria:

1. Strength: Design system to withstand wind loads acting normal to plane of wall as required by CBC.

a. Deflection: Maximum L/175 with full recovery of glazing materials, when measured in accordance with ASTM E330.
b. Safety Factor: Unless otherwise specified, design parts and assemblies (including glazing stops, gaskets, adhesives, and sealants) for safety factor not less than 1.65.

2. Air Leakage: Maximum 0.06 cfm/sf, ASTM E283, at differential static pressure of 6.24 psf.

3. Water Penetration/Leakage:

   a. No uncontrolled water penetration, ASTM E331, with no water on exposed interior components; static pressure differential of 20 percent of inward wind load, with minimum 6 psf load.
   b. Static Pressure, ASTM E331: None, when subjected to water spray at 5 gallons per hour per square foot, at static pressure of 10 psf as defined in AAMA 501.
   c. Dynamic Pressure, AAMA 501.1: None, when subjected to water spray at 5 gallons per hour per square foot and wind from a wind generator at static pressure of 6.24 psf or 20 percent of design pressure for 15 minutes.

4. Energy Performance: Storefront system shall have certified energy performance ratings in accordance with NFRC standards and approved software. The following parameters shall be documented:

   a. Value for U-factor to be not more than 0.38.
   b. Value for SHGC shall be as specified for the Glass Type scheduled and specified in Section 08 8000, “Glazing.”

D. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

E. Safety Glass Standard: Comply with CBC and CPSC 16 CFR 1201, and pass ANSI Z97.1.

F. Expansion/Contraction: System shall provide for expansion and contraction within system components caused by a temperature range of 180 degrees F over a 12-hour period without causing detrimental effect to system components.

G. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

H. Sustainable Design:

1. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

2.05 METAL MATERIALS

A. Aluminum:

1. Extruded: ASTM B221, 6063-T5 alloy and temper, size, and shape as required by design criteria but not less than 0.125 inch thick.

2. Sheet: ASTM B209. Aluminum sheet for formed members shall be not less than 0.05 inch thick.

3. Structural: ASTM B308, 6063-T6 alloy and temper.

B. Steel: ASTM A36.

2.06 GLASS AND GLAZING MATERIALS

A. Glass: 1-inch insulating; Type GL-1 as specified in Section 08 8000, "Glazing."

B. Glazing Materials:

1. General: Materials shall achieve weather, moisture, and air infiltration requirements and comply with requirements of Section 08 8000, "Glazing."

2. Gaskets: Elastomeric, as recommended or provided by system manufacturer.

2.07 SEALANT MATERIALS

A. General:

1. Use materials and application procedures as recommended by manufacturer. Seal joinery, fastener penetrations, and welds as required for watertight installation. Sealant on exposed finished surfaces will not be permitted.

2. Use only non-hardening, non-shrinking, and non-migrating materials.

3. For nonworking metal-to-metal joints within framing members, use small-joint sealant conforming to 803.3 as described in AAMA 800.

B. Perimeter Sealants: As specified in Section 07 9200, “Joint Sealants.”

2.08 ACCESSORIES

A. Coating for Separation of Dissimilar Metals: Cold-applied asphalt mastic, zinc chromate paint, or other nonconductive, non-absorptive material.

B. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

C. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Flashings: Comply with requirements of Section 07 6200, “Sheet Metal Flashing and Trim.

1. Exposed: Aluminum, finish to match storefront sections. Secure with concealed fastening methods.

2. Concealed: Dead-soft stainless steel, 26 gage minimum; extruded aluminum, 0.062 inch minimum; or an alloy and type selected by manufacturer for compatibility with other components.

E. Slip-Joint Accessories: Pads, sheets, shims, or washers that allow free movement and prevent corrosion "freeze-up."

F. Fasteners: Aluminum, nonmagnetic stainless steel or other non-corrosive material compatible with aluminum window members, trim hardware, anchors, and other components.

1. Provide reinforcement where fasteners are screwed into aluminum members of less than 1/8-inch thickness.

2. Do not use exposed fasteners.

G. Anchoring Devices: Corrosion resistant type capable of supporting entrance system and superimposed design loads; design to allow adjustments of system prior to being permanently fastened in place.

H. Steel Reinforcement and Brackets: Manufacturer's standard with minimum 2 oz. hot-dip zinc coating, ASTM A123, applied after fabrication.

I. Concrete Inserts: Cast iron, malleable iron, or hot-dip galvanized steel complying with ASTM A123.

J. Miscellaneous Concealed Metal Members: Aluminum or nonmagnetic stainless steel.

1. Members that are not exposed to weather or abrasion may be hot-dip galvanized steel complying with ASTM A123.

2. Galvanized members located in internal drainage channels shall be completely coated with dissimilar metal coating.

2.09 FABRICATION

A. General:

1. When it is necessary to proceed with fabrication without actual field measurements, provide adequate fabrication and installation tolerances for proper fit.

2. Maintain accurate relationships of planes and angles, with hairline fit of contacting members.

3. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metalwork in manner that prevents damage to exposed finish surfaces.

4. Wall thickness of framing members shall be as required for systems to meet specified performance criteria for height at each location while maintaining indicated profile dimensions. Internal supplemental steel reinforcing, if required, shall be indicated on submittals and shall be galvanized.

B. Mullions: Extruded aluminum, designed for fully captured glazing.

C. Members shall include extruded-aluminum gutter lugs, aluminum or stainless-steel spring face clips, screws, and metal setting blocks with lead pads. Gutter screws shall not be in contact with glass.

D. Framing shall be accurately assembled, with no exposed fasteners, utilizing extruded splines, shear blocks, and/or snap-in features.

E. Integral Base, Exposed Flashings, and Trim: Brake-formed aluminum, finish to match storefront wall mullion sections, secured with concealed fastening method.

2.010 PROTECTIVE COATINGS AND FINISHES

A. General:

1. Perform all finishing prior to shipping to Project site.

2. Protect against galvanic action where dissimilar metals are in contact, except in case of aluminum in contact with galvanized steel, zinc, or relatively small areas of stainless steel or nickel silver (white bronze). Protect by applying specified coating or by application of an appropriate sealant or tape.

B. Ferrous Metal:

1. Hot-dip galvanize in accordance with ASTM A123 after fabrication. Do not galvanize portions of items completely embedded in concrete. Touch up damaged galvanized surfaces and welds with zinc-rich paint.

2. Contractor's Option: In lieu of hot-dip galvanize, use zinc-rich paint as follows:

a. Surface Preparation: Near-white blast cleaning in accordance with SSPC SP-10.
b. Application: Apply before rust bloom appears but not more than 8 hours after cleaning. Minimum dry film thickness, 2.5 mils.

C. Aluminum Finish: Architectural Class I clear anodic coating conforming to AA-M12C22A41.

PART 3 - EXECUTION

3.01 PREPARATION

A. Separate aluminum from dissimilar metals.

B. Coat dissimilar metals in drainage cavities, using specified material. Aluminum, stainless steel, zinc, cadmium, and small areas of white bronze are not considered dissimilar from each other.

C. Coat metals that come into contact with masonry, concrete, cement plaster, and treated wood, using specified material.

D. Galvanized Steel: Clean and touch up welds, bolted connections, and abraded areas in accordance with ASTM A780, using galvanizing-repair paint.

3.02 INSTALLATION

A. Install aluminum framed storefront assemblies in accordance with manufacturer's recommendations and installation requirements for weathertight installation.

B. Comply with manufacturer's instructions, drawings, specifications, and reviewed submittals. Erection shall be plumb, level, square, and in proper alignment and relationship to other work.

C. Ensure assemblies are plumb, level and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.

1. Maximum Variation from Plane or Location: 1/8 inch in 12 feet, with maximum 1/2 inch variation in total length.

2. Maximum Offset between Members: 1/16 inch.

D. Anchor securely to surrounding construction as detailed and required.

E. Finished aluminum work shall be free of waves, buckles, dents, or other defects.

F. Moldings joined at corners shall be accurately cut and neatly fitted to result in a tightly closed miter.

G. Install glass in accordance with Section 08 8000, "Glazing," and manufacturer's instructions in order to achieve performance criteria. Ensure proper seating of gaskets for continuous contact with glass around perimeter of glazed openings.

1. Do not allow glass to touch metal surfaces.

H. Sealant:

1. General:
   a. Apply in accordance with sealant manufacturer's written instructions.
   b. Install perimeter sealant to method required to achieve performance criteria.

2. Preparation: Clean and prime substrate surfaces in accordance with manufacturer's recommendations.

3. Application: Tool all sealant applications. Tape and tool exposed sealant applications. Where permitted, tool exposed sealant applications flush or as otherwise approved by the Owner's Representative, with no excess sealant on exposed finished surfaces.

4. Comply with additional requirements specified in Section 07 9200, "Joint Sealants."

3.03 FIELD QUALITY CONTROL

A. Field Tests:

1. General:
   a. Owner's Representative shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, with perimeter calked and cured.
   b. Conduct tests for air infiltration and water penetration with manufacturer's representative present.
   c. Testing shall be performed by a qualified independent testing agency.
   d. See additional testing requirements specified in Section 01 4000, "Quality Control."
   e. Testing shall be in accordance with AAMA 503-08.

2. Air Infiltration Tests: Conduct tests in accordance with ASTM E783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft2, whichever is greater.

3. Water Infiltration Tests: Conduct tests in accordance with ASTM E1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf (300 Pa).

B. Tests not meeting specified performance requirements and units having deficiencies shall be corrected at no additional cost to Owner.

3.04 CLEANING AND TOUCH-UP

A. Leave manufacturer's labels in place, intact, and legible until installation is reviewed and accepted.

B. After initial inspection, remove labels, protective coating, and other foreign materials from glass and aluminum surfaces.

C. Clean glass and metalwork of smears, spots, and other markings. Comply with additional requirements for final cleaning specified in Section 01 7700, "Closeout Procedures."

D. Replace aluminum components with damaged finish, determined as unacceptable by the Owner's Representative, at no additional cost to Owner.

END OF SECTION 08 4313

SECTION 08 4413
GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for stick-framed, aluminum curtain wall framing system including:

1. Glazing.
2. Glazing gaskets.
3. Sills, trim, mullion extensions, and similar border and filler items.
4. Vertical sunshades.
5. Operable windows within the curtain wall system.
6. Anchors, shims, fasteners, inserts, accessories and support brackets.
7. Supplemental internal reinforcing and secondary bracing.

B. Related Requirements:

1. Alternates: Section 01 2300; alternates affecting the work of this Section.

~~1.~~**2.** Delegated Design: Section 01 3325.

~~2.~~**3.** Mockups: Section 01 4339.

~~3.~~**4.** Structural Metal Stud Framing: Section 05 4100.

~~4.~~**5.** Sheet Metal Flashing and Trim: Section 07 6200.

~~5.~~**6.** Thermal Board and Batt Insulation: Section 07 2117; fire safing insulation and smoke seal at floor and roof edges.

~~6.~~**7.** Joint Sealants: Section 07 9200; system perimeter sealant and backup materials.

~~7.~~**8.** Aluminum-Framed Entrances: Section 08 4213.

~~8.~~**9.** All-Glass Entrances: Section 08 4226.

~~9.~~**10.** Glazing: Section 08 8000.

~~10.~~**11.** Metal Louvers: Section 08 9110; aluminum louvers within the curtain wall system.

~~11.~~**12.** Sun Control Devices: Section 10 7173; sunshades and light shelves attached to curtain wall system.

1.02 REFERENCE STANDARDS

A. Curtain wall systems shall comply with the following standards. When conflicts arise between standards and requirements of this Section, the more stringent shall apply.

1. Aluminum Association (AA):

   a. ADM-1: "Aluminum Design Manual."

2. Aluminum Architectural Manufacturers Association (AAMA).

   a. CW-DG-1: "Aluminum Curtain Wall Design Guide Manual."
   b. MCWM: "Metal Curtain Wall Manual."
   c. 501: "Methods of Test for Exterior Walls."
   d. 501.1: "Standard Test Methods for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure."
   e. 501.2: "Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems."
   f. 503: "Voluntary Specification for Field Testing of Storefronts, Curtain Walls and Sloped Glazing Systems."
   g. 609 & 610 (Combined Document): "Cleaning and Maintenance Guide for Architecturally Finished Aluminum."
   h. 800: "Voluntary Specifications and Test Methods for Sealants."
   i. 2605: "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."
   j. RPC: "Rain Penetration Control – Applying Current Knowledge."
   k. CW-13: "Structural Sealant Glazing Systems."
   l. TIR (Technical Information Report) A11, Maximum Allowable Deflection of Framing Systems for Building Cladding Components at Design Wind Loads."

3. American Institute of Steel Construction (AISC):

   a. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" including commentary of the AISC Specifications.
   b. "Specifications for the Design of Cold - Formed Steel Structural Member."

4. American Society of Civil Engineers (ASCE):

   a. SEI/ASCE 7: "Minimum Design Loads for Buildings and Other Structures."

5. American Society for Testing and Materials (ASTM): Standards as specified.

6. SSPC-Society for Protecting Coatings: SSPC-Paint 20, "Zinc-Rich Primers (Type I - Inorganic & Type II – Organic)."

7. American Welding Society (AWS):

   a. AWS D1.1: "Structural Welding Code – Steel."
   b. AWS D1.2: "Structural Welding Code – Aluminum."

8. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA): "Architectural Sheet Metal Manual."

9. GANA - Glass Association of North America

    a. "Glazing Manual."
    b. "Sealant Manual."

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Pre-Submittal Meeting:

1. Contractor shall schedule a meeting with the Owner's Representative, Owner's Design Professional, and applicable subcontractors to discuss design intent, concerns and expectations, coordinate specification and shop drawings issues, and finalize system design parameters and details prior to completion of the submittals documents.

2. Notify participants at least 7 calendar days before conducting meeting.

C. Pre-installation Meeting:

1. Contractor shall schedule a job meeting to review curtain wall work prior to installation.

2. Meeting shall be scheduled after review and acceptance of shop drawing submittal.

3. Notify participants at least 14 calendar days before conducting meeting.

4. Conference shall be attended by Owner's Representative, and by representatives of the Contractor, curtain wall installer, and other installers whose work may affect quality of installation.

5. The following major considerations shall be reviewed at the conference:

    a. Review in detail the Specifications, curtain wall design, drainage and flashing details, construction tolerances, interface with adjoining materials, and other related work.
    b. Review in detail job conditions, schedule, construction sequence, installation requirements, and quality of completed installation.
    c. Review in detail the means of protecting completed work during remainder of construction period.
    d. Record discussions of conference and any conflict, incompatibility, inadequacy, or any action required. Furnish a copy of record to each participant.

D. Coordination:

1. Coordinate with installation of any intermediate stabilization anchors for the curtain wall maintenance in locations required.

2. Coordinate installation of any embeds and secondary supports for curtain wall including miscellaneous metal connections.

3. To assure a complete and coordinated fabrication and installation of the curtain walls and attached sunshade system, sunshades specified in Section 10 7173, "Sun Control Devices," shall be designed and installed under the direct supervision of the curtain wall fabricator.

1.04 ACTION SUBMITTALS

A. Shop Drawings: Submit complete shop and erection drawings signed by the engineer in responsible charge.

1. Show direction and magnitude of dynamic movement, interior and exterior joinery elevations, details of each condition at large scale for reach section, joint, anchor assembly, sealant application, and glazing system and as required for proper fabrication, assembly, and installation.

2. Anchor Assemblies:

a. Shop Layout and Erection Drawings: Coordinate with related support system details.
b. Provide loading diagrams of resultant loads transmitted to support systems.

3. Other Component Parts:

a. Shop and Erection Drawings: Prepare in same detail specified for curtain wall.
b. Verify and coordinate related details, conditions, dimensions, tolerances, and integration with adjacent materials.

4. Show entrances included as part of curtain wall system.

B. Product Data: Provide component dimensions describe components within assembly, anchorage and fasteners, glass, internal drainage details, hardware, and other components.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. MR 5: Documentation for products regionally extracted, processed, and manufactured.

1) Include statement indicating costs for each product.

c. EQ 4.1: Printed statement of volatile organic compounds (VOCs) for field-applied adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Samples:

1. Aluminum Components:

a. Framing: Typical 12 inch long extrusion, with each specified finish.
b. Sunshades: 12-inch long section of vertical fin and frame, with each specified finish.

2. Glass and Glazing Accessories: As specified in Section 08 8000, "Glazing."

3. Sunshades and Light Shelves: As specified in Section 107173, “Sun Control Devices."

E. Delegated Design: Calculations prepared by the engineer in responsible charge retained by the Contractor shall be submitted to demonstrate compliance with CBC and specified performance requirements. Where specifications and code differ, the more severe requirements shall govern.

1. Indicate loads on which calculations are based.

2. Submit wind design calculations for various values, including positive and negative loading.

3. Calculations shall show design accommodates the specified structural frame deflection and drift criteria.

4. Cross-reference calculations to shop drawings.

5. Review of calculations by Owner’s Representative and Project Structural Engineer will not relieve Contractor of any responsibilities for providing systems of required strength.

1.05 INFORMATIONAL SUBMITTALS

A. Statement of qualifications as specified.

B. Manufacturer’s standard warranty form.

C. Manufacturer's Reports:

1. Test Reports:

a. Submit from independent testing laboratory verifying conformance with AAMA and ASTM performance requirements specified for each of following listed tests, showing that glazed aluminum curtain wall system assembly including operable windows have been tested in accordance with specified test procedures and complies with performance characteristics as indicated by manufacturer’s testing procedures.

1) Deflection and structural tests.
2) Water penetration tests.
3) Air infiltration tests.
4) Thermal conductance tests.

b. Where a curtain wall system or component of similar type, size, and design as specified for this Project has been previously tested within last year, under conditions specified herein, resulting test reports may be submitted in lieu of listed testing.

2. Field Reports:

a. Submit reports of manufacturer's field representative observations of installation for curtain wall indicating observations made during inspection at beginning, during middle, and at conclusion of installation.
b. Indicate results of field testing and any directions given Contractor for corrective action.

3. Certifications:

a. Manufacturer's certification for fasteners as specified.

D. Documentation and verification of certification by AAMA of Contractor's testing agency to perform field performance testing on curtain wall.

1.06 CLOSEOUT SUBMITTALS

A. Extended warranties as specified.

1.07 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: A company capable of providing an aluminum framed curtain wall system that meets or exceed performance requirements specified and of documenting this performance by inclusion of test reports, and calculations.

2. Fabricator/Installer: Firm shall specialize in the fabrication and installation of curtain wall systems with not less than 10 years consecutive successful experience on work similar in scope and type specified for this Project.

a. Firm shall be approved by system manufacturer if fabricator/installer is not the manufacturer.
b. The subcontracting of work is not permitted without prior approval of the Owner's Representative.

3. Engineer in Responsible Charge: A professional engineer lawfully eligible in the State of California to design the element or component and to seal the design in accordance with state law and having a minimum of 10 years' experience in providing engineering services of the kind required.

B. Source Limitations:

1. Contractor shall engage a single firm to assume undivided responsibility for fabrication, installation, and total coordination of the glazed aluminum curtain wall systems.

2. Contractor shall assure sunshade fabricator reviews the Drawings and Specifications and is in agreement that the design-build curtain wall system, operable windows, and sunshades are proper, compatible, and adequate for application shown, and that details do not conflict with any specified warrantees.

C. Manufacturer's Field Representative: A technical field representative of the manufacturer shall be at project site, as a minimum, at start, during middle, towards end of the curtain wall installation, and during field testing of field mockup panel.

D. Brackets and Fasteners:

1. The general requirement for torquing of bolts shall be highlighted on the submittal drawings and tightening torque values shall be clearly stated.

2. Allowable loads shall be in accordance with the CBC.

3. Shimming will only be allowed to accommodate local variations in construction tolerances. The maximum allowable shim dimension shall be noted on the submittal drawings.

4. When not following an applicable code, standard or design guide, a minimum safety factor of 2 shall be used for permissible load design of anchoring assemblies.

5. The design of brackets for site drilled fasteners shall allow for reinforcement or other obstructions encountered during installation and for moving an attachment position. No reinforcement or other obstructions shall be cut without the approval of the Owner's Representative and Project Structural Engineer.

E. Locked in Stresses:

1. The curtain wall design and detailing shall avoid the introduction of locked-in stresses that may be detrimental to the curtain wall performance.

2. Locked-in stresses are those that can develop in an individual component if the various fasteners that secure that component are so rigid that they do not allow for thermal or other movement of the component.

F. Visual Mockup:

1. Provide a full size jobsite mockup of curtain wall system as part of the free-standing off-building exterior wall mockup as specified in Section 01 4339, "Mockups."

2. Mockup shall consist of typical assemblies, sunshades, operable windows, and custom profiles in specified finish, complete with mounting devices. Mockup shall be sufficiently complete to demonstrate installation and aesthetic effect of completed system.

   a. Size: Mullions and sunshades in sufficient quantity to show appearance of system with specified finish.
   b. Mockup shall include scheduled Glass Types, both vision and spandrel.

3. Use of similar products is not acceptable.

4. Intent of mockup is to permit verification of workmanship, component interface, and visual qualities including appearance of specified finish.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabricated units and component parts to Project site completely identified in accordance with numbering system used on shop drawings or erection diagrams.

B. Handle work of this Section in accordance with AAMA "Metal Curtain Wall Manual" and "Installation of Aluminum Curtain Walls" publications.

C. Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.09 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings.

1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.

2. Coordinate fabrication schedule with construction progress to avoid construction delays.

B. Do not install sealants when ambient temperature is less than 40 degrees F. See additional requirements specified in Section 07 9200, "Joint Sealants."

C. Coordinate construction and installation of curtain wall with other work having a direct bearing on work of this Section. Furnish setting templates and layouts affecting work of other Sections.

1.10 WARRANTY

A. Manufacturer: Provide Owner with curtain wall manufacturer's written 2-year warranty, co-signed by Contractor, that products will be free from material defect in materials and workmanship.

B. Contractor: Provide Owner with a written 5-year warranty, co-signed by curtain wall installing contractor, agreeing to repair or replace work which fails in materials or workmanship.

1. Under terms of warranty, Contractor shall agree to repair or replace defective materials and workmanship to "like new condition," including such exploratory work, as necessary to determine the cause, during the guarantee period, at no additional cost to the Owner.

2. Defective materials and workmanship are hereby defined to include, but not be limited to, evidence of:

a. Penetration of water into the building.
b. Air infiltration exceeding specified limits.
c. Structural failure of components resulting from forces within specified limits.
d. Glass breakage including secondary glass damage due to falling components.
e. Adhesive or cohesive failure of sealants including adhesive or cohesive failure, crazing on surface of non-structural sealant, and non-structural sealant hardening beyond Shore A durometer 50 or softening below 20.
f. Failure of operating parts to function normally.
g. Failure to fulfill other specified performance requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design: System performance and profiles reflect the design intent and Owner's project requirements and are generally based on the specified products by Kawneer Company, Inc.

B. Products by both listed and non-listed manufacturers shall meet the specified design and performance criteria.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. General:

1. The curtain wall systems are a delegated design which requires a complete system designed and engineered to meet the requirements of the Contract Documents and to provide a complete weatherproof enclosure for the building.

2. The glazed aluminum curtain wall shall be designed, engineered, fabricated, and installed by the Contractor to meet or exceed the minimum structural and weather resistance requirements specified herein as demonstrated by engineering calculations and field testing. The requirement for design includes the requirement for cooperative coordination with the Owner's Representative to develop the final accepted curtain wall system and their connections and supports.

3. Drawings are diagrammatic. The details shown are intended as a guide for the aesthetic and interfacing requirements of the various components of the exterior wall to and with other work; details are intended to establish basic dimensions of the module and the sight lines, jointing and profiles of members. The Contractor is responsible for the design and engineering of the system within these aesthetic parameters. The Drawings shall not be considered as an engineering design or adequate to meet the engineering design requirements.

4. The Drawing details do not show all required conditions or modifications. Conditions not detailed shall be developed by the Contractor and included on the shop drawings to the same level of aesthetics and in compliance with performance criteria as indicated for detailed areas and as stipulated in these Specifications.

5. Contractor is responsible for coordination, compatibility, and design integrity to secure a weathertight seal of the curtain wall system and between system and interfacing surfaces and materials.

B. Design system to resist deflection and vertical and lateral forces in accordance with CBC seismic and wind provisions and building drift requirements. In addition, system shall accommodate and support decorative metal elements attached to framing members.

C. Safety Factor: Unless otherwise specified, design parts and assemblies (including glazing stops, gaskets, adhesives, and sealants) for safety factor not less than 1.65.

1. Failure of any part or assembly shall not occur at less than 1.65 times maximum wind load pressure.

2. Failure shall be defined as breakage, disengagement, or permanent deformation of framing members in excess of L/1,000 or 1/64 of their clear span, whichever is less, or permanent deformation of anchor assemblies beyond tolerance and slippage limitations.

D. Design Modifications: Acceptable only to comply with design criteria and as approved by the Owner's Representative.

1. Submit variations in details and materials for review.

2. Maintain general design concept without altering profiles or adversely affecting appearance, durability, or strength of materials.

3. Wind load testing, conducted in accordance with ASTM E330, shall verify conformance to the following deflection requirements:

E. Deflection under Wind Load Pressure:

1. Design wind pressure shall be calculated in accordance with code, using wind speed required by code and indicated on the Structural Drawings, and applied in the positive and negative direction in accordance with ASTM E330.

2. Do not exceed following clear span deflections.

a. Normal to Wall Plane:

1) Spans up to 13 feet 6 inches: L/175.
2) Spans over 13 feet 6 inches: In accordance with recommendations of AAMA TIR-A11-04.
3) Glass: Maximum 3/4 inch.

b. Parallel to Wall Plane: Unless otherwise required for seismic drift, 75 percent of design clearance dimension or 1/8 inch vertically and 3/8 inch horizontally, whichever is less, between members and adjacent glass, panel, or other part immediately adjacent.
c. Door Headers: Horizontal members over doors; 1/16 inch.

3. Sealant Interface: Do not exceed dynamic movement capacity of sealant.

F. Deflection – Structural Support Frame: System shall be designed to accommodate anticipated wind and gravity load deflection of supporting structural frame based on the following criteria from the Project Structural Engineer:

1. Design system to accommodate the vertical live load deflection of the primary structure of not less than dimension indicated on the Structural Drawings.

2. Design system to accommodate the inter-story drifts as noted on the Structural Drawings.

G. System Assembly:

1. Accommodate without damage to system or components or deterioration of seals, movement within system, movement between system and perimeter framing components, dynamic loading and release of loads, deflection of structural support framing, tolerance of supporting components, and shrinkage of building structure, except as caused by seismic drift at corner conditions.

H. Systems shall have internal gutters and weep system to collect and drain water leakage and condensate to outside.

I. Air Infiltration: Limit air infiltration through assembly to less than 0.06 cfm/square foot of wall area, measured at a reference differential pressure across assembly of 6.24-psf pressure differential when tested in accordance with ASTM E283.

J. Water Leakage:

1. Definition: "Water penetration" is defined as appearance of uncontrolled water other than condensation on indoor face of any part of curtain wall work.

2. Static Pressure: None, when subjected to laboratory testing in accordance with ASTM E331 at 12 psf.

3. Dynamic Pressure: None, when subjected to laboratory testing in accordance with AAMA 501.1 at 12 psf.

K. Condensation Resistance of Frame: Condensation Resistance Factor of 66 or better when tested in accordance with AAMA 1503 or equivalent results when determined according to NFRC 500, and/or as required to ensure there is no excessive condensation on interior surfaces under Project specific conditions.

L. Accommodation for Thermal Movement: System shall provide for expansion and contraction within system from the following maximum change (range) in ambient and surface temperatures:

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees, material surfaces.

2. Test Interior Ambient-Air Temperature: 75 degrees F.

3. Test Performance: Components used within the system shall noiselessly withstand thermal movements without buckling, distortion, cracking, failure of glass, failure of joint seals, or undue stress on the finished surfaces, materials, or fixing assemblies when tested according to AAMA 501.5, “Test Method for Thermal Cycling of Exterior Walls.”

M. Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system to exterior by a weep drainage network.

N. Energy Performance: Glazed aluminum curtain wall and components shall have certified energy performance ratings in accordance with NFRC standards and approved software. The following parameters shall be documented:

1. Thermal Transmittance (U-factor):

a. Fixed glazing and framing areas shall have a U-factor determined according to NFRC 100 accounting for all frame effects.
b. Values used shall be with the final glass and glazing assembly to be provided.
c. Contractor to assess the heat transfer through the curtain walls by numerical analysis using US Green Building Council (USGBC) approved software. The results of the assessment shall:

1) Be summarized as thermal transmittance (U-value) for the center of the panels, edge effects and frames of each curtain wall System.
2) Be carried out in accordance with the requirements of NFRC standards.
3) Take into account the internal and external air temperatures and surface heat transfer coefficients.

a) Coefficients and the parameters shall be documented.
b) The method used shall take into account the effects of air filled spaces and the thermal interaction between the curtain wall and other elements of the curtain wall including vertical and horizontal fins.

4) When applicable, point thermal transmittances shall be calculated for penetrations through the curtain wall.

2. Solar Heat Gain Coefficient (SHGC): SHGC of each curtain wall assembly as determined according to NFRC 200.

3. Value for U-factor to be met by System shall be 0.35.

4. Value for SHGC shall be as specified for the Glass Type scheduled and specified in Section 08 8000, "Glazing."

O. Sealant Joints: Movement joints using sealant shall be designed in accordance with manufacturer's recommended guidelines and ASTM C1193.

1. Color: As selected by the Owner's Representative.

P. Brackets and Fasteners:

1. Torquing of bolts shall be highlighted on the Contractor's drawings noting the tightening torque values.

2. Fastener design on aluminum components shall be in accordance with AA ADM-1 document.

3. Allowable loads shall be in accordance with AAMA TIR A9 and current amendments.

4. The design of the fasteners shall allow for the following:

a. Shimming only to accommodate local variations in construction tolerances. The maximum allowable shim dimension shall be stated in the Contractor's submittal drawings.
b. Reduction in safe working loads in fasteners due to fastener spacing, location in areas of tension, near edges or proximity to cast-in inserts, or thickness of shims.

5. Calculations shall show the extent of movements allowed in the design of fasteners.

6. When not following an applicable code, standard, or design guide, a minimum safety factor of 2 shall be used for permissible load design of anchoring assemblies.

7. The design of brackets for site drilled fasteners shall allow for the possibility of reinforcement or other obstructions being encountered and the fastening position being moved. No reinforcement or other obstructions shall be cut without the approval of the Project Structural Engineer.

8. Proprietary fasteners shall be reviewed and approved by the fastener manufacturer and certified by manufacturer as appropriate for conditions of intended use as shown on the Contractor's details.

Q. Locked in Stresses: Systems designed and detailing shall avoid the introduction of locked-in stresses that may be detrimental to the performance of the curtain wall during its service life. These stresses include those that can develop in an individual component if the fasteners that secure the component in position are so rigid that they do not allow for thermal or other movement.

R. Fire Performance: Curtain wall component materials shall be non-combustible, shall not exhibit sustained flaming according to NFPA 268, and shall comply with the relevant fire resistance and firestopping requirements of the CBC.

S. Infestation: Materials used in the Work shall not be attacked or infested by micro-organisms, fungi, insects or other vermin.

T. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building components, or loosening, weakening, or fracturing of attachments or components of system.

2.03 CURTAIN WALL SYSTEM

A. General: Details on the Drawings reflecting mullion profiles and dimensions are diagrammatic only.

B. System: Stick-fabricated high performance, pressure-equalized, thermally-broken; "1600UT System 1" by Kawneer Company, Inc.

1. Mullions: 2-1/2 inch face width by 7-1/2 inch depth.

2. Glazing:

a. Type: 4-side captured.
b. Glass: Insulating, as specified in Section 08 8000, "Glazing."

3. Sunshades and Light Shelves: At locations shown and specified in Section 10 7173, "Sun Control Devices."

4. Systems shall be capable of accepting integrated operable windows and louvers.

2.04 OPERABLE WINDOWS

A. Performance Class: Meeting or exceeding AW-60 or HC-80 in accordance with AAMA/WDMA/CSA 101/I.S.2/A44 for each operation shown.

B. Type: Thermally broken, heavy commercial windows designed and manufactured specifically for minimal sight lines and inclusion in the curtain wall system; Kawneer "Sealair" Architectural Windows, or accepted equal.

1. Series: "GLASSvent – 1600 Wall System 1."

2. Operation: Casement and awning.

C. Glass: Insulating, as specified in Section 08 8000, "Glazing.

D. Hardware: As standard with manufacturer and as follows.

1. Cast white bronze cam locking handles.

2. Stainless steel 4-bar hinges.

3. Provide supplemental chain operator for high level windows above 7'-0"; Teal Products, or equal.

E. Motor Operators: Provide at window Type F1, clerestory awning windows at Level 3; stainless steel chain type by Functional Fenestration, Inc., or equal.

1. Operators shall be capable of being wired in parallel to open and close all windows in bank in unison, controlled from a wall switch, or operated by building automation system.

2. Operators shall be sized for weight and dimensions of the F1 windows.

3. Operators shall be installed concealed within frame of window or curtain wall.

4. All wiring shall be concealed within window and curtain wall framing.

5. Supply control panel, power supply, wiring, switch, and other components and accessories required for a completion operating system.

F. Finish on Exposed Aluminum: As specified.

G. The frame and ventilator shall be factory fabricated and assembled.

2.05 ADDITIONAL SYSTEM COMPONENTS

A. General:

1. Provide matching stops; drainage holes, deflector plates, and internal flashings to accommodate internal weep drainage system; internal mullion baffles to eliminate "stack effect" air movement within internal spaces.

2. Pressure plates at stick systems shall be of sufficient size and strength to provide bite on glass and infill panels. Provide custom profile pressure plate as detailed.

3. Verify any size changes required by compliance with performance requirements with the Owner's Representative.

4. Provide custom profile extrusions for mullion extensions and other conditions as shown.

B. Exposed Flashings and Trim: Brake-formed aluminum, finish to match curtain wall mullion sections, secured with concealed fastening method. Aluminum thickness shall be as required to prevent warping, bending, "oil canning," and other appearance characteristics determined as objectionable by the Owner's Representative.

C. Concealed Flashing: Dead-soft stainless steel, 26 gage minimum; extruded aluminum, 0.062 inch minimum; or an alloy and type selected by manufacturer for compatibility with other components.

D. Secondary Steel Support: Provide and install embeds, anchor plates, and other steel components for installation of curtain wall system and to meet specified performance criteria.

E. Girts, Anchors, Fasteners, Clips, Closures, and other Components: Provide as required for a complete structurally sound and weatherproof system.

F. Sunshades: Aluminum, fabricated and engineered to profiles shown and complying with requirements of Section 10 7173, Sun Control Devices."

G. Swing Entrances: As specified in Section 08 4213, “Aluminum-Framed Entrances,” and Section 08 4226, “All-Glass Entrances.”

H. Louvers: As specified in Section 08 9110, “Metal Louvers.”

2.06 METAL MATERIALS

A. Aluminum:

1. Extruded: ASTM B221, 6063-T5 alloy and temper, size, and shape as required by design criteria but not less than 0.125 inch thick.

2. Sheet: ASTM B209. Aluminum sheet for formed members shall be not less than 0.05 inch thick.

3. Structural: ASTM B308, 6063-T6 alloy and temper.

B. Steel Sections: ASTM A36.

C. Fasteners, Anchors, Embeds, and Miscellaneous Fastening Devices: Aluminum, stainless steel, or other non-corrosive and non-corroding material compatible with aluminum.

2.07 GLASS AND GLAZING MATERIALS

A. Glass: Insulating, as specified in Section 08 8000, “Glazing.” See Drawings for Type required at each location.

B. Glazing Materials:

1. General: Materials shall achieve weather, moisture, and air infiltration requirements and comply with requirements of Section 08 8000, “Glazing.”

2. Gaskets: Elastomeric, as recommended by system manufacturer.

2.08 SEALANT MATERIALS

A. General:

1. Use materials and application procedures as recommended by sealant manufacturer. Seal joinery, fastener penetrations, and welds as required for watertight installation. Sealant on exposed finished surfaces will not be permitted.

2. Use only nonhardening, nonshrinking, and nonmigrating materials.

3. For nonworking metal-to-metal joints within framing members, use small-joint sealant conforming to 803.3 as described in AAMA 800.

B. Preparation: Clean and prime substrate surfaces in accordance with manufacturer's recommendations.

C. Application: Tool all sealant applications. Tape and tool exposed sealant applications. Where permitted, tool exposed sealant applications flush or as otherwise approved by the Owner’s Representative, with no excess sealant on exposed finished surfaces.

D. Perimeter sealants and additional sealant requirements are specified in Section 07 9200, “Joint Sealants.”

2.09 ACCESSORY MATERIALS

A. Coating for Separation of Dissimilar Metals: Cold-applied asphalt mastic, zinc chromate paint, or other nonconductive, non-absorptive material.

2.10 PROTECTIVE COATINGS AND FINISHES

A. General:

1. Perform all finishing prior to shipping to Project site.

2. Protect against galvanic action where dissimilar metals are in contact, except in case of aluminum in contact with galvanized steel, zinc, or relatively small areas of stainless steel or nickel silver (white bronze). Protect by applying one coat of specified bituminous paint or zinc chromate primer or by application of an appropriate sealant or tape.

B. Concealed Ferrous Metal:

1. Hot-dip galvanize in accordance with ASTM A123 after fabrication. Do not galvanize portions of items completely embedded in concrete. Touch up damaged galvanized surfaces and welds with zinc-rich paint.

2. Contractor's Option: In lieu of hot-dip galvanizing, use SSPC Paint 20, Type II zinc-rich urethane with not less than 80 percent zinc in dried film; Tnemec "90-97," or equal, applied as follows:

a. Surface Preparation: Joint Surface Preparation Standard SSPC-SP 6/NACE No. 3, “Commercial Blast Cleaning.”
b. Application: Apply primer before rust bloom appears but not more than 8 hours after cleaning. Minimum dry film thickness, 2.5 mils.

C. Anodized Finish: Architectural Class I clear anodic coating conforming to AA-M12C22A41.

D. Painted Finish at Trim Interfacing with Metal Panel System and Not Provided under Section 07 4243, “Metal Panels”: High-performance fluoropolymer coating containing minimum 70 percent polyvinylidene fluoride (PVDF) resin and meeting or exceeding all the requirements of AAMA 2605.

1. Coating: Two-coat system; PPG “Duranar,” or equal.

2. Colors: As specified in Section 07 4243, “Metal Panels.”

2.11 FABRICATION

A. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to ensure concealment from view.

E. Reinforce interior horizontal head rail if required to receive window treatment track brackets and attachments.

F. Reinforce framing members for external imposed loads if required to meet design criteria and for support of sunshades and other decorative metal assemblies attached to curtain wall framing.

G. Where vertical mullion height exceeds maximum length available from manufacturer, locate splice joint on shop drawings for review by Owner's Representative.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify field dimensions, tolerances, and method of attachment to other work. Adjust curtain wall construction and glazing panel size to accommodate field conditions.

B. Representative of manufacturer shall examine structure and substrate to determine that they are properly prepared, sized, and ready to receive curtain wall and related work.

3.02 PREPARATION

A. Separate aluminum from dissimilar metals.

B. Coat dissimilar metals in drainage cavities, using specified material. Aluminum, stainless steel, zinc, cadmium, and small areas of white bronze are not considered dissimilar from each other.

C. Coat all metals that come into contact with masonry, concrete, cement plaster, and treated wood, using specified material.

D. Galvanized Steel: Clean and touch up welds, bolted connections, and abraded areas in accordance with ASTM A780, using galvanizing-repair paint.

3.03 INSTALLATION

A. Install curtain wall system in accordance with reviewed shop drawings and manufacturer's specifications and recommendations.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments, anchors, embeds, and shims to fasten system permanently to building structure. Provide secondary structural steel support framing as required to comply with code and specified performance criteria. Steel shall be concealed or located outside of finished Public spaces, and as shown on the Drawings.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, and align with adjacent work.

E. Install flashing and closures pieces integral with curtain wall system.

F. Install glass in accordance with Section 08 8000, "Glazing," to glazing method required to achieve performance criteria.

G. Sealant:

1. Install perimeter sealant by method required to achieve performance criteria. Type, backing materials, and installation criteria shall be in accordance with Section 07 9200, "Joint Sealants."

2. Give special attention to proper cleaning of aluminum surfaces in contact with sealant.

3.04 SAFING INSULATION AND SMOKE SEAL

A. Fill void at floor and roof edges with safing insulation as specified in Section 07 2117, “Thermal Board and Batt Insulation.”

B. Follow requirements of UL fire containment system noted on the Drawings, including clips, sheet metal retainers, and mineral fiber insulation, and the following.

C. Thickness shall be four inches minimum top to bottom. Cut safing insulation minimum 0.5 inch wider than opening to assure compression fit.

D. Framing system to support safing at the slab edge shall be provided for under this Section. The design and support of the framing system shall be approved by the material supplier as being capable of providing protection against fire penetration at the slab edge.

E. Support fire stop insulation on galvanized steel impaling clips spaced at maximum 12 inches on center.

F. Unless otherwise shown or required by UL assembly, completely coat top surface of safing insulation with an approved spray-on fire barrier.

1. Coating shall overlap floor and wall a minimum of 0.5 inch. Provide minimum wet thickness 0.125 inch.

2. Comply with coating manufacturer requirements for temperature and condition of substrates.

3.05 ERECTION TOLERANCES

A. Variations from Plumb or Angle Shown: 1/8-inch maximum variation in story height or 10-foot run, non-cumulative.

B. Variation from Exterior Wall Plane: Unless otherwise shown, maximum 1/8-inch variation in planer alignment between curtain wall components and adjacent exterior building components.

C. Maximum Offset from True Alignment: Maximum 1/32-inch end-to-end or edge-to-edge alignment of adjacent or abutting sections. Offset cut edges of butting sections minimum 0.015 inch or as otherwise required to conceal cut edge.

D. Sealant Space between Curtain Wall Mullions and Adjacent Construction: Maximum of 1/2 inch and minimum of 1/4 inch.

3.06 FIELD QUALITY CONTROL

A. General:

1. Tests shall be at first one bay wide section of curtain wall installed and as acceptable to Owner's Representative and shall include the edge of the glass surface and places where the frame is horizontal, vertical, and intersecting.

2. Testing shall be performed after installation and curing of sealants.

3. Tests shall be observed by a full-time independent inspector at Contractor's expense.

4. Correct deficiencies, and modify system at no additional cost to Owner. Retest to assure no leakage.

5. Testing does not relieve warranty responsibility required for watertightness.

B. Required Tests:

1. Water Stream Test: Field "nozzle" test shall be performed in accordance with AAMA 501.2

2. Pressure Test:

a. At Owner's option, and in addition to water stream test, water test in accordance with ASTM E1105 at test pressure of not less than 8 psf.
b. Pressure test, if required, shall be at the Owner's expense.

C. Manufacturer's representative shall periodically inspect material and installation to insure installation is proceeding in accordance with manufacturer's recommendations and warranty requirements. Representative shall submit a written report of each visit indicating observations, findings, and conclusions of inspection.

D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections and shall be corrected to satisfaction of the Owner's Representative.

3.07 CLEANING AND ADJUSTING

A. Protect installation from damage by tools, acid, cement, or other compounds.

B. Leave manufacturer's labels in place, intact, and legible until installation is reviewed and accepted.

C. After initial inspection, remove labels, protective coating, and other foreign materials from glass and aluminum surfaces.

D. Clean glass and metalwork of smears, spots, and other markings. Comply with additional requirements for final cleaning specified in Section 01 7700, "Closeout Procedures."

E. Replace aluminum components with damaged finish, determined as unacceptable by the Owner's Representative, at no additional cost to Owner.

END OF SECTION 08 4413

SECTION 08 7100
DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following, but is not necessarily limited to:

1. Door Hardware, including electric hardware.
2. Storefront and Entrance door hardware.
3. Gate Hardware.
4. Digital keypad access control devices.
5. Hold-open closers with smoke detectors.
6. Wall-mounted electromagnetic hold-open devices.
7. Power supplies for electric hardware.
8. Low-energy door operators plus sensors and actuators.
9. Thresholds, gasketing and weather-stripping.
10. Door silencers or mutes.

C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.

1. Division 8: Section - Steel Doors and Frames.
2. Division 8: Section - Wood Doors.
3. Division 8: Section - Aluminum Storefront
4. Division 28: Section - Fire/Life-Safety Systems & Security Access Systems.

1.03 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE.)

A. 2010 California Building Code, CCR, Title 24.

B. BHMA – Builders' Hardware Manufacturers Association

C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

D. DHI – Door and Hardware Institute

E. NFPA - National Fire Protection Association.

1. NFPA 80 - Fire Doors and Other Opening Protectives
2. NFPA 105 - Smoke and Draft Control Door Assemblies

F. UL - Underwriters Laboratories.

1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

G. WHI - Warnock Hersey Incorporated

H. SDI - Steel Door Institute

1.04 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.

B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Submit six (6) copies of schedule organized vertically into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

1. Include a Cover Sheet with;
   a. Job Name, location, telephone number.
   b. Architects name, location and telephone number.
   c. Contractors name, location, telephone number and job number.
   d. Suppliers name, location, telephone number and job number.
   e. Hardware consultant's name, location and telephone number.

2. Job Index information included;
   a. Numerical door number index including; door number, hardware heading number and page number.
   b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
   c. Manufacturers' names and abbreviations for all materials.
   d. Explanation of abbreviations, symbols, and codes used in the schedule.
   e. Mounting locations for hardware.
   f. Clarification statements or questions.
   g. Catalog cuts and manufacturer’s technical data and instructions.

3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number – HW -1)						
			(a) 1 Single Door #1 - Exterior from Corridor 101		(b) 90°	(c) RH
				(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea		(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE
2	6AA	1 ea		Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH

(a) - Single or pair with opening number and location. (b) - Degree of opening (c) - Hand of door(s) (d) - Door and frame dimensions and door thickness. (e) - Label requirements if any. (f) - Door by frame material. (g) - (Optional) Hardware item line #. (h) - Keyset Symbol. (i) -

Quantity. (j) - Product description. (k) - Product Number. (l) - Fastenings and other pertinent information. (m) - Hardware finish codes per ANSI A156.18. (n) - Manufacture abbreviation.

D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.

E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.

F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.

I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.

J. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.05 QUALITY ASSURANCE

A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Responsible for detailing, scheduling and ordering of finish hardware.
2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing. To maintain the integrity of patented key systems provide a letter of authorization from the specified manufacturer indicating that supplier has authorization to purchase the key system directly from the manufacturer.
3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree

of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.

1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

1.06 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.

B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.

C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.

D. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

1.07 WARRANTY

A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:

1. Locksets: "L" Series Three (3) years / "ND" Ten (10) years.
2. Electronic or VIP Locks: One (1) year.
3. Closers: Thirty (30) years; 1260 Twenty (20) years; Concealed High Security Fifteen (15) years; electronic closers shall be Two (2) years.
4. Exit devices: Three (3) years.
5. All other hardware: Two (2) years.

1.08 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.09 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference at least one week prior to beginning work of this section.

B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key District Personnel, and Project Inspector.

C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

	Item	Manufacturer	Acceptable Substitutes
A.	Hinges	Ives	Hager, Stanley, McKinney
B.	Locks, Latches & Cylinders	Schlage	Best
C.	Exit Devices	Von Duprin	Sargent
D.	Closers	LCN	Sargent
E.	Push, Pulls & Protection Plates	Rockwood	DonJo, Ives
F.	Flush Bolts	Ives	None
G.	Dust Proof Strikes	Ives	None
H.	Coordinators	Ives	None
I.	Stops	Ives	None
J.	Overhead Stops	Glynn-Johnson	None
K.	Thresholds	National Guard	Pemko
L.	Seals & Bottoms	National Guard	Pemko
M.	Magnetic Hold-opens	LCN	

2.02 MATERIALS

A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.

1. Hinges shall be sized in accordance with the following:
   a. Height:
      1) Doors up to 42" wide: 4-1/2" inches.
      2) Doors 43" to 48" wide: 5 inches.
   b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
   c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.

2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Pivots: High strength forgings and castings with precision bearings for smooth operation. Positive locking vertical adjustment mechanism to allow installer to precisely position the door and balance the load.

C. Continuous Hinges: As manufactured by Ives, an Allegion Company. UL rated as required.

D. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Sparta" design, fastened with through-bolts and threaded chassis hubs.

1. Locksets to comply with ANSI A156.2, Series 4000, Grade 1; tested to exceed 3,000,000 cycles. Locksets shall meet ANSI A117.1, Accessible Code.
2. Chassis: One piece modular assembly and multi-functional allowing function interchange without disassembly of lockset.
3. Spindle shall be deep-draw manufactured not stamped. Spindle and spring cage to be one-piece integrated assembly.
4. Anti-rotation plate to be interlocking to the lock chassis. Lock design utilizing bit-tabs are not acceptable.
5. Lever Trim: Accessible design, bi-directional, independent assemblies.
6. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.
7. Thru-bolts to secure anti-rotation plate without sheer line. Fully threaded thru-bolts are not acceptable.
8. Spring cage to have double compression springs. Manufacturers utilizing torsion springs are not acceptable.
9. Latchbolt to be steel with minimum ½" throw deadlatch on keyed and exterior functions; ¾" throw anti-friction latchbolt on pairs of doors.
10. Strikes: ANSI curved lip,1-1/4" x 4-7/8", with 1" deep dust box (K510-066). Lips shall be of sufficient length to clear trim and protect clothing.

E. Extra Heavy duty Commercial Mortise Locks: Schlage "L" Series as scheduled with "17" Style Lever and "L" Escutcheon.

1. Locksets to comply with ANSI A156.13, Series 1000, Operational Grade 1 and Security Grade 1 with all standard trims. Locksets shall also comply with UL10C Positive Pressure requirements
2. Lock case shall be manufactured with heavy 12 gauge steel with fully wrapped design. Lock cases with exposed edges are not acceptable. Lock case shall be multi-functional allowing transformation to a different function without opening lock case.
3. Latchbolt shall have ¾" throw and be non-handed, field reversible without opening the lock case. Solid latchbolts and / or plastic anti-friction devices are not acceptable.
4. The deadbolt, when used, shall be 1" throw stainless steel with a ¾" internal engagement when fully extended.
5. All trim shall be through-bolted with the spring cages supporting the trim attached to the lock cases to prevent torquing.
6. Levers to have independent rotation in both directions. Exterior lever assembly to be one-piece design attached by threaded bushing. Interior lever assembly shall be attached by screwless shank
7. Thru-bolt lever assemblies through the door for positive interlock. Locks using a through the door spindle for attachment are not acceptable. Spindles shall be independent, designed to "break-away" at a maximum of 75psi torque.
8. Hand of lock chassis to be changeable by simply moving one screw from one side to the case to the other and pulling and reversing the latchbolt.
9. Cylinders to be secured by a cast stainless steel, dual retainer. Locks utilizing screws and / or stamped retainers are not acceptable.

F. Deadlocks: Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of ¼" diameter steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike alloy deadbolt with reinforcer and two 3" long screws. ANSI A156.5, 2001 Grade 1 certified.

G. Exit devices: Von Duprin as scheduled.

1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
2. Provide exit devices UL certified to meet maximum 5 pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware.
3. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
4. Mechanism case shall have an average thickness of .140".
5. Compression spring engineering.
6. Non-handed basic device design with center case interchangeable with all functions.
7. All devices shall have quiet return fluid dampeners.
8. All latchbolts shall be deadlocking with ¾" throw and have a self-lubricating coating to reduce friction and wear.
9. Device shall bear UL label for fire and or panic as may be required.
10. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
11. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130" thickness, match lockset lever design.
12. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
13. Furnish glass bead kits for vision lites where required.
14. All Exit Devices to be sex-bolted to the doors.
15. Panic Hardware shall comply with CBC Section 1008.1.9 and shall be mounted between 30" and 44" above the finished floor surface. The unlatching force shall not exceed 15 lbs. applied in the direction of travel.

H. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.

1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
5. Closers shall be installed to permit doors to swing 180 degrees.
6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
7. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.
8. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or

disengage other devices that hold the door in a closed position. Door shall take at least 3 seconds to move from an open position of 70 degrees to a point of 3 inches from the latch jamb.

9. Provide sex-bolted or through bolt mounting for all door closers.

I. Flush Bolts & Dust Proof Strikes: Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.

1. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
2. Provide dust proof strikes at openings using bottom bolts.

J. Door Stops:

1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 1133B.8.6).
3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

K. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW at single doors and 10” high and 1” LDW at pairs of doors. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.

L. Thresholds: As Scheduled and per details.

1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 “Thermal and Moisture Protection”.
3. Use ¼” fasteners, red-head flat-head sleeve anchors (SS/FHSL).
4. Thresholds shall comply with CBC Section 1133B.2.4.1.

M. Seals: Provide silicone gasket at all rated and exterior doors.

1. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
2. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.
3. Smoke & Draft Control Doors, Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on “S” labeled Positive Pressure door assemblies.

N. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

O. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.03 KEYING

A. University of California Police Department and Physical Plant-Campus Services have mandatory lock and core requirements. UC Berkeley campus standard is small format interchangeable cores (SFIC).

B. All orders of cores and keys shall be done through UCPD or PPCS. The campus standard is Medeco. UC Berkeley shall provide the keying instructions.

C. The PPCS shall install the permanent cores and shall perform the keying.

2.04 FINISHES

A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.

B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.

C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

1. Interior door closers to be painted to match interior paint color.

D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.05 FASTENERS

A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) 2007 Edition. A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified

FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 30" and 44" AFF.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.

I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.

J. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.

K. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.

L. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer’s technical documentation.

3.03 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surface soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 HARDWARE LOCATIONS

A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.05 FIELD QUALITY CONTROL

A. Hardware supplier is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.06 SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.

B. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations (Mfr.)

GLY	=	Glynn-Johnson Corporation	Overhead Door Stops
IVE	=	Ives	Hinges, Pivots, Bolts, Coordinators, Dust Proof Strikes, Push Pull & Kick Plates, Door Stops & Silencers
LCN	=	LCN	Door Closers
MED	=	Medeco	Cylinders
NGP	=	National Guard Products	Thresholds, Gasketing & Weather-stripping
SCE	=	Schlage Electronics	Electronic Door Components
SCH	=	Schlage Lock Company	Locks, Latches
VON	=	Von Duprin	Exit Devices

HARDWARE GROUP NO. 01 - EXTERIOR FROM CORRIDOR

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	CONCEALED CLOSER	2030 BUMP	689	LCN
1	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 02 - EXTERIOR FROM LOBBY

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CYLINDER HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
1	EA	AUTO OPERATOR	PER MANUFACTURER		OPC
4	EA	ACTUATOR	6R-3	630	WIK
1	EA	BOLLARD	BPS SM-48 (2 PREPS)	630	WIK
1	EA	BOLLARD	BPS SM-48 (3 PREPS)	630	WIK
1			CARD READER BY OTHERS		
1			HARDWARE BY CR LAURENCE		

HARDWARE GROUP NO. 03 - EXTERIOR @ TERRACE FROM LOUNGE

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 5 X 4.5 TW8	630	IVE
1	EA	EU STOREROOM LOCK	LV9080LEU 17L	626	SCH
1	EA	MORTISE HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
1	EA	CONCEALED CLOSER	2030 BUMP	689	LCN
1	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL		
1	EA	POWER SUPPLY	PS902 FA-BBK	LGR	SCE
1			CARD READER BY OTHERS		

HARDWARE GROUP NO. 04 - EXTERIOR @ TERRACE FROM LOUNGE

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 5 X 4.5 TW8	630	IVE
1	EA	EU STOREROOM LOCK	LV9080LEU 17L	626	SCH
1	EA	MORTISE HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
1	EA	CONCEALED CLOSER	2030 BUMP	689	LCN
1	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL		
1	EA	POWER SUPPLY	PS902 FA-BBK	LGR	SCE
1			CARD READER BY OTHERS		

HARDWARE GROUP NO. 05

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	AX99NL-OP	626	VON
1	EA	RIM CYLINDER	PER CAMPUS STANDARDS		MED
1	EA	OFFSET DOOR PULL W/	RM7240 24" CTC	629	ROC
1	EA	CONCEALED CLOSER	2030 BUMP	689	LCN
1	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 06 - EXTERIOR @ TERRACE FROM STUDIO

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
2	EA	PANIC HARDWARE	3349A-EO	626	VON
2	EA	CONCEALED CLOSER	2030	689	LCN
2	EA	FLOOR STOP/HOLDER	FS41	626	IVE
1	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		
2	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 07 - ELECTRICAL ROOMS

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	AUTO FLUSH BOLT	FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
2	EA	OH STOP	100S	630	GLY
2	EA	SILENCER	PER ALUMINUM FRAME MFR		

LOCKSET IS TO BE MOUNTED ON THE LEFT HAND REVERSE DOOR LEAF DUE TO THE ELEVATOR DOORS. FLUSH BOLTS ARE TO BE INSTALLED ON THE RIGHT HAND REVERSE LEAF.

HARDWARE GROUP NO. 07A - STORAGE/E.C.C.

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
2	EA	OH STOP	100S	630	GLY
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 08 - HALL

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 5 X 4.5 TW8	630	IVE
1	EA	EU STOREROOM LOCK	LV9080LEU 17L	626	SCH
1	EA	MORTISE HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
1	EA	SURFACE CLOSER	1461 EDA	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	2525C	CHAR	NGP
1	EA	POWER SUPPLY	PS902 FA-BBK	LGR	SCE
1			CARD READER BY OTHERS		

HARDWARE GROUP NO. 09 - HALL @ STAIRS

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	AUTO FLUSH BOLT	FB32	630	IVE
1	EA	PASSAGE SET	L9010 17L	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	1461	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7840/SEM7850	689	LCN
1	SET	SEALS	2525C	CHAR	NGP

NOTE: INACTIVE LEAF IS 21" AND NEEDS TO BE TEMPLATED FOR A 180 DEGREE SWING AS PER THE FACTORY. VERIFY WITH FACTORY PRIOR TO ORDERING CLOSERS.

HARDWARE GROUP NO. 10 - STAIRS FROM CAD LAB

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
7	EA	HW HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 5 X 4.5 TW8	652	IVE
1	EA	FIRE EXIT HARDWARE	9949EO-F-LBL	626	VON
1	EA	ELEC FIRE EXIT HARDWARE	9949L-F-LBL X E996L-17 FSE	626	VON
1	EA	RIM CYLINDER HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
2	EA	SURFACE CLOSER	4040XP	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7840/SEM7850	689	LCN
1	SET	SEALS	2525C	CHAR	NGP
1			CARD READER BY OTHERS		

HARDWARE GROUP NO. 11 - STAIRS @ LOBBY/EXHIBIT/HALL

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	9949EO-F-LBL	626	VON
1	EA	FIRE EXIT HARDWARE	9949L-BE-F-LBL X 996L-17	626	VON
2	EA	SURFACE CLOSER	4040XP	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7840/SEM7850	689	LCN
1	SET	SEALS	2525C	CHAR	NGP

HARDWARE GROUP NO. 12 - STAIRS FROM LOBBY/EXHIBIT

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	9949EO-F-LBL	626	VON
1	EA	FIRE EXIT HARDWARE	9949L-BE-F-LBL X 996L-17	626	VON
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7840/SEM7850	689	LCN
1	SET	SEALS	2525C	CHAR	NGP

HARDWARE GROUP NO. 13 - MECHANICAL ROOM

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	2525C	CHAR	NGP
1	EA	DOOR BOTTOM	422N	AL	NGP
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 14 - JANITOR/STORAGE

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 15 - MECHANICAL ROOM

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	2525C	CHAR	NGP
1	EA	DOOR BOTTOM	422N	AL	NGP
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 16 - EQUIPMENT ROOM

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	EU STOREROOM LOCK	LV9080LEU 17L	626	SCH
1	EA	MORTISE HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
1	EA	SURFACE CLOSER	1461	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	107SA	CL	NGP
1	EA	DOOR BOTTOM	422N	AL	NGP
1	EA	POWER SUPPLY	PS902 FA-BBK	LGR	SCE
1			CARD READER BY OTHERS		

NOTE: STC DOOR AND FRAME.

HARDWARE GROUP NO. 16A - EQUIPMENT ROOM

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	MORTISE HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
1	EA	SURFACE CLOSER	1461	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	107SA	CL	NGP
1	EA	DOOR BOTTOM	422N	AL	NGP

NOTE: STC DOOR AND FRAME.

HARDWARE GROUP NO. 17 - ELECTRICAL ROOM

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	99L-NL-F X 996L-17	626	VON
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	1461 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	SET	SEALS	2525C	CHAR	NGP
1	EA	DOOR BOTTOM	422N	AL	NGP
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 21 - TELECOM

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU STOREROOM LOCK	LV9080LEU 17L	626	SCH
1	EA	MORTISE HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	1461 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
	SET	SEALS	2525C	CHAR	NGP
1	EA	DOOR BOTTOM	422N	AL	NGP
1	EA	THRESHOLD	PER DETAIL		
1	EA	POWER SUPPLY	PS902 FA-BBK	LGR	SCE
1			CARD READER BY OTHERS		

HARDWARE GROUP NO. 22 - EDUCATIONAL SPACE

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU STOREROOM LOCK	LV9080LEU 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	SURFACE CLOSER	1461 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	2525C	CHAR	NGP
1	EA	POWER SUPPLY	PS902 FA-BBK	LGR	SCE
1			CARD READER BY OTHERS		

HARDWARE GROUP NO. 23 - EXISTING DOORS TO ETCHEVERRY HALL

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1			EXISTING DOOR, FRAME AND HARDWARE TO REMAIN		
1	EA	CARD READER	EXISTING TO REMAIN		

HARDWARE GROUP NO. 24 - RESTROOMS

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	1461	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		

HARDWARE GROUP NO. 25 - JANITOR

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
3	EA	SILENCER	PER ALUMINUM FRAME MFR		

HARDWARE GROUP NO. 26 - OFFICE

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE W/SIM RETRACT	LV9056L 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		

HARDWARE GROUP NO. 27 - EQUIPMENT ROOM

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 5 X 4.5 TW8	652	IVE
1	EA	EU STOREROOM LOCK	LV9080LEU 17L	626	SCH
1	EA	MORTISE HOUSING	PER CAMPUS STANDARDS		MED
1	EA	PERMANENT CORE	PER CAMPUS STANDARDS		INS
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	1461	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		
1	EA	AUTO. DOOR BOTTOM	PER DOOR MFR REQUIREMENTS		
1	EA	THRESHOLD	PER DETAIL		
1	EA	POWER SUPPLY	PS902 FA-BBK	LGR	SCE
1			CARD READER BY OTHERS		

HARDWARE GROUP NO. 28 - LOUNGE/STUDIO

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	VANDL CLASSROOM SEC	ND95LD SPA	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	SURFACE CLOSER	1461	689	LCN
1	EA	FLOOR STOP	FS436/8	626	IVE
2	SET	SEALS	PER ALUMINUM DOOR/FRAME MFR		

HARDWARE GROUP NO. 29 - STUDIO

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 5 X 4.5	652	IVE
2	EA	PANIC HARDWARE	AX9949EO-LBL	626	VON
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	SEAL	700SA (@ HEAD)	GRY	NGP
2	EA	SEAL	107SA (@ JAMBS)	GRY	NGP
1	EA	THRESHOLD	PER DETAIL		

HARDWARE GROUP NO. 30

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 5 X 4.5	652	IVE
2	EA	90 DEG OFFSET PULL	8190HD 10" H-I-L	630	IVE
1	EA	SURFACE CLOSER	1461 EDA	689	LCN
1	EA	FLOOR STOP	FS436/8	626	IVE
1	EA	SEAL	700SA (@ HEAD)	GRY	NGP
2	EA	SEAL	107SA (@ JAMBS)	GRY	NGP

HARDWARE GROUP NO. 31 - EQUIPMENT ROOM

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU STOREROOM LOCK	LV9080LEU 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	SURFACE CLOSER	1461	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	THRESHOLD	PER DETAIL		
1	EA	POWER SUPPLY	PS902 FA-BBK	LGR	SCE
1			BALANCE OF HARDWARE BY DOOR MANUFACTURER		
1			CARD READER BY OTHERS		

HARDWARE GROUP NO. 32 - EDUCATIONAL SPACE

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	STOREROOM LOCK	LV9080L 17L	626	SCH
1	EA	CYLINDER	PER CAMPUS STANDARDS	626	MED
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	1461 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	2525C	CHAR	NGP

END OF SECTION 08 7100

SECTION 08 8000
GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for:

1. Glass and glazing materials.

B. Factory-glazed window and door units shall conform to the requirements of this Section.

C. Related Requirements:

1. Delegated Design: Section 01 3325.

2. Joint Sealants: Section 07 9200.

3. Hollow Metal Doors and Frames: Section 08 1113.

4. Interior Aluminum Frames: Section 08 1216.

5. Wood Doors: Section 08 1400.

6. Sound Control Door Assemblies: Section 08 3473.

~~3.~~**7.** Aluminum-Framed Entrances: Section 08 4213.

~~4.~~**8.** All-Glass Entrances: Section 08 4226.

~~5.~~**9.** Aluminum-Framed Storefronts: Section 08 4313.

~~6.~~**10.** Glazed Aluminum Curtain Walls: Section 08 4413.

11. Toilet Accessories: Section 10 2813.

1.02 REFERENCES

A. American National Standards Institute (ANSI): Z97.1, "Performance Specifications and methods of Test for Transparent Safety Glazing Material Used in Buildings."

B. American Society for Testing and Materials (ASTM):

1. C509-06(2011): "Specification for Cellular Elastomeric Preformed Gasket and Sealing Material."

2. C1036-11e1: "Standard Specification for Flat Glass."

3. C1048-12e1: "Standard Specification for Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass."

4. D2287-12: "Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds."

C. Consumer Products Safety Commission (CPSC): 16 CFR, Part 1201, "Safety Standard for Architectural Glazing Materials."

D. Glass Association of North America (GANA):

1. Glazing Manual.

2. Sealant Manual.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Provide watertight and airtight installation of each piece of exterior glass and sealed glass unit.

B. Coordinate with work of other Sections for weathertight installation at interface with other materials and systems.

C. Each installation shall withstand local normal thermal movement, temperature changes, wind loading, and impact loading (for operating sash and doors) without failure of any kind, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, loss of hermetic seal, deterioration of glazing materials, and other defects.

1. Normal thermal movement is defined as that resulting from an ambient temperature range of 120 degrees F and from a consequent temperature range within glass and glass framing members of 180 degrees F.

D. Comply with applicable design and performance requirements of related Sections for systems in which glazing is installed.

E. Deflection Criteria: Glass center deflection at code required design load shall not exceed 3/4 inch.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, “Guarantees,” and Section 01 7839, “As-Built Documents.”

B. Attendance is required at preconstruction meetings specified in related Sections.

1.05 ACTION SUBMITTALS

A. Shop Drawings: As specified in related Sections for systems in which glazing is installed.

B. Product Data: Manufacturer's literature for all materials proposed for use, substantiating that glass and glazing materials comply with specified requirements.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. Credit IEQ 4.1: Manufacturers' product data for interior sealants, including printed statement of VOC content.

1) Include statement indicating costs for each product.

d. Credit IEQ 8.1: Manufacturer’s documentation for visible light transmission of each exterior glass Type.

1) Include statement indicating costs for each product.

D. Delegated Design: Calculations for exterior glass to demonstrate compliance with applicable codes and specified structural and deflection requirements. Calculations shall be signed and sealed by the engineer in responsible charge retained by the Contractor. Engineer shall be a California licensed civil or structural engineer.

E. Samples:

1. Glass:

a. Sample, 12 inches square, of each type specified, except clear single-pane units.
b. Samples of insulating glass shall be constructed from same material and by method as to be installed in Project.

2. Sealants and Gaskets:

a. Sample, 12 inches long, of each type of sealant and gasket, including molded corners, exposed to view.
b. Install sealant or gasket sample between two strips of material representative of adjoining framing system, in color.

3. Samples may be submitted as part of sample submittals required under other Sections.

1.06 INFORMATIONAL SUBMITTALS

A. Statement of fabricator/installer qualifications for exterior glazing.

B. Certificates:

1. Insulating Glass: Certification that units meet IGMA Class CBA requirements.

C. Sealants: The following statements for the installation:

1. General: Signed by installer and Contractor, stating that sealants installed comply with Specifications and that installation methods comply with manufacturer's written instructions for each condition of installation and use on this Project.

2. Test Reports: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

1.07 CLOSEOUT SUBMITTALS

A. Extended warranty for insulating glass.

1.08 QUALITY ASSURANCE

A. Qualifications:

1. Fabricator/Installer of Exterior Glazing: Company specializing in work of this Section, with not less than 10 years' experience on jobs of similar type and complexity.

B. Regulatory Requirements:

1. Comply with CBC Chapter 24.

2. Where safety glass is indicated or required, provide type of products indicated that comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category I or II materials, as applicable.

3. Mirrors shall meet CPSC or ANSI safety glazing requirements and shall be certified by the Safety Glazing Certification Council (SGCC).

C. Industry Standards:

1. Insulating glass shall be certified under a certification program approved by the Insulating Glass Manufacturers Alliance (IGMA).

2. Comply with GANA "Glazing Manual," except where more stringent requirements are indicated.

3. Comply with applicable provisions of the AAMA "Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual."

D. Sealant Compatibility and Adhesion Testing:

1. Submit samples of all glass, gaskets, glazing accessories, and glass framing members proposed for use in contact with or in proximity to glazing sealants to the sealant manufacturer for compatibility and adhesion testing in accordance with sealant manufacturer's standard testing methods and the following requirements:

   a. Durability Test: Bond cohesion; after testing, cut samples lengthwise, and examine for bubbles.
   b. Adhesion in Peel: Each individual test; peel strength not less than 20 pounds per inch and no adhesion loss.
   c. Past Performance Tests: Not acceptable, except for uncoated-glass-to-uncoated-glass condition.

2. Schedule sufficient time for testing and analysis of results to prevent delay in progress of work.

3. Investigate materials that fail compatibility or adhesion tests, and obtain sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.

4. Submit certification of compatibility as specified above.

E. Mockups: Provide glazing for mockups specified in Section 01 4339, “Mockups.”

F. Where conformance with specified deflection criteria results in different thickness of glass in the same building elevation, it shall be brought to the attention of the Owner’s Representative in writing so that options for dealing with resulting different appearance can be considered.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass with manufacturer's label indicating type, quality, and thickness on each piece.

B. Protect glass and glazing materials during delivery, storage, and handling so as to comply with manufacturer's directions and as required to prevent face and edge damage to glass and damage to glass and glazing materials from effects of moisture, including condensation and other causes.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements,” and Section 01 6600, “Material and Equipment.”

1.10 WARRANTY

A. Manufacturers:

1. Insulating Glass: Written 10-year warranty for sealed insulating glass unit in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period.

   a. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions
   b. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

2. Mirrors:

a. Standard form 10-year warranty made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate as specified, f.o.b. the nearest shipping point to Project site, within specified warranty period.
b. Deterioration shall be defined as defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

B. In addition, warranty requirements of related Sections for systems in which glazing is installed shall apply to work of this Section.

C. In addition, warranty requirements of related Sections for systems in which glazing is installed shall apply to work of this Section.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE REQUIREMENTS

A. Provide watertight and airtight installation of each piece of exterior glass and sealed glass unit.

B. Minimum Wind Load for Exterior Glass and Glazing Assemblies: In accordance with CBC.

C. Each installation shall withstand local normal thermal movement, temperature changes, wind loading, and impact loading (for operating sash and doors) without failure of any kind, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, loss of hermetic seal, deterioration of glazing materials, and other defects.

1. Normal thermal movement is defined as that resulting from an ambient temperature range of 120 degrees F and from a consequent temperature range within glass and glass framing members of 180 degrees F.

2. Minimum Wind load for exterior glass and glazing assemblies shall be in accordance with CBC.

3. Glass center deflection at code required design load shall not exceed 3/4 inch.

D. Comply with applicable design and performance requirements of related Sections for systems in which glazing is installed.

2.02 GLASS MATERIALS

A. General:

1. Except as otherwise specified, minimum glass thickness shall be 1/4 inch.

2. Provide increased glass thickness if recommended by fabricator for size of light to be glazed and design criteria.

3. Where multiple sizes occur in a glazed element or assembly, provide a uniform glass thickness where the thickest required glass shall govern throughout.

B. Annealed Float Glass: ASTM C1036, Type I, Class 1, Quality q3 or better.

C. Heat-Strengthened and Tempered Float Glass: ASTM C1036, Type I float glass as specified above and conforming to requirements of ASTM C1048 and as specified.

1. Tempered glass shall meet ANSI Z97.1 test requirements.

2. Heat-strengthened glass shall have surface compression levels between 3500 and 7000 psi.

D. Spectrally Selective Glass: Specified white low iron with a spectrally selective Low-E coating that will provide highest visible transmittance, lowest shading coefficient, and high UV radiation blockage.

E. Laminated Glass: Two glass plies meeting criteria of ANSI Z97.1 and CPSC 16 CFR 1201 for safety glazing.

1. Interlayer shall be polyvinyl butyral (PVB); "Safelex," or equal.

~~F.~~**2.** Thickness and Color: As scheduled for Glass Type.

F. Fire Rated Glass: UL and WHI listed, visually clear ceramic, with polished surfaces; "SuperLite X-90" by SAFTI*First* Division of O'Keeffe's Inc., San Francisco, CA, 415-822-4222, or equal.

1. Rating: 90 minutes.

2. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).

3. Thickness: 3/4 inch.

4. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL), fire rating period, safety glazing standards, and date of manufacture.

2.03 GLAZING MATERIALS

A. Sealants for Glazing:

1. Interior Locations, If Not Dry Glazed:

a. Typical: One-part, gun grade; Tremco "Mono," Pecora "60 Plus," or accepted equal.
b. At Fire-Rated Condition: Glazing compound as approved or provided by the fire-rated assembly manufacturer to meet requirements for the required fire rating.

~~1.~~**2.** Exterior Locations: Silicone conforming to ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with system components with which it comes in contact; Momentive Performance Materials “SCS-1200 Construction," or equal.

a. Color: Black.

~~2.~~**3.** Structural Silicone Sealant: One or two-component, non-acidic, neutral curing silicone which meets or exceeds ASTM C920, Type M, NS, and ASTM C1184 for structural silicone sealants; Momentive Performance Materials “UltraGlaze SSG4000” or “UltraGlaze SSG4400,” Dow-Corning “983” or "795," or equal.

a. Color: Black.

B. Joint Backer: Diameter size at least 25 percent larger than joint width; type and material as recommended, in writing, by glass and sealant manufacturer.

C. Silicone Glazing Materials: Provide silicone setting blocks, jamb blocks, and sealant joint backer or spacers in lieu of neoprene, if recommended by sealant manufacturer, for compatibility with sealant. Corners, sizes, profiles, and color as specified for neoprene glazing materials.

D. Glazing Blocks and Spacers: Closed-cell neoprene complying with ASTM C509, in black color.

E. Glazing Gaskets: Standard products provided by aluminum framing or entrance manufacturer,

F. Glazing Tape: ~~Butyl rubber type, black color; Pecora "Extru-Seal Tape G-66," Tremco "440 Tape," or equal.~~

1. Typical: Butyl rubber type, black color; Pecora "Extru-Seal Tape G-66," Tremco "440 Tape," or equal.

2. Fire-Rated Glass Note Provided by Framing Manufacturer: Closed-cell PVC or as otherwise approved by glass manufacturer for required fire rating.

G. Mirror Channels: Stainless steel, stain finish, width to match glass thickness.

~~G.~~**H.** Accessory Materials: Miscellaneous clips and fastenings as required and as standard with window or door manufacturer.

2.04 FABRICATION

A. Glazing framing dimensions shall provide for necessary minimum bite on glass, minimum edge clearance, and adequate sealant thicknesses, with reasonable tolerances. Provide correct glass size for each opening, within tolerances and necessary dimensions established.

B. Factory-label each pane of glass. Do not remove labels until final acceptance is obtained.

C. Insulating glass shall be certified under IGMA-approved program and meeting Test Class CBA requirements when tested in accordance with ASTM E773 and ASTM E774.

D. Tempered glass shall be horizontally tempered with roller ripples in horizontal direction.

1. Provide visible permanent identifying label on each pane in accordance with ANSI Z97.1.
   a. Fused to glass and located in a lower corner.
   b. Include manufacturer's name or trademark, glass type, thickness, and designation of treatment.
   c. Label shall be upright and located in same corner of all glass after installation.

2. Maximum warpage in accordance with PPG standards.

3. Provide fireman's tempered-glass marker at locations required by the local fire department.

4. Provide cutouts for fittings and hardware.

E. Edges at butt-joint structural glazing shall be flat ground with a 1/16-inch ground 45-degree seam and polished.

F. Dimensional Tolerances: Glass shall comply with referenced standards, except for the following:

1. Edge bow in open- or closed-joint, butt-glazed situation shall not cause misalignment of adjacent panels in excess if 1/8 inch.

2. Width of joint dimension shall not vary within any butt joint by more than 1/16 inch.

3. Width of joint dimension shall not vary from nominal dimension by more than 1/16 inch.

G. Organic-Coated Mirrors: Provide backing tape on back of mirrors that are less than 36 inches above finished floor to keep glass fragments together should mirrors be accidentally shattered; "CRL" shatterproof safety tape as manufactured by C.R. Laurence Co., 800-421-6411, or equal.

1. Taped mirrors shall comply with 16 CFR 1201, ANSI Z97.1 for impact testing as a Category I or II as required by installation.

2. Grind smooth all exposed edges.

2.05 GLASS TYPES ("GL")

A. GL-1: Insulated, Low E vision glass.

1. Exterior Glass Ply: 1/4 inch (6mm) thick, clear, heat strengthened, with Low E coating on the #2 surface; PPG "PPG "Solarban 60," or equal.

2. Gap: 1/2 inch, Argon filled.

3. Interior Glass Ply: 1/4 inch (6mm) thick, clear, heat strengthened.

4. Spacer Frame: Aluminum, clear anodized.

5. Overall Unit Thickness: 1 inch.

6. Provide tempered glass for both glass plies where shown and required by code.

7. Properties:

a. Visible Light Transmittance: 70.4 percent.
b. Solar Heat-Gain Coefficient: 0.39.
c. Shading Coefficient: 0.44.
d. Outdoor Visible Light Reflectance: 10.9 percent.
e. Winter Nighttime U-Value: 0.24.
f. Summer Daytime U-Value: 0.22.

B. GL-1A: Insulated, Low E vision glass with a translucent laminated glass inner ply.

1. Exterior Glass Ply: 1/4 inch (6mm) thick, clear, heat strengthened, with Low E coating on the #2 surface; PPG "PPG "Solarban 60," or equal. Provide tempered glass where shown and required by code.

2. Gap: 1/2 inch, Argon filled.

3. Interior Glass Ply: Laminated Glass: two lights of 1/8-inch-thick, clear, heat-strengthened glass with a polyvinyl butyral (PVB) inner layer.

    a. Inner Layer:

        1) Thickness: 0.015 inch.
        2) Translucent white interlayer color and opacity to be selected by Owner's Representative.

4. Spacer Frame: Aluminum, clear anodized.

5. Overall Unit Thickness: 1 inch.

C. GL-2: Insulated, Low E vision glass.

1. Exterior Glass Ply: 1/4 inch (6mm) thick, clear, heat strengthened, with Low E coating on the #2 surface; PPG "Solarban 70XL," or equal.

2. Gap: 1/2 inch, Argon filled.

3. Interior Glass Ply: 1/4 inch (6mm) thick, clear, heat strengthened.

4. Spacer Frame: Aluminum, clear anodized.

5. Overall Unit Thickness: 1 inch.

6. Provide tempered glass for both glass plies where shown and required by code.

7. Properties:

    a. Visible Light Transmittance: 64 percent.
    b. Solar Heat-Gain Coefficient: 0.27.
    c. Shading Coefficient: 0.32.
    d. Outdoor Visible Light Reflectance: 12 percent.
    e. Winter Nighttime U-Value: 0.24.
    f. Summer Daytime U-Value: 0.21.

D. GL-2A: Insulated, Low E vision glass with a translucent laminated glass inner ply.

1. Exterior Glass Ply: 1/4 inch (6mm) thick, clear, heat strengthened, with Low E coating on the #2 surface; PPG "PPG "Solarban 70XL," or equal. Provide tempered glass where shown and required by code.

2. Gap: 1/2 inch, Argon filled.

3. Interior Glass Ply: Laminated Glass: two lights of 1/8-inch-thick, clear, heat-strengthened glass with a polyvinyl butyral (PVB) inner layer.

    a. Inner Layer:

        1) Thickness: 0.015 inch.
        2) Translucent white interlayer color and opacity to be selected by Owner's Representative.

4. Spacer Frame: Aluminum, clear anodized.

5. Overall Unit Thickness: 1 inch.

E. GL-2B: Insulated, Low E vision glass with a partially clear/partially translucent laminated glass inner ply.

1. Exterior Glass Ply: 1/4 inch (6mm) thick, clear, heat strengthened, with Low E coating on the #2 surface; PPG "PPG "Solarban 70XL," or equal. Provide tempered glass where shown and required by code.

2. Gap: 1/2 inch, Argon filled.

3. Interior Glass Ply: Laminated Glass: two lights of 1/8-inch-thick, clear, heat-strengthened glass with a polyvinyl butyral (PVB) inner layer.

a. Inner Layer:

1) Thickness: 0.015 inch.
2) Colors: Clear at top portion of lite, and translucent white at bottom portion of lite.
3) Location of Dividing Line: As shown on the Drawings.
4) Translucent white interlayer color and opacity to be selected by Owner's Representative.

4. Spacer Frame: Aluminum, clear anodized.

5. Overall Unit Thickness: 1 inch.

F. GL-3: Spandrel glass at exterior vertical glazing.

1. Specified float glass, 1/4 inch (6mm) thick heat strengthened, with an opaque coating on the #2 surface to provide a non-glass appearance; "Viraspan Premier," or equal.

a. Color: To be selected by Owner's Representative.

G. GL-6: Specified laminated glass, clear, 3/8 inch thick.

~~G.~~**H.** GL-7: Clear, tempered, 3/4 inch thick.

I. GL-8: Specified fire-rated glass.

J. GL-9: Acoustically rated insulating glass; two lights of laminated glass with a 3-inch air gap.

1. Laminated Glass: Two lights of 1/8-inch-thick, clear float glass with a 0.30 inch thick clear interlayer.

PART 3 - EXECUTION

3.01 GLAZING

A. Comply with combined printed recommendations of glass manufacturers and manufacturers of sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.

B. Tempered Glass: Provide at locations where indicated and required in accordance with regulatory requirements.

C. Protect glass from edge damage during handling and installation.

1. Use a rolling block in rotating glass units to prevent damage to glass corners.

2. Use suction cups to shift glass units within openings.

3. Do not raise or drift glass with a pry bar.

4. When glass has flares or bevels along one horizontal edge that would occur in vicinity of setting blocks, install with flares or bevels at top of opening.

5. Use glazing tape and shims to position glass properly.

D. Remove and dispose of glass with edge damage or other imperfections of any kind that, when installed, would weaken glass and impair performance and appearance.

E. Install setting blocks of proper size at sill, located one-quarter of glass width from each corner, unless otherwise required. Set blocks in sealant acceptable for heel bead use.

F. Provide edge blocking to comply with requirements of GANA "Glazing Manual," except where otherwise required by glass fabricator.

G. Set units in each series with uniformity of pattern, draw, bow, and similar characteristics.

H. Compression Gaskets: Provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.

1. Miter-cut at corners. Install as recommended by gasket manufacturer to prevent pull-away at corners.

2. Seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3. Install gaskets to protrude slightly out of channel so as to eliminate dirt and moisture pockets.

3.02 PROTECTION AND CLEANING

A. Do not apply markers to surfaces of glass.

B. Protect glass from contact with contaminating substances resulting from construction operations. If contaminating substances come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

D. Remove nonpermanent labels, and wash glass on both faces by method recommended by glass manufacturer. Comply with the additional requirements specified in Section 01 7700, "Closeout Procedures."

END OF SECTION 08 8000

SECTION 08 9110
METAL LOUVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for:

1. Wall louvers and frames at metal wall panels.

2. Wall louvers and frames at cast-in-place concrete walls.

~~2.~~**3.** Wall louvers in curtain walls.

B. Related Requirements:

1. Alternates: Section 01 2300; alternates affecting the work of this Section.

~~1.~~**2.** Delegated Design: Section 01 3325

~~2.~~**3.** Sheet Metal Flashing and Trim: Section 07 6200.

~~3.~~**4.** Joint Sealants: Section 07 9200.

~~4.~~**5.** Metal Wall Panels: Section 07 4243.

~~5.~~**6.** Glazed Aluminum Curtain Walls: Section 08 4413.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Indicate louver layout plan and elevations; opening and clearance dimensions; tolerances; head, jamb, and sill details; blade configuration; screens; blank-out areas required; frames; and anchorage and interface with adjoining materials.

B. Product Data: Manufacturer's descriptive data of louvers, including standard drawings and free area of louvers.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

D. Samples: 12-inch length of each louver blade profile and specified finish and color.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturer's certification that louvers comply with requirements and are licensed to bear the AMCA seal, based on tests made according to AMCA 500-L and complying with AMCA's Certified Ratings Program.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.06 FIELD CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate with installation of exterior wall finish.

1.07 WARRANTY

A. Manufacturer: Furnish manufacturer's 20-year guarantee for aluminum finish against defects in materials and workmanship, including against delamination or pitting of finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Louvers: Airolite Company, Construction Specialties Inc. (C/S), Greenheck Louvers, Ruskin Manufacturing, or equal certified by AMCA. Products specified by Airolite are listed as the Basis of Design and to establish required level of performance, appearance, and quality.

B. Products by both listed and non-listed manufacturers shall meet the specified design and performance criteria.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. LEED Sustainable Design Performance Criteria: Aluminum members shall have a minimum postconsumer recycled content plus one-half of preconsumer recycled content by weight of not less than 25 percent.

2.03 METAL LOUVERS

A. Wall Louvers at Curtain Wall and Metal Panels: Extruded aluminum, ventilating, stationary, continuous narrow blade profile; Airolite Company Model ~~K6772~~ **SCH201**, or equal.

1. Frame Depth: 2 inches.

2. Nominal Metal Thickness:

   a. Frame: 0.063 inches.
   b. Blade: 0.063 inches.

3. Blade Angle: ~~45 degrees~~ **Shaped**.

4. Performance Requirements:

~~4.~~**a.** Free Area: 8.67 square feet as demonstrated by testing manufacturer's stock units 48 inches wide by 48 inches high.
~~5.~~**b.** Percent Free Area: ~~54.2~~ **39** percent.
c. Wind-Driven Rain Water Penetration

1) Exterior Wind Velocity: 29 mph

a) Rainfall Rate: 3 incher per hour
b) Effectiveness: Greater than 99 percent

2) Exterior Wind Velocity: 50 mph

a) Effectiveness: Greater than 99 percent

~~6.~~**5.** Mullions: Concealed.

~~7.~~**6.** Corners: Mitered.

~~8.~~**7.** Manufacturer Accessories:

a. Perimeter clips or continuous angles to suit installation conditions.
b. Internal flashing to weep water penetrating louver blades to exterior.

~~9.~~**8.** Louvers shall accommodate back-draft dampers where shown and provided under other Sections.

B. Wall Louver at Concrete Walls: Extruded aluminum, ventilating, stationary, drainable; Airolite Company Model SK609HP, or equal.

1. Frame Depth: 4 inches.

2. Nominal Metal Thickness:

a. Frame: 0.081 inches.
b. Blade: 0.081 inches.

3. Blade Angle: 37/45 degrees.

4. Performance Requirements:
a. Free Area: 8.32 square feet as demonstrated by testing manufacturer's stock units 48 inches wide by 48 inches high.
b. Percent Free Area: 52 percent.

5. Mullions, if Required: Concealed.

6. Corners: Mitered.

7. Manufacturer Accessories:

a. Perimeter clips or continuous angles to suit installation conditions.
b. Internal flashing to weep water penetrating louver blades to exterior.

8. Louvers shall accommodate back-draft dampers where shown and provided under other Sections.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221, 6063-T52 alloy.

B. Fasteners: Stainless steel or aluminum.

2.05 FABRICATION

A. Shop-fabricate louvers in such a manner as to comply with requirements indicated for design, dimensions, materials, joinery, and performance.

B. Maintain equal blade spacing.

C. Frame: Channel shape with mechanically fastened corner joints.

D. Intermediate Mullions: Extruded aluminum, concealed, profile to suit louver frame.

E. Assemble louvers by welding.

F. Install vertical stiffener assemblies between blades, spacing as recommended by manufacturer.

G. Bird Screen: Aluminum wire mesh as standard with louver manufacturer, interior mounted in a rewirable aluminum frame.

1. Frame Finish: To match louvers.

2. Attach screen fame to louver with stainless steel screws, approximately 18 inches on center.

H. Blank-out Sheeting: Provide on interior of frame where shown.

1. Fabricate of same material as louver frame.

2. Configuration: Composite panel.

3. Face Material: Aluminum.

4. Core: Rigid polyurethane.

5. Thickness: 1 inch.

2.06 FINISHES

A. General: Finish at louvers "glazed" into curtain walls shall have specified anodized finish and louvers at punched openings in metal panels system shall receive specified paint finish.

B. Paint Finish at Metal Panel and Concrete Locations:

1. Finish on Exposed Exterior Surfaces: High-performance fluoropolymer coating containing minimum 70 percent polyvinylidene fluoride (PVDF) resin and meeting or exceeding all the requirements of AAMA 2605.

a. Coating: Two-coat system; PPG "Duranar," or equal as standard with metal panel manufacturer.
b. Colors: Custom, solid, light gray tones as selected by the Owner's Representative and to match finish on adjacent surfaces. Coordinated with Section 07 4243, "Metal Wall Panels."

2. The finished surfaces of panel shall have a removable plastic film applied prior to fabrication, which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

C. Anodized Finish at Curtain Wall Locations: Architectural Class I clear anodic coating conforming to AA-M12C22A41 to match aluminum curtain wall finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check openings so as to assure that dimensions conform to Drawings.

B. Ensure that openings are free of irregularities that would interfere with installation.

3.02 INSTALLATION

A. Install louver assembly level and plumb as indicated on Drawings.

B. Follow procedures in manufacturers' recommended installation instructions.

C. Install flashings and align louver assembly so as to ensure moisture shed from flashings and diversion of moisture to exterior. Coordinate installation with installation of head and sill flashing as specified in Section 07 6200, "Sheet Metal Flashing and Trim."

D. Seal perimeter interior and exterior with sealant specified in Section 07 9200, "Joint Sealants."

3.03 ADJUSTING AND CLEANING

A. After initial inspection, remove labels, protective coating, and other foreign materials from aluminum surfaces.

B. Clean metalwork of smears, spots, and other markings. Comply with additional requirements for final cleaning specified in Section 01 7700, "Closeout Procedures."

C. Field touch-up of factory-applied finish will not be allowed.

END OF SECTION 08 9110

SECTION 09 2216
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Metal framing of nonbearing vertical and horizontal surfaces.

B. Related Requirements:

1. Delegated Design: Section 01 3325.

2. Metal Fabrications: Section 05 5000; supplemental internal steel bracing at exterior walls, partial height partitions and other locations where shown.

3. Gypsum Board Shaft-Wall Assemblies: Section 09 2116.

4. Suspension Systems: Section 09 2226.

5. Gypsum Board: Section 09 2900.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

1.03 ACTION SUBMITTALS

A. Product Data:

1. Specifications and installation instructions for each type of steel stud required to show compliance with specified requirements.

2. Manufactured top track for deflection relief, with UL approval data for each required condition and fire rating.

3. Manufactured drywall furring system, if used.

4. ICC-ES Report of framing system for stud gage and spacing for all wall conditions.

B. Delegated Design: Engineering data for framing systems to be provided to verify compliance with design loads. Include structural analysis data signed and sealed by the engineer in responsible charge retained by the Contractor.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

1.04 INFORMATIONAL SUBMITTALS

A. Calculations verifying stud gage and conformance with specified design and performance requirements where not shown in manufacturer’s standard data.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Engineer in Responsible Charge: A professional engineer lawfully eligible in the State of California to design the element or component and to seal the design in accordance with state law. Engineering services are defined as those performed for installations of cold-formed metal framing similar to those indicated for this Project in material, design, and extent.

B. Regulatory Requirements:

1. Framing at rated partitions shall comply with fire-resistance ratings required by governing authorities and codes.

2. Provide materials, accessories, and application procedures that have been listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.

3. Framing system shall conform to ICC-ES Report for stud gage and spacing for all wall conditions.

C. Comply with American Welding Society (AWS) D1.1, "Structural Welding Code - Steel" for welding.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Wall Systems: Select steel studs in accordance with the manufacturer's standard load tables and the following design pressures and deflections:

1. Typical Partitions: L/240 at 5 psf.

2. Lobbies: L/120 at 15 psf.

3. At Stairs and Vertical Shafts: L/120 at 10 psf.

4. At non-composite conditions where wallboard is partial height, submit calculations by a structural engineer licensed in the State of California verifying compliance with required deflection.

B. Joisted ceiling deflection shall be designed to limit deflection to L/360.

C. Steel framing shall be isolated from building structure so as to prevent transfer of loading imposed by structural movement and at locations indicated below.

1. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.

2. Where partition framing abuts overhead structure. Provide slip-type joints as shown on the Drawings.

2.02 SUSTAINABLE DESIGN CRITERIA

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

2.03 MANUFACTURERS

A. Metal Stud Systems: Cemco, ClarkDietrich Building Systems, Steeler, Inc., or equal.

2.04 COMPONENTS

A. General:

1. Metal studs, track, and sheet metal furring channels shall comply with ASTM C645.

2. Gage identification shall be color coded in accordance with ASTM C955.

B. Prefabricated, Steel Studs:

1. Fabricate from cold-formed steel; ASTM A653.

a. 0.0677 Inch and 0.0538 Inch (14 and 16 Gage): SQ Grade 50.
b. 0.0428 Inch (18 Gage): CQ Grade 33.
c. 0.0329 Inch (20 Gage): CQ Grade 33 or in equivalent metal thickness using “UltraSTEEL” EQ or equivalent dimpled sheet metal.

2. Width: As indicated on the Drawings.

3. Shape: Roll-formed channel with punched openings along web and knurled flanges.

4. Finish: Galvanized, minimum G-40 coating meeting ASTM A653 and C955.

C. Ceiling Joists: 0.0538 inch (16-gage) steel C-shaped section with punched webs and 1-5/8-inch plain or perforated flanges to receive screws, ASTM A568 or A570 Grade 50, galvanized in accordance with ASTM A653 with G-60 coating.

D. Floor and Top Tracks:

1. Fabricate from cold-formed steel; ASTM A653.

2. Grade to match stud used.

3. Minimum Thickness: Gage equal to or heavier than stud used.

4. Width: Acceptable stud manufacturer's regular type or proper width for stud specified.

5. Shape: Snap-in type, formed with slots or prongs so as to hold stud securely in place. Where required for fire rating, use shape formed for use with stud shoes and wire ties in order to hold studs securely in place.

6. Finish: As specified for studs.

7. Top Track for Deflection Relief: "SLP-TRK" slotted single track by ClarkDietrich Framing Systems, or equal.

   a. Rated Partitions: When tested in accordance with UL 2079 for cyclical movement and subsequently tested in accordance with the time temperature curve of ASTM E119 and ASTM E814, system shall meet requirements for 1 and 2 hour fire resistance rated construction and to requirements of hose steam resistance.
   b. Provide sliding clips and other accessories as required for a complete installation.

E. Channels:

1. Cold-Rolled Channels: 16 gage (minimum 0.053-inch thick), with factory-applied, rust-resistant paint.

2. Furring Channel, Screwable Type: 25 gage (minimum 0.0188 inches), cold-formed galvanized steel, hat shaped, 7/8 inch deep, with plain or knurled face to receive screws.

F. Partition Stiffeners or Bridging: Specified cold-rolled channels or stud; manufacturer's standard bridging for approved stud.

G. Partition Strapping: 2-inch-wide metal strap, same gage as studs.

H. Wire: ASTM A641, Class 1 zinc coating, soft temper.

1. Bracing Wire: Minimum 0.106-inch nominal diameter (12 gage).

2. Tie Wire:

   a. Single Strand: Minimum 0.062-inch nominal diameter (16 gage).
   b. Double Strand: Minimum 0.048-inch nominal diameter (18 gage).

I. Clips for fastening furring channels to carrying channels shall be standard product of the gypsum board manufacturer intended for this use.

J. Fasteners: ASTM C1002; Self-drilling and self-tapping, No. 10 flat pan-head screws.

K. Anchorage Devices:

1. Low-Velocity, Powder-Driven Fasteners: Hilti Fastening Systems, Impex Tool Corporation, or equal.

a. Tempered-steel pins, minimum 0.145 inch diameter, with special corrosive-resistive plating or coating.
b. Pins shall have guide washers to control penetration accurately, minimum 1-1/4 inch.
c. Verify suitability and allowable penetration of anchorage into slabs with Owner's Representative prior to installation.

2. Concrete Screws: Heat treated with high-low thread designed to cut threads in predrilled holes in concrete.

3. Drilled Expansion Bolts: Hilti "Kwik Bolt 3," or equal.

4. Machine Bolts, Nuts, and Washers: Low carbon steel standard fasteners, externally and internally threaded, ASTM A307, with malleable washers.

L. Backing Plates: Comply with the following where backing plate details are not shown on the Drawings:

1. Continuous across not fewer than three studs.

2. Notch channels at studs.

3. For Loads Less Than 50 Pounds per Foot: 16-gage track channel, 6 inches by 1-1/4 inches, attached to each stud with three No. 8 flat-head sheet metal screws.

4. For Loads of 51 Pounds per Foot to 100 Pounds per Foot: 16-gage track channel, 6 inches by 1-1/4 inches, welded to each stud.

5. For Loads of 101 Pounds per Foot to 250 Pounds per Foot: 14-gage steel plate, 6 inches wide, with 16-gage track channel stiffeners, 4 inches by 1-1/4 inches, welded to back and attached to each stud with at least one No. 10 flat-head sheet metal screw.

M. Welding Electrodes: Comply with requirements of AWS.

N. Furnish miscellaneous components as required for completion of installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting structure and conditions under which metal support systems will be installed.

3.02 GENERAL REQUIREMENTS

A. Comply with requirements of ASTM C754.

B. Wire Tying:

1. Use single-strand 16-gage or double-strand 18-gage tie wire.

2. Splicing: Double-wrap-tie.

3. Horizontal Stiffeners to Channel Brackets: Figure-eight tie.

4. Framing Members Perpendicular to Each Other: Saddle tie.

C. Deflection Relief: Provide specified manufactured system for top track for deflection relief unless otherwise shown.

1. Cut studs short where abutting underside of steel construction.

2. Do not abut end studs to steel walls.

3. Secure ends of horizontal stiffeners to abutting steel or walls and columns.

3.03 INSTALLATION OF FIRE-RATED ASSEMBLIES

A. Install studs that are components of fire-rated partition in accordance with the requirements of governing authorities and codes.

B. Provide manufactured top track designed for deflection relief at top of fire-rated partitions.

3.04 APPLICATION OF FURRING CHANNELS

A. Space hat-shaped furring channels at 16 inches on center unless otherwise shown.

3.05 ERECTION OF NON-STRUCTURAL STUDS

A. Tracks:

1. Align floor and top tracks.

2. Where studs run to structure, attach tracks to structure at maximum of 24 inches on center for powder-driven fasteners and 48 inches on center for expansion bolts, unless otherwise indicated.

3. Where studs run to a point just above ceiling line, anchor and/or brace as required to meet the design criteria.

B. Studs:

1. Plumb and align studs.

2. Space studs as indicated on the Drawings. Where not indicated, space as required to meet specified deflection criteria, or as required for rated construction.

3. Attach studs to tracks by method recommended by stud manufacturer.

4. Do not splice studs.

5. At wall-mounted fixtures, casework, shelving, equipment, handrails, and grab bars, provide 16-gage or heavier studs at least 3-5/8 inches wide.

6. At walls to receive ceramic tile, provide 20-gage studs.

C. Horizontal Strapping: Place straps both sides of studs where unsupported height of studs exceeds 4 feet.

D. Horizontal Stiffeners: Brace studs with steel channel stiffeners placed horizontally at midpoint of the stud slot on inside of partition, if indicated on the Drawings or if recommended by the stud manufacturer. Secure as recommended by the stud manufacturer.

E. Install diagonal bracing at locations indicated or as required for frame stability and to resist seismic and lateral loads.

F. Weld Connections: Resistance-spot or projection-weld, fillet-weld, or plug-weld in accordance with recommended procedures and practices of AWS.

G. Framing Around Openings:

1. Install double stud at each jamb of metal frame, continuous for full height of partition.

2. Secure stud to jamb anchors with screws.

3. Attach section of track horizontally to head of frame.

a. Install cripple studs at 16 inches on center maximum over head of frame and below sidelight openings.
b. Attach to head track, and anchor top of cripple studs in same manner as provided for full studs.

H. Form corners and intersections of partitions with three studs.

I. Place studs forming internal corners 2 inches from point of partition intersection.

J. Provide backing plates in wall to support wall-mounted items, including but not limited to wall-mounted casework, shelving, fixtures, equipment, and other locations as required by the various Sections of the Work.

1. Attach backing plates, as specified, to carry loads required by CBC.

2. Provide supplemental studs as required.

K. At walls that support wall-mounted items such as handrails, casework, countertops, or shelving and that do not extend to deck, brace studs to building structure so as to meet specified deflection criteria.

3.06 HORIZONTAL FRAMED SURFACES

A. Frame with specified joists, minimum 6-inch size, at 16 inches on center and to limit deflection as specified.

B. Provide runner channels to receive framing at ceiling and walls of same gage as studs. Secure with mechanical fasteners at 24 inches on center maximum. Secure studs to channels with screws.

END OF SECTION 09 2216

SECTION 09 2226
SUSPENSION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Suspended ceiling framing for the following:

1. Gypsum board.

2. Wood panel ceilings.

B. Related Requirements:

1. Non-Structural Metal Framing: Section 09 2216.

2. Gypsum Board: Section 09 2900.

3. Wood Ceiling and Wall Panels: Section 09 5426.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Prepare and submit for plywood ceiling suspension system signed by the engineer in responsible charge retained by the Contractor.

1. Show concealed layout and spacing of main runner channels and furring channels coordinated with perforated plywood panel layout.

2. Indicate locations of bracing assemblies concealed from view.

3. Layout shall be revised as requested by Owner's Representative at no additional cost.

B. Product Data: Manufactured suspension system.

C. Delegated Design: Engineering data for suspension systems to be provided to verify compliance with design loads. Include structural analysis data signed and sealed by the engineer in responsible charge retained by the Contractor.

D. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for products regionally extracted, processed, and manufactured.

1) Include statement indicating costs for each product.

1.04 QUALITY ASSURANCE

A. Comply with referenced AWS industry standards for welding.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products and materials in original unopened packages, containers, or bundles with manufacturer's label intact and legible.

B. Remove items delivered in broken, damaged, rusted, or unlabeled condition from Project site immediately.

C. Protect metal joists and suspension materials from rusting and damage.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. System Components Using Metal Channels: ClarkDietrich Building Systems, Cemco, or equal.

2.02 MANUFACTURED SYSTEM FOR GYPSUM BOARD

A. As an option, standard tied furring and hat channel suspension system using specified components may be substituted with a manufactured system; USG "Drywall Suspension System," Chicago Metallic, or equal.

2.03 DESIGN AND PERFORMANCE CRITERIA

A. Structural Requirements:

1. Ceiling-support system shall limit deflection of finished ceiling to 1/360 of span.

    a. Attachment devices shall be an approved type capable of carrying five times the ceiling load or 100 pounds, whichever is greater.
    b. Hangers shall be plumb or countersplayed and not press against pipe or duct insulation.
    c. Carrying channels and main runners shall be level within 1/8 inch in 12 feet. Perform leveling with hangers taut. Do not use kinks or bends as a means of leveling.
    d. In a 4-foot span, if a fixture causes deflection in excess of 1/8 inch, fixture shall be independently supported, or grid shall be supplementally supported within 6 inches of each corner with 12-gage wire.
    e. Fixture installation shall not cause runners to rotate more than 2 degrees from vertical (equivalent to 1/32 inch out of horizontal for a standard 1 inch Tee).

B. Steel framing shall be isolated from building structure to prevent transfer of loading imposed by structural movement where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.

C. Sustainable Design Requirements:

1. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 20 percent.

D. Suspension system shall comply with Division of the State Architect Interpretation of Regulations 25-3.13.

E. Suspension System at Plywood Ceiling Panels: Coordinate layout of framing and furring with panel layout to conceal suspensions system when viewed from below. System elements shall not be visible crossing perforations or spanning from panel edges to wall.

2.04 COMPONENTS

A. General: Gage identification shall be color coded in accordance with ASTM C955.

B. Channels:

1. Cold-Rolled Framing: Minimum 0.053-inch (16-gage) thick steel with factory-applied, rust-resistant paint.

2. Furring, Screw Type: Minimum 0.0179 inch (25-gage), cold-formed galvanized steel, hat shaped, 7/8 inch deep, with plain or knurled face to receive screws.

C. Wire: ASTM A641, Class 1 zinc coating, soft temper. Minimum thickness:

1. Hanging Wire: 0.162-inch nominal diameter (8 gage).

2. Bracing Wire: 0.106-inch nominal diameter (12 gage).

3. Tie Wire:

a. Single Strand: 0.062-inch nominal diameter (16 gage).
b. Double Strand: 0.048-inch nominal diameter (18 gage).

D. Clips for fastening furring channels to carrying channels shall be standard product of the gypsum board manufacturer intended for this use.

E. Fasteners: ASTM C1002; self-drilling and self-tapping, No. 10 flat pan-head screws.

F. Anchorage Devices: As selected by Contractor and complying with the following.

1. Low-Velocity, Powder-Driven Fasteners: Hilti Fastening Systems, Impex Tool Corporation, or equal.

a. Tempered-steel pins, minimum 0.145 inch diameter, with special corrosive-resistive plating or coating.
b. Pins shall have guide washers to control penetration accurately, minimum 1-1/4 inch.

2. Concrete Screws: Heat treated with high-low thread designed to cut threads in predrilled holes in concrete.

3. Drilled Expansion Bolts: Hilti “Kwik Bolt 3,” or equal.

4. Machine Bolts, Nuts, and Washers: Low carbon steel standard fasteners, externally and internally threaded, ASTM A307, with malleable washers.

5. Verify suitability and allowable penetration of anchorage into concrete slabs and toppings with Project Structural Engineer prior to installation.

G. Welding Electrodes: Comply with requirements of AWS.

H. Compression Struts: As shown on the Drawings or manufactured proprietary struts; Donn "Seismic Compression Post," or equal.

I. Furnish other components as required for installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting structure and conditions under which metal ceiling suspension systems will be installed.

B. Notify the Owner’s Representative, in writing, of any conditions detrimental to the proper and timely completion of the work.

3.02 GENERAL REQUIREMENTS

A. Comply with applicable requirements of ASTM C754 and CBC Chapter 25.

B. Wire Tying:

1. Use single-strand 16-gage or double-strand 18-gage tie wire.

2. Splicing: Double-wrap tie.

3. Framing Members Perpendicular to Each Other: Saddle tie.

3.03 INSTALLATION

A. Installation of suspension systems for gypsum board and plywood panels shall be as follows and specified additional requirements for the plywood panel system.

B. Hangers:

1. Secure hanging wire to structure above as recommended by the manufacturer of the suspension-system components and as required to meet all applicable building code requirements.

   a. Connection devices shall be of an approved type and be secured to the building structure.
   b. Fasten hanging wire to support above with a minimum of three turns.
   c. Do not attach or bend around other material or equipment.
   d. Wire shall be not more than 1 in 6 out of plumb without being countersplayed.
   e. A trapeze or equivalent shall be used where obstructions preclude direct attachment to the structure. Trapeze suspensions shall be a minimum of back-to-back, 1-1/4-inch, cold-rolled channels when spans exceed 48 inches.
   f. Wires shall be taut.

2. Space hangers not more than 4 feet on center and within 6 inches of perimeter walls.

3. Locate hanger within 6 inches of ends of main runner channels.

4. Securely fasten hanging wire to main runner channels.
   a. Saddle-tie by at least three turns around each channel.
   b. Prevent twisting and turning of main runner channel.
   c. Develop full strength of hanger.

5. Separate ceiling and hanger and bracing wires at least 6 inches from unbraced ducts, pipes, conduit, and similar items.

6. Bracing Assembly: As shown consisting of compression struts and 4 splayed wires oriented 90 degrees from each other.

   a. Provide at the following locations and as noted on the Drawings:

      1) Not more than 12 feet on center in each direction.
      2) Not more than 6 feet from perimeter walls and edges of vertical ceiling offsets.

   b. Compression struts shall not replace hanger wires.
   c. Splices in bracing wires are not permitted.

7. Ceiling grid members shall be attached to not more than 2 adjacent walls and shall be at cut short of other walls as specified.

8. Ceilings with an area of 144 square feet or less surrounded by walls attached directly to structure above do not require bracing if attached to at least two adjacent walls.

C. Main Runner Channels:

1. Spacing: 48 inches on center, maximum.
2. Locate main runner channel within 6 inches of parallel walls.
3. Cut short of abutting walls 1-inch (plus or minus 1/2 inch).
4. Level carrying channels with turnbuckles where required.

D. Cross Furring:

1. Spacing: As indicated or required by code.
2. Wire-tie cross furring to main runners.
3. Furring channels shall be securely fastened to main ceiling runners with furring clips.
4. Do not continue cross furring across control or expansion joints.
5. No suspension grillage shall come in contact with abutting partitions or load-bearing walls.

E. Splicing:

1. Overlap ends of cross furring and furring channels a minimum of 8 inches.
2. Interlock channel flanges.
3. Wire-tie near each end of splice.

F. Members perpendicular to walls shall be tied together (stabilized) to prevent their spreading.

1. This shall be done immediately adjacent and parallel to the wall.
2. The wall shall not be used for this purpose.

G. Fixtures and Equipment:

1. Light fixtures shall be positively attached to the suspension system. Attachment device shall have a capacity of 100 percent of the fixture weight in any direction.
2. Light fixtures or equipment weighing more than 20 pounds but less than 56 pounds shall have two 12-gage wires from the housing to the structure above or to other hanger wires. These wires may be slack.
3. Light fixtures or other equipment weighing in excess of 56 pounds shall be independently supported with 12-gage wire at each corner to structure above.
4. Pendant-hung fixtures or equipment shall be independently supported with a minimum of one 9-gage wire.

H. Additional Requirements for Plywood Panel System:

1. Coordinate hanger spacing with channel layout.

2. Ensure the bracing assembly, including struts and wires are not visible from below.

3. Do not attached grid members to adjacent walls. System shall be braced independent of walls.

4. Main runners shall be concealed and spaced in accordance with approved shop drawings.

5. Fixtures and equipment shall be coordinated with perforated openings in accordance with the Drawings.

END OF SECTION 09 2226

SECTION 09 2900
GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Gypsum board.
2. Gypsum board finishing.
3. Metal trim.

B. Related Requirements:

1. Gypsum Sheathing: Section 06 1643; wall sheathing.
2. Built-Up Bituminous Roofing: Section 07 5200, gypsum cover board at roof insulation.
3. Firestopping: Section 07 8400; fire-rated sealants.
4. Access Doors: Section 08 3100.
5. Gypsum Board Shaft-Wall Assemblies: Section 09 2116.
6. Non-Structural Metal Framing: Section 09 2216.
7. Acoustic Insulation and Sealants: Section 09 8200; acoustical sealants and sound control requirements.
8. Painting and Coating: Section 09 9000.

1.02 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C11 and GA-505 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

1.04 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data for the following system materials suitable to show compliance with requirements.

1. Each type of board material.

2. Metal accessories, if other than listed products are to be provided.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. Credit EQ 4.1: Printed statement of volatile organic compounds (VOCs) for adhesives applied inside the weatherproofing.

1) Include statement indicating costs for each product.

1.05 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications, if requested by Owner’s Representative.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Fire-Resistance Ratings:

a. Comply with fire-resistance ratings as indicated and required by governing authorities and codes.
b. Provide materials, accessories, and application procedures that have been listed by a nationally recognized testing agency or tested according to ASTM E119 for type of construction shown.

2. Comply with the CBC Chapter 25.

B. Industry Standards: Work shall comply with the applicable requirements of GA publication GA-216 and GA-214.

C. Installer Qualifications: Company specializing in work similar to that required on this Project, with not less than 5 years of documented experience.

D. Notify Owner's Representative prior to covering or enclosing framing, ducts, and pipes in sound-rated construction in order to allow for on-site review and correction as required.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials in dry location, fully protected from weather, direct exposure to sunlight, and damage from other construction activity.

B. Stack gypsum board products flat and level, properly supported in such a manner as to prevent sagging or damage to ends and edges.

C. Store metal accessories so as to prevent bending, sagging, distortion, or other mechanical damage.

D. Do not store or stack gypsum board on floors of new work with an equivalent loading in excess of 50 pounds per square foot.

E. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.08 FIELD CONDITIONS

A. Ambient Conditions: Maintain temperature in installation area in accordance with GA-216 requirements. Provide supplemental heat as required to maintain minimum temperatures specified in GA-216.

B. Ventilation:

1. Provide controlled ventilation during joint finishing when necessary to eliminate excessive moisture.

2. Avoid drafts during hot, dry weather in order to prevent excessively fast drying of joint compound.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.02 MATERIALS - GENERAL

A. Products of specific manufacturers, when listed, are for quality and performance identification only. The listing is not intended to limit selection of similar products from other manufacturers.

B. Provide products manufactured by or recommended by manufacturer of gypsum board in order to maintain single-source responsibility.

C. Provide materials in accordance with ASTM C840.

D. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR PANEL PRODUCTS

A. Fire Rated Gypsum Board: USG "Sheetrock Firecode Core," or equal.

1. ASTM C1396, Type X.

2. Thickness: 5/8 inch, unless otherwise noted.

3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Fire-Rated Moisture- and Mold-Resistant Board: USG "Mold Tough Firecode Core," or equal.

1. ASTM C1396, Type X, unless more stringent required by code.

2. Thickness: 5/8 inch, unless otherwise noted.

3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

4. Mold Resistance: 10 on scale of 10 in when tested accordance with ASTM D3273.

5. Moisture Resistance: The average water absorption for panels shall not exceed 5 percent by weight after two-hour immersion when tested in accordance with ASTM C473.

C. Gypsum Board, Type C: ASTM C 1396, manufactured to have increased fire-resistive capability; USG "Firecode C Core," or equal.

1. Thickness: 5/8 inch, unless otherwise noted, and as required by fire-resistance-rated assembly.

2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

D. Abuse Resistant Gypsum Board: Fire rated Type X abuse resistant gypsum board. Provide at Studios, stairwells, elevator lobbies, and Equipment Room walls scheduled for paint; USG "Fiberock VHI Abuse Resistant," or equal.

1. Thickness: 5/8 inch.

2. Indentation Resistance: ASTM C1629; Level 1.

3. Hard Body Impact: ASTM C1629 Annex A.1; Level 3.

4. Soft Body Impact Resistance: ASTM C1629; Level 3.

2.04 ACCESSORIES

A. Laminating Adhesive: As recommended by gypsum board manufacturer for laminating gypsum board together in fire-rated construction and complying with VOC regulations.

B. Fasteners:

1. Screws: Phillips head with bugle shape, Type W, conforming to ASTM C1002. Use Type S for attachment to metal furring and framing.

2. Sizes of fasteners shall be as required by code and as recommended by wallboard manufacturer.

C. Concealed Metal Reinforcements and Casing: Electrogalvanized, conforming to ASTM C1047.

1. Exterior Corner: United States Gypsum (USG) "Dur-A-Bead," Casings Western No. 220, or equal.

2. Intersection of Gypsum Board with Dissimilar Material: USG No. 200-B "L" shaped trim and 200-A "J" shaped trim, Casings Western, or equal.

3. Control Joint: USG No. 093 or equal.

D. Exposed Metal Trim:

1. Recessed Hanging Rail: Slotted extruded aluminum rail; “Maxi” by FX Hanging Systems, or equal.

E. Joint-Treatment Materials:

1. Manufacturer: Same as gypsum board.

2. Comply with ASTM C475 and with manufacturer's recommendations for specific project conditions.

3. Joint Tape: Manufacturer's standard paper type. If recommended by manufacturer, provide open-weave fiberglass tape for joint treatment of gypsum backing board.

4. Joint Compound: Vinyl-based, ready-mixed type for interior use and as follows:

a. Taping Compound: Specifically formulated for embedding tape and accessories and for prefilling.
b. Topping Compound: Specifically formulated for finishing drywall over taping compound.
c. At joints and fasteners in moisture-and-mold-resistant gypsum backing board intended for tile surfacing, provide compound specifically recommended or permitted by manufacturer of backing board.

F. Miscellaneous Items: Furnish components not specified but shown on the Drawings and other items required to complete the installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check framing for accurate spacing and alignment.

B. Verify that spacing of installed framing does not exceed maximum allowable for thickness of gypsum board to be used.

C. Do not proceed with installation of gypsum board until deficiencies are corrected and surfaces to receive gypsum board are acceptable.

D. Repair twisted or unaligned members before starting installation of gypsum board.

3.02 APPLICATION OF GYPSUM BOARD

A. General: Comply with ASTM C840, GA-216, and CBC. Where UL designs are indicated on the Drawings for fire-rated partitions, comply with UL requirements, except where exceeded by other requirements.

1. Wherever possible, install gypsum board in such a manner as to minimize butt end joints.

2. Apply ceiling boards prior to installation of wall boards. Arrange so as to minimize butt end joints near center of ceiling area.

3. Install wall boards in such a manner as will minimize butt end joints in center of wall area. Stagger vertical joints on opposite sides of walls. Stagger horizontal joints where required by governing code.

4. Butt all joints loosely, with maximum of 1/16 inch between boards.

5. Place wrapped edges adjacent to one another. Do not place cut edges or butt ends adjacent to wrapped edges.

6. Support all edges and ends of each board on framing or by solid substrate, except that long edges at right angles to framing members in non-fire-rated construction may be left unsupported, unless required by governing code.

7. Use moisture and mold-resistant board in Restrooms, Janitor Closets, and sink alcoves.

B. Single-Layer Application:

1. Install gypsum board by means of screw attachment.

2. On walls and partitions, plan installation so that leading edge or end of gypsum board is attached to open end of stud flange first.

C. Double-Layer Application:

1. Apply base layer vertically, offsetting vertical joints at least one stud space between layers.

2. Install base layer by means of screw attachment.

3. Provide fire taping only.

4. Precut and fit face layer by laminating to base layer with adhesive.

5. Provide temporary support for face layer, by fasteners or shoring, until adhesive is dry.

6. At Contractor's option, provide permanent support by attaching face layer to base layer with screws in accordance with manufacturer's instructions.

D. Metal Trim:

1. Apply trim at all exterior corners and where gypsum board intersects metal or other dissimilar material.

2. Install in longest lengths practicable.

3. Run trim straight and square with all planes.

4. Control Joints:

a. Provide control joints in accordance with ASTM C840 recommendations, where areas are 30 feet or more in either direction, and where otherwise shown.
b. Where not shown, locate as directed by Owner’s Representative.
c. Break gypsum board back of joint 1/2 inch.
d. Ceilings: Back with continuous furring channels each side, spaced 2-1/4 inches apart, centered on break.
e. Fire-Rated Ceilings: Install 2-inch-wide continuous strip of wallboard between channels of same thickness as ceiling board.

1) Butt strip against one channel in order to permit 1/4-inch clearance.
2) Secure butted side to ceiling wallboard with adhesive.

5. Partitions: Back with double studs.

6. Edges:

a. Apply applicable shape of metal edge trim at exposed edges of wallboard and where otherwise shown.
b. Gypsum Board Abutting Other Materials: Install edge trim with 1/8-inch clearance to allow for sealant.

7. External Corners: Apply metal corner beads at external corners in single lengths, unless details clearly indicate its omission at specific locations.

E. Remove and replace sheets damaged in handling or installation.

F. For conditions not specified or shown on the Drawings, follow procedures recommended by the gypsum board manufacturer.

G. Leave gypsum board in a clean condition, ready for taping and painting.

3.03 SOUND-RATED CONSTRUCTION

A. Comply with requirements for sealing penetrations at sound-rated construction as specified in Section 09 8200, "Acoustic Insulation and Sealants."

3.04 FIELD QUALITY CONTROL

A. Construction Tolerances:

1. Gypsum board surfaces to be painted shall have no measurable variation in any 2-foot direction and a maximum variation of 1/8 inch in 10 feet 0 inches when a straightedge is laid on the surface in any direction.

2. See Section 09 3000, “Tiling,” for tolerances required for surfaces to receive tile.

3. Shim work as required to comply with specified tolerances.

4. Do not exceed 1/16-inch offset between planes of abutting sheets at edges or ends.

3.05 TAPING AND FINISHING

A. Gypsum board partitions shall be appropriately prepared for finish indicated on the Drawings.

B. General Requirements:

1. Apply finishing compounds in accordance with manufacturer's directions. Do not apply tape and joint compound over joints containing acoustical sealant until the sealant has completely cured.

2. Center tape over joint, and embed in uniform layer of joint compound of sufficient width and depth to provide firm and complete bond.

   a. Apply skim coat while embedding tape.
   b. Apply second coat after skim coat has hardened and been sanded.
   c. Apply finish coat, and sand smooth, flush with adjacent surfaces.
   d. Use appropriate water-resistant compound at moisture and mold resistant gypsum board filling all fastener heads, penetrations, and joints.

3. Treat angles with reinforcing tape, folded to conform to adjacent surfaces and with straight, true angles.

4. Provide minimum 24 hours' drying time between applications of compounds.

5. Conceal flanges of metal reinforcement with minimum two coats compound. Compound shall extend 8 to 10 inches each side of metal nosing.

C. Level of Finishes: In accordance with GA-214.

1. Exposed Locations, Unless Otherwise Noted: Level 4.

2. Locations Indicated to Receive "Fire-Taping" and at Unexposed Gypsum Board Applications: Level 1.

3. Surfaces to Receive Ceramic Tile: Level 3.

3.06 PROTECTION OF FINISHED WORK

A. Provide proper procedures for protection of completed gypsum board from damage or deterioration until final acceptance of the Project.

END OF SECTION 09 2900

SECTION 09 3000
TILING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior floor and wall tile.
2. Grouting of tile.
3. Tile sealers.
4. Waterproofing under interior floor tile.

B. Related Requirements:

1. Joint Sealants: Section 07 9200.
2. Gypsum Board: Section 09 2900; moisture and mold-resistant gypsum backing board.
3. Toilet Accessories: Section 10 2813.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."
2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."
3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Show tile patterns and layouts.

B. Product Data:

1. Manufacturer's product literature for all manufactured products.
2. Installation instructions for cement backer board, trim, and accessories.
3. Installation instructions for manufactured setting and grouting products.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. EQ 4.1: Printed statement of volatile organic compounds (VOCs) for sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Verification Samples:

1. Each color, size, and type of tile and grout specified and selected, mounted on plywood or hardboard backing, grouted, and not less than 24 inches square. For products with color and texture variation, submit sets showing full range of variations expected.

2. Samples of each type of edge trim and accessory, 6 inches long, in each color.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications. Include list of completed projects with project names, addresses, and names of architects and owners.

B. Certified laboratory or field tests for slip resistance as specified if not included with product data submittal.

C. Master grade certificates for each shipment of ceramic tile, type, and composition of tile, signed by the manufacturer and installer.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance materials as specified.

B. Extended warranty for setting and grouting products.

1.06 QUALITY ASSURANCE

A. Slip Resistance: Floor tile shall provide a minimum wet DCOF AcuTest value of 0.42 in accordance with ANSI A137.1-2012.

1. If manufacturer of selected tile does not have test data to substantiate compliance with DCOF AcuTest value, provide alternative testing to verify compliance, including static coefficient value of 0.60 for level surfaces as determined by testing identical products in accordance with ASTM C1028, as acceptable to governing authorities.

2. Laboratory tests shall be made on a minimum of three tiles of each material and finish proposed for use.

B. Installer Qualifications: Successful completion of tile installations similar in material, design, and extent to that required for this Project.

C. Except where more stringent requirements are specified, conform to applicable ANSI Standards as follows:

1. Ceramic Tile: ANSI A137.1 "Standard Grade."

2. Tile Installation Materials: Comply with ANSI standard referenced with products and materials specified for setting and grouting.

D. Within any given tile setting system, use the products of a single manufacturer to insure compatibility and single source responsibility.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Ceramic Tile cartons shall be grade sealed by manufacturer in accordance with ANSI A137.1. Grade seals shall be unbroken.

B. Manufactured setting and grouting materials shall contain hallmarks certifying compliance with reference standards.

C. Deliver dry-set mortar in sealed, moistureproof containers.

D. Waste Management: As specified in Section 01 7419, “Construction and Demolition Waste Management,” and as follows:

1. Coordinate with manufacturer(s) for take-back program for collection of construction scrap, unused material, demolition scrap, and packaging material.

2. Where feasible, separate demolition waste, construction waste, and recycling to further utilize waste reduction programs.

E. Comply with additional requirements specified in Section 01 6000, "Product Requirements,” and Section 01 6600, “Material and Equipment.”

1.08 FIELD CONDITIONS

A. Ambient Conditions: Comply with minimum temperature recommendations of manufacturers for bonding and grouting materials. If manufacturer has no recommendations, maintain temperature at not less than 50 degrees F during tile installation and for at least 7 days after completion of installation.

1.09 MAINTENANCE

A. Extra Material: 5 percent of each color, size, and type of tile installed for Owner's use in future.

1. Package in sealed, clean, marked cartons of the tile manufacturer.

2. Deliver to Owner as instructed.

1.10 WARRANTY

A. Manufacturer Warranties:

1. Manufacturer of setting and grouting materials shall provide a written 5-year warranty for the installation, covering replacement of materials and labor.

2. Manufacturer of waterproofing materials shall provide a written warranty of not less than 10 year warranty against defects in materials and workmanship including water leakage.

PART 2 - PRODUCTS

2.01 SUSTAINABLE DESIGN CRITERIA

A. Recycled Content: Tile products shall contain a minimum of 50 percent (combined) post-industrial/post-consumer recycled content.

2.02 TILE PRODUCTS

A. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory, and package accordingly so that tile units taken from one package will show the same range of colors as those taken from other packages and will match accepted samples.

B. Glazed Wall Tile #1: Field tile.

1. Manufacturer: Daltile as specified, or equal.

2. Product: “Plaza Nova” Colorbody Porcelain.

3. Color: “Gray Fog,” PN98.

4. Finish: High gloss glaze.

5. Face Size: 12 inches by 12 inches.

6. Accessory Shapes: 6 inch by 12 inch cove base, inside corner, and bullnose.

C. Glazed Wall Tile #2: Accent Tiles.

1. Manufacturer: Daltile as specified, or equal.

2. Product: “Natural Hues on Eco-Body” ceramic tile.

3. Colors:
   a. #2A (Yellow): “Daisy,” QH97.
   b. #2B (Green): “Kiwi,” QH30.
   c. #2C (Blue): “Iceberg,” QH82.

4. Finish: High gloss glaze.

5. Face Size: 2 inches by 2 inches.

D. Porcelain Floor Tile:

1. Manufacturer: Dal-tile as specified, or equal.

2. Product: “Keystones” Color body.

3. Color: “Desert Gray,” D014

4. Face Size: 2 inches by 2 inches.

E. Trim Shapes and Bases:

1. Provide cove base, bullnose, returns, trimmers, and other shapes as specified, and as available from manufacturer for specified tiles, to finish installation and as indicated on the Drawings.

2. Color and finish of trim shapes shall match adjacent tile.

2.03 WATERPROOFING AND CRACK ISOLATION MATERIALS

A. Liquid-Applied Waterproofing and Crack Isolation Membrane: “RedGard” by Custom Building Products, or equal meeting ANSI A118.12 for crack isolation membranes, ANSI 118.10 for waterproofing membranes, and suitable for installation over both Portland cement and plywood substrates.

2.04 MORTAR BED AND UNDERLAYMENT MATERIALS

A. Latex Modified Portland-Cement Mortar Bed: ANSI A118.1; Portland-cement-based filler with synthetic latex additive; “Thick Bed Bedding Mortar” by Custom Building Products, or equal.

B. Reinforcing Mesh for Mortar Bed: ASTM A185, 2-inch-x-2-inch-x-16/16-gage welded-wire fabric.

2.05 SETTING MATERIALS

A. Latex Portland Cement Mortar: ANSI A118.4.

1. Porcelain Tile: “Porcelain Tile Fortified Thin-Set Mortar” by Custom Building Products, or equal.

2. Ceramic Wall Tile: "VersaBond” Fortified Thin-Set Mortar by Custom Building Products, or equal.

B. Provide primers, levelers, and other products recommended by manufacturers of setting materials or required for a complete installation.

2.06 GROUTING MATERIALS

A. Epoxy Grout: ANSI A118.3; "CEG-Lite" 100% Solids Commercial Epoxy Grout by Custom Building Products, or equal.

B. Grout Colors: As selected by the Owner's Representative.

2.07 OTHER MATERIALS

A. Sealant: As provided by grout manufacturer.

1. Color: To match color of grout in adjacent joints.

2. Provide sanded or non-sanded type as required to match type of grout.

B. Water: Clean and potable.

C. Cleaners and Sealers: HMK Stone Care Products as specified, Aqua-Mix, Miracle Sealants, or equal.

1. Glazed Tile:
   a. Cleaner: "R55 Intensive Cleaner/Grout Film Remover."

2. Porcelain Tile:
   a. Cleaner: "R61 Porcelain Tile Cleaner."
   b. Sealer: One coat "S45 Water Base Impregnator."

D. Metal Edge Protection and Transition Strips: Extruded anodized aluminum.

1. Manufacturer and Product: "DECO-SG" AE 12 by Schlüter Systems, or equal.

2. Height: As required by tile installation; see Drawings.

E. Protective Paper: Non-staining laminated and reinforced Kraft paper with bituminous or latex binder.

2.08 MIXING MORTAR AND GROUT

A. Mix mortar and grout so as to comply with requirements of referenced standards and manufacturer's instructions in order to produce mortar and grout of uniform quality, with optimum performance characteristics for application indicated.

B. Prepare and proportion premixed setting beds and grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive ceramic tile, setting beds, or accessories for defects or conditions adversely affecting quality and execution of tile installation.

1. Surfaces shall be firm, dry, clean, and free of oily or waxy films.

2. Grounds, anchors, plugs, hangers, bucks, and electrical and mechanical work in or behind tile shall be installed prior to proceeding with tile work.

B. Allowable Tolerances of Surfaces to Receive Tile:

1. Maximum Variation in Vertical Surfaces: 1/8 inch in 8 feet.

2. Maximum Variation in Horizontal Surfaces: 1/8 inch in 10 feet.

3.02 PREPARATION

A. Protect adjoining work surfaces before tile work begins. Close spaces in which tile is being set to traffic and other work. Keep closed until firmly set.

B. Install underlayment as required to achieve level or sloping surface as shown.

3.03 INSTALLATION OF RUBBER WATERPROOF/CRACK ISOLATION MEMBRANE

A. Install membrane over prepared substrate in accordance with ANSI A108.13 and manufacturer's instructions and summarized as follows.

1. Pretreat penetrations, coves, corners, drains, perimeter sealant joints, and other similar conditions.

2. Apply a liberal coat liquid membrane with brush or roller over substrate including pre-treated areas.

3. Apply another liberal coat of liquid membrane over entire substrate.

4. When dry to the touch, inspect surface and apply an additional liquid membrane to seal pin holes and other defects.

B. Water test membrane before installation of tile at Restrooms in accordance with ASTM D5957.

1. If leakage develops, make repairs in accordance with manufacturer's instructions and retest.

2. Report and submit results of each test in writing.

3.04 TILE INSTALLATION - GENERAL

A. Except as otherwise specified, work shall conform to the recommendations and listed installation methods included in the “Handbook for Ceramic Tile Installation” published by the Tile Council of North America, Inc.

B. Laying out Tile Work:

1. Lay out tile work so that, insofar as possible, no tile less than half full size occurs.

2. Lay floor areas out from center lines so that all major adjustments are made at walls and perimeter of tiled areas.

3. Lay out wall tiles so that fields and patterns center exactly on individual wall areas, and at intersections of wall and floor tiles.

    a. Exterior angles shall be bullnose.
    b. Cap shall be bullnose, same size as wall tile.

4. Align joints vertically and horizontally.

5. Align joints of floor and wall tiles.

C. Cutting of Tiles:

1. Cut and drill without marring tile.

2. Rub cuts smooth with a fine abrasive stone.

3. Set no cut edge against any fixture, cabinet, or other tile without a joint at least 1/16 inch wide.

4. Whenever possible, turn cut to inside corner.

5. Fit tile around electric outlets, plumbing pipes, fixtures, and fittings close enough to permit standard plates and collars to overlap tile.

D. Sound tile after setting. Remove and replace hollow-sounding units.

E. Allow tile to set at least 48 hours prior to grouting.

F. Grout tile to comply with requirements of ANSI A108.10.

G. Joint Sealants:

1. Install sealant in perimeter, control joints, and around floor drains and pipes.

2. Comply with installation requirements for sealants specified in Section 07 9200, "Joint Sealants."

3. After curing, remove spacers, and dry and clean all joints requiring sealant.

3.05 INSTALLATION METHODS

A. Prepare surface, fit, set or bond, grout, and clean in accordance with applicable requirements of ANSI standards for setting method specified.

B. Wall Tiles: TCNA Method W243-14.

1. Thin-set tile over moisture- and mold-resistant gypsum board specified in Section 09 2900, "Gypsum Board," with latex Portland cement mortar in accordance with ANSI A108.5.

2. Install grout as specified.

C. Floor Tile at Restrooms: Similar to TCNA Method F111-14.

1. Install waterproofing and crack isolation membrane over concrete substrate as specified.

2. Install reinforced mortar bed over membrane to thickness to achieve top of tile elevation at threshold as shown. Exercise care so as to avoid damage to membrane.

3. Thin-set tiles over mortar bed in bond coat of latex Portland cement mortar in accordance with ANSI A108.5.

4. Install epoxy grout as specified.

D. Control and Isolation Joints:

1. Locate joints, and install in accordance with TCNA Method EJ171 and as follows.

2. Provide where tile abuts restraining surfaces in such locations as perimeter walls, dissimilar floors, curbs, columns, pipes, and ceilings and where changes occur in backing materials.

3. Joint width, unless otherwise shown or where larger width is required to match typical tile grout joint width:

a. 1/4-inch expansion joint at junction of floor tile with wall.
b. 1/8-inch space between wall tile and floor.

3.06 ADJUSTMENT AND CLEANING

A. Remove cracked, stained, discolored, broken, or damaged tile. Replace with new tile.

B. Clean tile surfaces as thoroughly as possible on completion of grouting.

C. Remove grout haze, observing grout manufacturers' recommendations as to use of acid and chemical cleaners.

D. Rinse tile work thoroughly with clean water before and after using chemical cleaners.

E. Use no acids or abrasive soaps on tile, except as approved by tile manufacturer.

3.07 CURING, PROTECTION AND FINISHING

A. Curing:

1. Apply protective paper over floor tile as soon as pointing and grouting and cleaning are completed.

2. Lap sheets at least 4 inches, and seal laps against escape of moisture.

3. Leave curing paper in place until job is ready for final cleaning.

4. Keep traffic off floors during the curing period (7 days).

5. Do not permit cement grouts to dry out until cured at least 72 hours.

B. Final Cleaning of Floor Tile:

1. Remove protective paper, and clean tiles with a neutral cleaner solution.

2. After cleaning, apply specified sealer in accordance with manufacturer's application instructions. Re-cover tile with paper to protect from construction dirt.

3. Just before final acceptance of tile work, remove paper and reclean surfaces with neutral cleaner as needed.

C. Finishing of Wall Tile:

1. Apply a protective coat of neutral cleaner solution, one part cleaner to one part water, to all clean, completed tile walls after grout has cured.

2. Just before final acceptance of tile work, rinse protective coat of neutral cleaner from all tile surfaces.

END OF SECTION 09 3000

SECTION 09 5113
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Suspended acoustical ceiling panels.

2. Suspension system for acoustical panel ceilings.

B. Related Requirements:

1. Division 23: HVAC; air diffusers.

2. Division 26: Electrical; lighting fixtures.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination:

1. Develop and coordinate locations of work supported by or penetrating through ceiling with the other Sections involved prior to making shop drawing submittal. In particular, note partitions that are to be installed prior to ceiling installation.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Include the following:

1. Layout of suspension system and location of hangers, seismic braces, and trapezes.

2. Trapeze details.

3. Splicing method for main and cross runners.

4. Support of ceiling fixtures and air diffusers, and support of adjacent acoustical panels.

5. Details at changes in ceiling level.

6. Locations and dimensions of access doors, light fixtures, supply and exhaust grilles and diffusers, sprinkler heads, speakers, detection devices, and all other items to be installed in suspended acoustical ceilings.

7. Seismic control details.

B. Product Data: Manufacturer's catalog cuts for new and replacement suspension system components and acoustical panels.

1. Data sheets shall be marked to identify specific products proposed for use.

2. Include ICC-ES Report for seismic clips.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

D. Samples:

1. 6-inch x 6-inch sample of each type of acoustical panel required.

2. 8-inch-long sample of each type of exposed suspension member and trim, showing profile and finish.

1.04 INFORMATIONAL SUBMITTALS

A. Delegated-Design Services: Seismic and structural design engineering data including diagrams, calculations, and supporting data when required by code to indicate conformance to specified design requirements including adequacy of suspension system to withstand specified seismic and structural loading. Engineering data shall be signed by a professional engineer registered in the State of California.

1.05 CLOSEOUT SUBMITTALS

A. Extra materials as specified.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of three installations of extent comparable to Project.

B. Coordination of Work: Coordinate layout and installation of acoustical ceiling panels and suspension system with work supported by or penetrating through ceilings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver with manufacturers' labels indicating brand name, pattern, size, thickness.

B. Store cartons open at each end to stabilize moisture content and temperature.

C. Do not begin installation until sufficient materials to complete a room are received.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.08 FIELD CONDITIONS

A. Ambient Conditions: Do not install acoustical panel ceilings until wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Do not install acoustical ceilings until work above ceilings is completed, including testing and approval of mechanical work.

1.09 EXTRA MATERIAL

A. Acoustical Units: Furnish extra material, in full size panels, equal to minimum 40 square feet, for each size and Type of acoustical panel installed.

B. Suspension System Components: Not required.

C. Deliver extra material to Owner in sealed containers of the material manufacturer.

1.10 WARRANTY

A. Provide the following extended product warranties by manufacturer:

1. Acoustical Panels: 10 years.

2. Suspension Grid: 10 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: As listed with individual products.

B. Products of other manufacturers will be considered for substitution, provided that materials match designated products in color, texture, appearance, and performance to satisfaction of Owner's Representative.

2.02 PERFORMANCE AND DESIGN CRITERIA

A. Seismic Requirements:

1. Ceilings shall comply with CBC requirements for seismic bracing of ceiling suspension system.

2. Ceiling Compression Struts: Provide struts as shown on Drawings and as required by code, placed maximum 12 feet on center in both directions and within 6 feet of each wall.

B. Fire Performance Characteristics:

1. Surface Burning Characteristics: Provide products complying with ASTM E 1264 for Class A products and meeting the following when tested in accordance with ASTM E84.

a. Flame Spread: 25 or less.
b. Smoke Developed: 50 or less.

C. Tolerances:

1. Deflection, ASTM C635: Maximum 1/360 of span. Applies to suspension system components, hangers, and fastening devices supporting light fixtures, ceiling grilles, and to acoustical panels.

2. Allowable Tolerance of Finished Acoustical Ceiling System: Level within 1/8 inch in 12 feet.

D. Attachment Devices: Size for five times design load required by ASTM C635, Table 1, Direct Hung, unless otherwise indicated.

E. Suspension system shall comply with Division of the State Architect Interpretation of Regulations 25-2.13.

2.03 SUSPENSION SYSTEMS

A. Comply with ASTM C635.

B. Structural Classification: Heavy-duty.

C. Main and Cross Members: Hot-dip galvanized cold-rolled steel, double-web design with rolled-steel cap.

D. Edge Moldings:

1. Walls: Hot-dip galvanized, cold-rolled steel, minimum 0.020-inch-thick steel.
   a. Profiles: Shadow mold, with 3/4 inch reveal and minimum flange width of 3/4 inch; Item #7890 by Armstrong World Industries, or equal.
   b. Finish: To match grid.

2. Floating: Aluminum.
   a. Profile: Channel, 1-3/4 inch high, 7/8 inch wide bottom flange, and with prefinished hem edges; Item #HD7831WA by Armstrong World Industries, or equal.
   b. Finish: To match grid.

E. Splices, End Connections, Clips, and Other Accessories: Hot-dip galvanized steel.

1. General: Design to provide strong, rigid, lock-type connections preventing movement or displacement of joined components and permitting disassembly without damage to component parts.

2. Hold-Down Clips: Concealed, spring-loaded, fully accessible; Item #7870 by Armstrong World Industries, or equal. Provide between ceiling panels and perimeter closure trim.

F. Suspension Wire: ASTM A641, Class 1 zinc coating, soft temper.

1. Hanger Wire: 0.106-inch nominal diameter (12 gage).

2. Bracing Wire: 0.120-inch nominal diameter (10 gage).

G. Compression Struts: Donn "Seismic Compression Post" or accepted equal manufactured proprietary product conforming to specified requirements and those indicated on the Drawings.

H. Finish:

1. Steel components shall be Bonderized and given a coat of rust-inhibitive paint.

2. Exposed surfaces of components shall have factory-applied semi-gloss white enamel finish, unless otherwise noted.

3. Grid Color: White, unless otherwise specified.

I. Suspension and Grid Types: As specified under Article 2.05 below.

2.04 ACOUSTICAL PANELS

A. Acoustical Panel Types: As specified under Article 2.05 below.

2.05 ACOUSTICAL PANEL CEILING TYPES

A. Manufacturer and Product: “Techzone” Ceiling System products by Armstrong World Industries as specified, or equal.

1. Grid: Direct-hung, exposed tee grid, 9/16-inch face; “Suprafine XL High Recycled Content (HRC).”

a. Color: White.

b. Total Recycled Content: Not less than 60 percent.

2. Panels:

a. General:

1) Material Type: Mineral fiber, formaldehyde free.
2) Total Recycled Content: Not less than 70 percent.

b. Field: 24 inches by 48 inches by 3/4-inch thick; “Ultima” No. 1915.

1) Edge: Beveled tegular.
2) Texture: Fine.
3) Finish: Factory-applied acoustically transparent white membrane.
4) NRC: 0.70.
5) CAC: 35.

c. Field - Basement: 12 inches by 48 inches by 3/4-inch thick; “Ultima” No. 1996.

1) Edge: Beveled tegular.
2) Texture: Fine.
3) Finish: Factory-applied acoustically transparent white membrane.
4) NRC: 0.70.
5) CAC: 35.

d. Technical - Typical: 6 inches by 48 inches by 3/4-inch thick, “Ultima” No. 1423.

1) Edge: Beveled tegular.
2) Texture: Fine.
3) Finish: Factory-applied acoustically transparent white membrane.
4) NRC: 0.70.
5) CAC: 35.

e. Technical - Basement: 12 inches by 48 inches by 3/4-inch thick; “Ultima” No. 1996.

1) Edge: Beveled tegular.
2) Texture: Fine.
3) Finish: Factory-applied acoustically transparent white membrane.
4) NRC: 0.70.
5) CAC: 35.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Pattern and layout shall be accepted by Owner’s Representative before installation of suspension systems.

B. Install suspension systems, including necessary hangers, grillage, and other supporting hardware in accordance with CBC, ASTM C636 and ASTM E580, manufacturer’s instructions, and as specified. The most stringent requirements shall govern.

3.02 GRID SYSTEMS

A. Hangers:

1. Coordinate hanger location with other work. Hanger wire attachment devices shall be capable of supporting 100 pounds.

2. Ensure that hangers and carrying channels are located to accommodate fittings and equipment that are to be placed after installation of ceiling grid system.

3. Space hanger wire as required by code for specified wire gage.

4. Install additional hangers at ends of each suspension member, at light fixtures, and 6 inches from vertical surfaces.

5. Do not splay wires more than 5 inches in a 4 foot vertical drop.

6. Wrap wire at least three times horizontally, turning ends upward in the first 3 inches.

7. Provide trapeze suspension or other appropriate system for suspension of ceiling system and light fixtures at large ductwork.

8. Provide two extra tie wires at each light fixture and HVAC register for use in tying off opposite corners at fixtures and registers.

9. Kinks and bends are not permitted in hanger wires to level carrying channels.

B. Main Runners:

1. Space main runners at 4 feet on center and run perpendicular to Technical Zone.

2. Level and square to adjacent walls.

3. Independently support a maximum of 8 inches from each wall.

4. Secure to structure above with four-way, bracing wire splays as specified and to meet applicable building code requirements for lateral design.

C. Space cross runners at 2 or 4 feet on center. Independently support if 8 inches or more from wall. Run parallel to Technical Zone.

D. Use standard "Tee" section at grid change in direction.

E. Wall and Perimeter Moldings:

1. Install wall molding at intersection of suspended ceiling and vertical surfaces.

2. Miter corners where perimeter moldings intersect.

3. Attach with concealed mechanical fasteners.

F. Seismic Bracing Assembly: Compression struts and splayed wires.

1. Horizontal Restraints: 4 splayed wires oriented 90 degrees from each other.

a. Seismic bracing wires may be 12 gage if permitted by code.
b. Provide at the following locations and where shown:

1) Not more than 12 feet on center in each direction.
2) Not more than 6 feet from each perimeter walls and edges of vertical ceiling offsets.

c. Splices in bracing wires are not permitted.
d. Angle of wires shall not exceed 45 degrees from the plane of the ceiling.

2. Vertical Restraints: A strut to resist vertical displacement at each seismic splay.

   a. Struts shall extend from the grid to structure above and shall be fastened at both ends.
   b. Compression struts shall not replace hanger wires.
   c. If other than a manufactured proprietary strut is used, it shall be approved by governing authorities.

3. Lateral force bracing is not required at ceiling areas less than 144 square feet that are surrounded by walls extending to structure above.

4. Ceiling areas exceeding 2,500 square feet shall have a seismic separation joint with each area provided with closure angles.

5. Seismic perimeter clips shall have current and approved ICC-ES Report and shall be installed in accordance with the details and recommendations of the Report.

6. Provide spreader bars at all main and perimeter runners.

G. Provide bracing to top of ceiling-height partitions.

3.03 LAY-IN ACOUSTICAL PANELS

A. Install in level plane in straight line courses.

B. Apply with grain, if any, in same direction, not checkerboard.

C. Minimum Width of Border Panel: One-half panel dimension, unless indicated on the Drawings or approved submittals.

D. Provide trim molding at recessed troffer lights as required.

E. Hold-Down Clips:

1. Acoustical panels surrounding recessed troffer lights shall be installed with hold-down clips to prevent movement or displacement of panels.

2. Provide hold-down clips at perimeter where grid meets wall molding.

3. Exposed fasteners are not acceptable.

F. Trim or rout tegular-edge panels to provide tegular edge at perimeter moldings.

G. Coordinate lay-in system with electrical fixtures and mechanical work that will be integrated with the ceiling.

3.04 CEILING MOUNTED LIGHT FIXTURES AND HVAC TERMINALS

A. Secure with mechanical fasteners to the ceiling grid runners to resist a horizontal force equal to the weight of the fixture.

B. Independently support with wires to structure above as follows:

1. Fixtures Less than 10 Pounds: One 12-gage wire from the fixture housing. This wire may be slack.

2. Fixtures Between 11 and 55 Pounds: Two 12-gage wires attached to fixture and structure above. These wires may be slack.

3. Fixtures 56 pounds and more shall be independently supported using 9-gage wire:

C. Fasteners shall be concealed in completed installation.

3.05 CLEANING

A. Clean soiled or discolored surfaces after installation.

B. Touch up scratches, abrasions, voids, and other defects in painted surfaces.

C. Remove and replace damaged or improperly installed work.

END OF SECTION 09 5113

SECTION 09 5426
WOOD CEILING AND WALL PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Perforated plywood panel system at walls and ceilings.

2. Shop finishing.

B. Related Requirements:

1. Alternates: Section 01 2300; alternates affecting the work of this Section.

2. Interior Architectural Woodwork: Section 06 4023; plywood infill panels at stair guardrails and balustrade.

3. Non-Structural Metal Framing: Section 09 2216.

4. Suspension Systems: 09 2226; suspension system for ceiling panels.

5. Acoustic Insulation and Sealants: Section 09 8200; black-faced insulation above ceiling panels.

6. Painting and Coating: Section 09 9000; accent colors behind perforated wall panels.

7. Fire Suppression: Division 21; sprinkler heads penetrating wood ceilings.

8. Electrical: Division 26; lighting fixtures and other electrical penetrations in wood ceilings.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, “Guarantees,” and Section 01 7839, “As-Built Documents.”

B. Coordinate installation of wood panels with suspension and metal framing for supporting and anchorage as specified in Section 09 2226, “Suspension Systems.”

1.03 ACTION SUBMITTALS

A. Shop Drawings:

1. Prepare for each ceiling and wall layout showing panel dimensions, junctions with other work or ceiling finishes, panel spacing, interrelation of mechanical and electrical and other items interfacing with wood panel systems.

2. Coordinate with shop drawings for suspension system specified in Section 09 2226, “Suspension Systems.”

B. Product Data:

1. Manufacturer's descriptive literature for panels, exposed fasteners, shop-applied finishing, and fabric scrim.

2. Fire Retardant treatment data for material treated to reduce combustibility and meet specified flammability requirements

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. Credit MR 6: Certificates of chain-of-custody signed by millwork manufacturer certifying that wood products were obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

1) Include evidence that millwork manufacturer is certified for chain-of-custody by an FSC-accredited certification body.
2) Include statement indicating costs for each certified wood product.

d. Credit EQ 4.4: Composite wood and agrifiber materials manufacturers' product data stating that they contain no added urea-formaldehyde resins.

1) Include statement indicating costs for each product.

D. Samples: Nominal 16-inches wide by 24 inches of perforated hardwood veneered panel in specified perforation pattern complete with application of specified fire retardant treatment and specified finish system.

1. Submit for each flammability Class rating.

2. Clearly note with each submittal variations from specified coatings and methods used, if any, for unifying appearance prior to application of clear topcoats.

3. Allow for up to two additional submittals with adjustments to veneer and coatings to achieve appearance acceptable to the Owner's Representative.

1.04 INFORMATIONAL SUBMITTALS

A. Certification that wood items meet specified fire-resistance characteristics.

B. Statement of installer qualifications.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Documented experience in installation of wood wall and ceiling systems similar to those indicated, and acceptable to system manufacturer.

B. Mockups: First installed area of each system shall serve as mockup for review and approval by Architect of workmanship, visual effect, and interface with adjoining construction.

1. Mockup shall include a typical access panel, cutout for light fixture, and interface with wall.

2. Make modifications to mockup if requested by Architect.

3. Accepted mockup may remain as part of the Work.

1.06 FIELD CONDITIONS

A. Ambient Conditions: Do not proceed with installation until dust-generating activities have been terminated and building temperature and humidity conditions approximate conditions that will exist when the Building is occupied.

B. Do not install wood panel systems until work above or behind them is completed, including testing and approval of mechanical work.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Wood Components:

1. Fire-retardant treated with UL stamp signifying a FR-S, NFPA Class A, or Class I rating.

2. Adhesive materials shall contain no added urea-formaldehyde resins.

B. Tolerances:

1. Allowable Tolerance of Finished Systems: 1/8 inch in 10 feet unless stricter tolerances is required by Owner's Representative during mockup review.

C. Sustainable Design:

1. Adhesive, composite wood, and agrifiber materials shall contain no added urea-formaldehyde resins.

2. Provide wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

3. Recycled Content of Steel Suspension System Products: For steel products where no recycled content information is given, or unclear, assume the recycled content is to be 25 percent post-consumer. Include statement indicating cost for each product having recycled content.

D. Flammability:

1. Suspended Ceilings - No Sprinklers (CBC 803.11.2): Class I or A.

a. Smoke Developed: 50 or less.
b. Flame Spread: 25 or less.

2. Lobby Wall Locations - Direct Application over Gypsum Board (CBC Table 83.9 and Section 803.11): Class II or B.

a. Smoke Developed: 450 or less.
b. Flame Spread: 75 or less.

3. Exit Enclosures - Direct Application over Gypsum Board (CBC Table 803.9 note b and Section 803.11): Class III or C.

a. Smoke Developed: 450 or less.
b. Flame Spread: 200 or less.

2.02 SUSPENSION SYSTEM

A. Suspension Grillage: As specified in Section 09 2226, "Suspension Systems."

2.03 WOOD PANELS

A. Perforated Plywood Panels: Hardwood veneer plywood complying with ANSI/HPVA HP-1; "Europly PLUS" by Columbia Forest Products, or equal.

1. Nominal Panel Thickness: As noted on the Drawings.

2. Face Species and Cut: FSC certified White Maple, plain sliced.

3. Inner Plies: Uniform laminations of solid Birch.

4. Panel Sizes: As shown on the Drawings.

5. Edge Profile: Square.

6. Perforation Pattern: Bordered hole pattern as shown on the Drawings. Holes shall be uniform with no chipping or other irregularities.

7. Shop cut penetrations, fixture cut-outs, and custom sizes.

2.04 SHOP FINISHING

A. Fire-Retardant: Penetrating, non-toxic, formaldehyde free, VOC compliant treatment applied to achieve specified flammability requirements for panels after application of transparent finish system; "Flame Stop II" by Flame Stop, Inc., or equal.

1. Treatment shall not warp panel or discolor finish veneer.

2. Treatment shall be compatible with waterborne finish system.

B. Shop-Applied Transparent System: Formaldehyde free, waterborne urethane polymer; American Formulating and Manufacturing (AFM) coatings as specified, or equal.

1. Stain: If required to provide a unified light Maple appearance and match accepted sample; "Safecoat DuroStain."

2. One Coat Sealer: "Safecoat Safe Seal."

3. Two Topcoats: "Safecoat Polyureseal BP," satin gloss level.
   a. Sand first topcoat.
   b. Allow to cure full time recommended by manufacturer before buffing.
   c. Coats: 2, with light sanding between coats.

4. Appearance and Gloss Level: Satin.

2.05 ADDITIONAL MATERIALS AND ACCESSORIES

A. Acoustic Insulation: Black-faced acoustic board as specified in Section 09 8200, "Acoustic Insulation and Sealants," to block view of support system.

B. Adhesive: VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Exposed Fasteners: As noted on the Drawings.

D. Provide additional accessories as recommended by manufacturer for conditions of installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify ceiling suspension system, including necessary hangers, grillage, and other supporting hardware, has been installed as specified in Section 09 2226, "Suspension Systems."

B. Verify backing has been installed at walls to receive fasteners as shown.

C. Wall panels shall be installed after walls receive final coat of accent wall paint color.

3.02 INSTALLATION

A. Install panels by mechanically fastening to concealed backing at walls and to carriers at ceiling.

B. Align panel joints to provide a uniform gap between panels as shown.

C. Exposed fasteners shall be countersunk flush to panel surface and uniformly spaced and aligned in both directions.

3.03 INSTALLATION OF MECHANICAL AND ELECTRICAL ITEMS

A. Install grilles, lighting, and other items required to penetrate or interface with panels as specified in Mechanical and Electrical Sections.

B. Conform to layouts on reviewed shop drawings.

C. Lighting fixtures, diffusers, and sprinkler heads shall be independently supported.

3.04 CLEANING

A. Wood surfaces shall be cleaned free of dirt, dust, grease, fingerprints, and other contaminants.

B. Work that cannot be successfully cleaned and repaired shall be removed and replaced.

3.05 PROTECTION

A. Protect installed plywood panels with minimum 1/4 inch protection board resistant to denting, puncture and other damage for the duration of the construction operations.

B. Replace damaged panels to match existing.

END OF SECTION 09 5426

SECTION 09 6120
CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Clear sealer applied to cured concrete at exposed interior concrete flatwork.

B. Related Requirements:

1. Cast-in-Place Concrete: Section 03 3000; curing and hardening compounds for concrete flatwork applied immediately after placement of concrete.

2. Concrete Fill for Metal Pan Stairs: Section 03 5600; curing and sealing compound for concrete fill at stairs not scheduled to receive an applied floor covering.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer’s literature for sealer.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. EQ 4.2: Printed statement of volatile organic compounds (VOCs) for coatings applied inside the weatherproofing.

1) Include statement indicating costs for each product.

1.04 QUALITY ASSURANCE

A. Slip Resistance:

1. Slip Resistance: After application of sealer, floor shall provide a minimum wet DCOF AcuTest value of 0.42 in accordance with ANSI A137.1-2012.

2. If sealer is applied to sloping surfaces exceeding 6 percent slope, ramp shall have a "heavy broom" finish.

1.05 FIELD CONDITIONS

A. Coordinate finishing of exposed concrete flatwork to receive sealer with surface textures specified in Section 03 3000, "Cast-in-Place Concrete. A finished surface with specified slip-resistance as specified is required.

B. Protect exposed surfaces, both new concrete flat work and concrete where surface treatment is completed, to prevent damage by impact or stains from rubbish and the work of other trades.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sealing Compound at Exposed Concrete Flatwork: VOC compliant, waterborne, formaldehyde free, acrylic polymer; AFM "Safecoat MexeSeal," or equal designed to seal and dustproof concrete.

PART 3 - EXECUTION

3.01 PREPARATION

A. Concrete surface shall be examined and prepared in accordance with the surface preparation requirements included in the specified manufacturers printed application instructions and as follows.

B. Sealer shall not be applied over stains, layout markings, oils, grease, wax, and other contamination caused by Contractor's construction activities subsequent to installation of concrete.

1. Stains, layout markings, and contamination shall be thoroughly removed by the use of detergent scrubbing with a heavy duty cleaner/degreaser, low pressure water cleaning (less than 5,000 psi), steam cleaning, or chemical cleaning.

2. If cleaning does not achieve an acceptable surface and remove contamination, surfaces shall be profiled using a shot blaster or hydro-blaster if necessary to provide a clean surface prior to application of sealer.

3. If profiling is required, comply with International Concrete Repair Institute (ICRI) "Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays." Coordinate required profile with Owner's Representative and provide IRCI visual concrete comparators, or other visual aid, to assist Owner's Representative in determining treatment procedures and an acceptable surface.

C. After surface has been prepared, apply sealer to a trial test area and verify that sealed surface meets specified slip-resistance and uniformity of appearance.

1. Test area shall be approximately 5 feet by 5 feet.

2. Document application rate and number of coats used for test area.

3. Allow sealer to completely cure before evaluating test area.

3.02 APPLICATION OF CLEAR SEALER

A. Apply specified sealer in minimum two thin coats using a low-pressure, non-atomizing spray applicator or by pouring followed by a squeegee or a broom for even distribution in accordance with manufacturer's instructions and as specified.

B. Allow first coat to dry minimum 2 hours before application of second coat.

C. If prepared surface is extremely porous, and if required to achieve a uniform appearing hard durable finish, apply a third coat after the second coat as dried a minimum of two hours.

D. Apply subsequent coats in a direction 90 degrees from the previous coat.

E. A lambswool applicator should be used for small areas.

F. Allow material to cure, 8 to 24 hours depending upon ambient temperature and humidity conditions, before allowing any traffic on surface.

3.03 PROTECTION

A. Protect exposed surfaces, including flat work, as required to prevent damage by impact or stains from rubbish and work of other trades.

END OF SECTION 09 6120

SECTION 09 6500
RESILIENT FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Resilient sheet flooring.
2. Resilient base.
3. Resilient stair covering.
4. Resilient tile flooring at elevator cab.
5. Resilient edge trim and accessories.

B. Related Requirements:

1. Concrete Moisture Testing: Section 01 4520.
2. Tile Carpeting: Section 09 6813; resilient accessories for carpet.
3. Electric Traction Elevator: Section 14 2100.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."
2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."
3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Layout diagram showing seam locations for each area to receive sheet flooring.

B. Product Data: Manufacturer's technical data for each resilient product required. Include profiles stair treads, resilient edge strips, and reducers.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit EQ 4.1: Printed statement of volatile organic compounds (VOCs) for adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Samples:

1. Stair Treads, Base, and Accessories: 9 inches long by full dimension for each profile.

2. Tile: Full-size.

1.04 INFORMATIONAL SUBMITTALS

A. Verification that flooring meets specified requirements for slip-resistance if not included in manufacturer's product data.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data, including list of recommended maintenance products and procedures for each type of resilient flooring material.

B. Manufacturer's extended product warranties.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Documented experience in installation of resilient flooring products similar to those specified.

B. Mockups:

1. First installed area or example of stair covering shall serve as a mockup for review and approval by Owner's Representative of workmanship, visual effect, and interface with adjacent construction.

2. See additional requirements for mockups specified in Section 01 4339, "Mockups."

1.07 FIELD CONDITIONS

A. Ambient Conditions:

1. Maintain temperature in spaces to receive resilient flooring to level expected during Owner occupancy for at least 24 hours before installation, during installation, and 48 hours after installation.

2. Provide 100 percent outside air ventilation during resilient flooring installation. See Section 01 3560, “Special Environmental Requirements.”

3. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation.

B. Install resilient flooring products after other finishing operations, including painting, have been completed.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Waste Management: As specified in Section 01 7419, “Construction and Demolition Waste Management,” and as follows:

1. Coordinate with manufacturer(s) for take-back program for collection of construction scrap, unused material, demolition scrap, and packaging material.

2. Where feasible, separate demolition waste, construction waste, and recycling to further utilize waste reduction programs.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements,” and Section 01 6600, “Material and Equipment.”

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Slip Resistance: Flooring, after application of specified finishes, shall maintain a minimum wet DCOF AcuTest value of 0.42 in accordance with ANSI A137.1-2012. Alternative testing to verify compliance, including wet and dry static coefficient value of 0.60 for level surfaces as defined by ASTM D2047 when determined by testing identical products in accordance National Floor Safety Institute (NFSI) recommendations, shall be acceptable to governing authorities.

B. Flammability:

1. ASTM E662 and NFPA 258 (Smoke Density): Less than 450.

2. ASTM E648 (Floor Radiant Panel Test): 0.45 watts/per square cm or higher.

C. Sustainability:

1. Adhesives and Sealants:

a. Satisfy the South Coast Air Quality Management District Rule 1168.

b. Meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.
c. Aerosol adhesives shall meet the VOC limits of the "Green Seal Environmental Standard for Certification of Commercial Adhesives" (GS-36) of Green Seal, Inc.

2. Primers and sealers shall satisfy the South Coast Air Quality Management District Rule 1113.

3. Rubber flooring shall be "Greenguard Gold Certified for Low VOC Emissions."

2.02 RESILIENT FLOORING

A. General:

1. Flooring shall:

a. Be uniform in thickness and size.
a. Have edges cut accurately and square.
b. Be uniform in color, with variations in variegated patterns kept to a minimum.

2. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern.

3. Provide each type of resilient product by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

B. Resilient Sheet (Keynote "RES-1"): Heat-weldable, marbleized linoleum consisting of oxidized linseed oil and natural resins mixed with wood or cork flour, limestone and pigments, conforming to ASTM F2034, Type I; "Marmoleum" by Forbo Industries, Inc. as specified, or equal.

1. Physical Characteristics:

a. Width: Nominal 6'-7" (200 cm).
b. Thickness (Gage): Nominal 1/10 inch (2.5mm).
c. Backing: Jute.

2. Pattern: "Real."

3. Color: To be selected by Owner's Representative.

C. Stair Treads and Risers: Pre-shaped stair nosing, riser and tread all-in-one piece with studded surface meeting ASTM F 2169, Type TS; Roppe "Rubber Tread" as specified, or equal.

1. Profile: #30.

2. Color: To be selected by Owner's Representative.

3. Pattern: Diamond with square nose.

4. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.

5. Landings: Rubber tile to match thickness, color, and pattern of treads.

6. Provide manufacturer's nominal 2-inch wide textured striping meeting governing accessibility requirements inserted into top and bottom nosing of each stair run.

    a. Color: Contrasting, as selected by Owner's Representative.

D. Resilient Tile at Elevator Cab Floors: To match rubber tile for stair landings.

2.03 ACCESSORIES

A. Resilient Base: ASTM F1861, Type TP, rubber; Roppe as specified, or equal.

1. Provide with premolded matching outside corners from same color run.

2. Lengths: Continuous roll stock only.

3. Profile: Straight.

4. Height: 4 inches.

5. Color: To be selected by Owner's Representative.

B. Resilient Edge Strips: Molded vinyl in profiles as selected by Owner's Representative from manufacturer's standards. Unless otherwise specified, match thickness of abutting flooring material.

C. Adhesives:

1. General:
    a. Provide adhesives as recommended by manufacturer of resilient flooring material for conditions of installation and for each type of flooring.
    b. Adhesive shall meet low VOC requirements consistent with meeting LEED Credit EQ 4.1.

2. Seams for Scheduled Linoleum: Armstrong S-761.

D. Heat Welding Rods:

1. Linoleum: "Marmoweld" as provided by flooring manufacturer and to match accepted sample.

E. Substrate Sealer:

1. Gypsum Underlayment: Non-staining Type as recommended by gypsum underlayment manufacturer and acceptable to flooring manufacturer for use under glue-down sheet linoleum.

2. Concrete Substrate: Product as recommended by the respective flooring manufacturer.

F. Crack and Depression Filler: Latex patching compound that does not require addition of water; DAP "Bondex Flexible Floor Patch and Leveler," or equal.

G. Stair-Tread-Nose Filler: Two-part, low VOC, epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.01 PREPARATION

A. Suitability of Substrate:

1. Comply with ASTM F710 and manufacturer's recommendations for surface preparation.
   a. Remove protrusions, and grind smooth.
   b. Apply patching compounds for filling small cracks, holes, depressions in subfloor where existing stacks have been removed, and to bring substrate to within specified tolerances and criteria.
   c. Substrate shall be flat to within 1/8 inch in 8 feet and shall be such that finish floor will not show "telegraphing" of irregularities.

B. Concrete: Conduct adhesive bond tests prior to the installation to ensure the integrity of the flooring system, and to ensure that a secure bond can be achieved.

C. Concrete and Gypsum: Perform moisture and acidity tests as specified in Section 01 4520, “Concrete Moisture Testing,” to verify compliance with requirements for maximum moisture content and alkalinity range of flooring manufacturer.

D. Gypsum Underlayment:

1. Apply sealer with spray or roller over gypsum underlayment at areas to receive glue-down carpet tile to reduce surface porosity of gypsum underlayment unless otherwise required by flooring manufacturer.

2. Apply approximately 2 hours prior to application of flooring adhesive.

E. Vacuum surfaces to be covered.

3.02 APPLICATION OF ADHESIVES

A. Mix and apply adhesives in accordance with each resilient product manufacturer's instructions.

B. Apply uniformly over substrates with notched trowel or other suitable tool.

1. Cover only that amount of area that can be covered by flooring material within the recommended working time of adhesive.

2. Remove any adhesive that dries or films over.

3. Do not soil walls, bases, or adjacent areas with adhesive.

4. Promptly remove any spillage.

C. Clean trowel, and rework notches as necessary to ensure proper application of adhesive.

3.03 INSTALLATION OF SHEET FLOORING

A. Install flooring using adhesives, in accordance with manufacturer's instructions and reviewed submittals.

1. Lay all sheets in single length from wall to wall.

2. Extend flooring into recesses, door reveals, closets, and similar spaces. Resilient flooring shall fit neatly into doorframes and around corners and other obstructions.

3. Lay sheets with seams square to room axis. Match patterns at seams.

B. Seams:

1. Make all seams tight, and solidly adhere to substrate.

2. Provide welded seams after the flooring adhesive has set up.

3. Seams shall be prepared for welding according to recommended seaming procedures of the flooring manufacturer with special routing tool supplied for this purpose.

4. Heat weld prepared seams with welding rod applied in accordance with manufacturer's seam welding instructions.

5. Finish all seams flush and free from voids, recesses, and raised areas.

6. Make welding rod repairs prior to performing the final trim.

C. Finished floors shall be smooth and free from buckles, cracks, breaks, waves, and projecting edges.

3.04 INSTALLATION OF ACCESSORIES

A. General:

1. Match edges at seams, or double-cut adjoining lengths.

2. Install with tight butt joints.

3. Maintain minimum measurement of 18 inches between joint and corner.

B. Top-Set Base:

1. Install base around perimeter of room or space at base of partitions, columns, pilasters, and other permanent fixtures where scheduled and where to replace existing removed to execute other work under this Contract.

2. Unroll base material, and let relax.

3. Cut into accurate lengths as required for minimum number of joints.

4. Apply adhesive, and firmly adhere to wall surfaces.

5. Press down so that bottom cove edge follows floor profile.

6. Corners:

a. Miter internal corners.
b. At external corners, use specified premolded outside corner units.

7. Scribe base accurately to abutting materials.

C. Edge Strips:

1. Apply adhesives, and bond securely to substrates in straight, true lines.

2. Provide where resilient flooring terminates, exposing edge of covering.

3. Center edge strips under doors where resilient flooring terminates at a door opening.

4. Top of strips shall be flush with top of resilient flooring.

5. Install reducer strips where required to provide smooth transition between resilient flooring and other finish.

3.05 STAIR ACCESSORIES:

A. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.

B. Tightly adhere to substrates throughout length of each piece.

C. For treads installed as separate, equal-length units, install to produce a flush joint between units.

3.06 FINISHING AND CLEANING

A. Clean approximately 72 hours after installation, or after adhesives have cured and after completion of adjacent work, as recommended by manufacturer for type of flooring installed.

1. Sweep or vacuum floor thoroughly.

2. Clean surfaces with a neutral cleaner.

3. Follow manufacturer's recommended procedure for cleaning and polishing.

4. Remove excess adhesive and other surface blemishes, using appropriate recommended cleaner.

B. Protect flooring against damage and from normal wear and tear during remainder of construction period, in accordance with flooring manufacturer's directions, so that flooring will remain without indication of use or damage.

1. Protect flooring by covering with non-staining building paper.

2. Protect flooring against rolling loads by covering with plywood or hardboard. Use dollies to move stationary equipment or furnishings across floors.

END OF SECTION 09 6500

SECTION 09 6813
TILE CARPETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Carpet tile.

2. Resilient carpet accessories.

B. Related Requirements:

1. Concrete Moisture Testing: 01 4520.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination: Sequence reinstallation of carpet with other work to minimize possibility of damage and soiling during remainder of construction period.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Diagrams showing layout for selected carpet and edge strips.

B. Product Data:

1. Manufacturer's data for carpet tile describing physical and performance characteristics; sizes, and method of installation.

2. Product literature for each type of installation accessory required.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.

c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit EQ 4.1: Printed statement of volatile organic compounds (VOCs) for adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Samples:

1. Tile: Full-size carpet tile of each type and color specified. Samples shall be reviewed at the Project site.

2. Edge Stripping: 9-inches-long of each type.

1.04 INFORMATIONAL SUBMITTALS

A. Installer qualifications.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranties.

B. Maintenance instructions.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Firm specializing in carpet installation, with documented successful experience in installation of carpeting similar to that required for this Project.

B. Odor: Materials used in construction of carpet tiles shall not give off any odors which could be unpleasant or hazardous to building occupants. This shall include outgassing and chemical migration in backing materials.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store new carpet tiles at least 3 days prior to installation in area of installation to achieve temperature stability in accordance with CRI 104 Standard.

B. Do not stack carpet tile the equivalent of more than six cartons high to avoid potential crushing.

C. Waste Management: As specified in Section 01 7419, “Construction and Demolition Waste Management,” and as follows:

1. Coordinate with manufacturer for take-back program for collection of construction scrap, unused material, and packaging material.

2. Where feasible, separate construction waste and recycling to further utilize waste reduction programs.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.08 WARRANTY

A. Contractor: Provide Owner with an extended 5-year written warranty, co-executed by the installing subcontractor, agreeing to repair, replace, or reset carpet tile that fails in installation materials or workmanship within the warranty period.

B. Manufacturer: Provide carpet tile manufacturer's Standard Product Warranty against product failure to due defects in materials and workmanship 15 years from date of acceptance.

1.09 MAINTENANCE

A. Maintenance Instructions:

1. Submit manufacturer's printed instructions for maintenance of carpet tile including recommended methods and cleaning frequencies for maintaining optimum conditions of materials under anticipated traffic and exposures.

2. Include precautions against materials and methods detrimental to carpet performance or to topical coating or to latex used between backings.

B. Extra Stock: Not required.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. General Construction Requirements:

1. Carpet tile shall comply with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2. Face yarns shall be of same dye batch, and finish material shall be of one mill run.

3. Consistency shall be such that any tile shall be interchangeable with any other tile, within a dye lot, with no visual difference.

4. Carpet shall have a built-in, permanent antimicrobial treatment for protection against bacteria and fungus growth.

5. Carton Labeling: Mark each carpet tile carton according to style, color, pattern, and dye lot.

6. Static Control (AATCC-134): Less than 3.0 Kv.

7. Colorfastness, Xenon Arc, AATCC 16E: Not less than 4 at 60 AFU's.

8. Flammability:

a. DOC FF-1-70: Pass.
b. NFPA 258 (Smoke Density): 450 or less.
c. ASTM E648 (Floor Radiant Panel Test): 0.45 W/cm^2 or higher.

B. Sustainable Design:

1. Manufacturer shall have an established reclamation and recycling program for the supplied carpet at the end of its life.

2. Adhesives and Sealants:

a. Satisfy the South Coast Air Quality Management District Rule 1168.
b. Meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.
c. Aerosol adhesives shall meet the VOC limits of the "Green Seal Environmental Standard for Certification of Commercial Adhesives" (GS-36) of Green Seal, Inc.

3. Carpet tile shall comply with the California Gold Sustainable Carpet Standard.

2.02 CARPET TILE

A. Manufacturer: Shaw Contract Group as specified, or equal with take back program for the carpet at the end of its life for recycling the used product.

1. Series: "Embark."

2. Collection: "Material Matters."

3. Color: 37515, "Delicate."

4. Tile Size: 24 inches by 24 inches.

5. Construction:

a. Type: Multi-level pattern loop.
b. Fiber: "eco solution q" nylon.
c. Color System: 98 percent solution dyed, 2 percent yarn dyed.
d. Tufted Yarn Weight: 17 ounces per square yard.
e. Gauge: 1/12 inch.
f. Pile Height: 0.19 inches.
g. Pile Thickness: 0.105 inches.
h. Stitches per Inch: 9.
i. Average Pile Density: 5,829 ounces per square yard.
j. Primary Backing: Synthetic.
k. Secondary Backing: "ecoworx" tile.

2.03 ACCESSORIES

A. Adhesives: Release type, waterproof, non-latex type, with no adverse effects on indoor air quality and acceptable to the carpet and carpet backing manufacturers and meeting the VOC requirements.

B. Edge Transitions: As shown.

C. Crack and Depression Filler: Latex patching compound that does not require addition of water; DAP "Bondex Flexible Floor Patch and Leveler," or equal.

D. Miscellaneous Materials: As recommended by carpet manufacturer and as selected by installer to meet Project circumstances and requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrates are dry, free of dust and harmful substances, and in satisfactory condition to receive carpeting materials.

B. Perform tests on concrete surfaces as specified in Section 01 4520, "Concrete Moisture Testing," to verify compliance requirements of carpet manufacturer.

C. Perform bond tests to ascertain presence of substances detrimental to obtaining adhesive bond.

3.02 PREPARATION

A. Follow carpet manufacturer's recommendations and instructions to ensure that each substrate is properly prepared to receive type of carpet to be installed.

B. Use subfloor filler to fill cracks, gaps, and depressions and for leveling to required tolerance.

C. Vacuum-clean substrates thoroughly, immediately before installation.

3.03 INSTALLATION OF CARPET TILE

A. General:

1. Apply in accordance with manufacturer's instructions for tile and backing, and requirements of CRI 104.

2. Integrate and blend carpet tiles from different cartons to ensure minimal variation in color match.

3. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

B. Layout: As selected by Owner's Representative from manufacturer's recommended layout options.

C. Apply floor adhesive uniformly to substrate in accordance with manufacturer's instructions.

D. Join tiles snugly together. Continually check that tiles are being placed together with correct firmness.

E. When placing tiles, brush face pile back from edge, and tip tile into place to prevent pile yarns from becoming entrapped in joint.

F. After installation, carpet tiles within a continuous carpet area exhibiting a difference in appearance due to color or light reflectance variation attributed to the manufacturing process shall be selectively relocated or replaced.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's agent shall supervise installation to a point at which he feels that installer is performing satisfactorily.

B. Snugness Testing:

1. Measure distance along ten installed tiles. There should be a 1/4-inch gain in distance along ten installed tiles.

2. If gain is less than 1/4 inch, peaking of tiles can occur. A wide gap between tiles may occur if gain is more than 1/4 inch.

3.05 CLEANING

A. Remove and dispose of trimmings, excess pieces of carpet, and laying materials from each area as it is completed.

B. Vacuum carpet using commercial machine with face-beater element unless otherwise recommended by carpet manufacturer.

C. Remove spots. Replace carpet tiles where spots cannot be removed. Do not get solvent used for cleaning into carpet backing system.

D. Use sharp scissors to remove protruding face yarn.

3.06 PROTECTION

A. Do not allow construction traffic, other than as may be required to fit up specific carpeted area, to traverse completed work.

B. Provide 6-mil-thick polyethylene covering with taped joints or equivalent as necessary to protect carpet from damage from traffic and subsequent construction operations.

END OF SECTION 09 6813

SECTION 09 8200
ACOUSTICAL INSULATION AND SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Batt acoustical insulation at walls.
2. Black-faced, rigid board for installation above wood ceiling.
3. Acoustical sealants and accessories.
4. Sound isolation requirements.

B. Related Requirements:

1. Firestopping: Section 07 8400; mineral fiber firesafing and firestopping sealants.
2. Joint Sealants: Section 07 9200; non-acoustical sealants.
3. Gypsum Board: Section 09 2900.
4. Lay-in Acoustical Panel Ceilings: 09 5113.
5. Wood Ceiling and Wall Panels: Section 09 5426.
6. Acoustical Wall and Ceiling Panels: Section 09 8430.
7. Heating, Ventilating and Air-Conditioning: Division 23; duct insulation.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications for each type of insulation and sealant.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. Credit EQ 4.1: Printed statement of volatile organic compounds (VOCs) for acoustical sealants.

1) Include statement indicating costs for each product.

d. Credit EQ 4.4: Product data from manufacturer of insulating materials stating that they contain no added urea-formaldehyde resins.

1) Include statement indicating costs for each product.

1.04 QUALITY ASSURANCE

A. Comply with Flame Spread Rating and Smoke Density requirements of CBC.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Clearly identify manufacturer, contents, brand name, and applicable standard.

B. Comply with manufacturer's recommendations for handling, storage and protection during installation.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sound-Control Batt: Preformed slag mineral or glass fiber with thermosetting resin binders, formaldehyde free, conforming to ASTM C665, Type I; Owens-Corning "Eco-Touch," or equal.

1. Thicknesses at Wall Cavity: Full thickness, unless otherwise indicated.

2. Surface Burning Characteristics: ASTM E84.

a. Smoke Developed: 50 or less.

b. Flame Spread: 25 or less.

3. Combustibility: Pass ASTM E136.

B. Acoustic Board: Glass fiber board with black, non-woven mat facing fully bonded to core, conforming to ASTM C612, Class 1A, "CertaPro AcoustaBoard Black" by CertainTeed, or equal.

1. Thickness: 1 inch.

2. Density: 3.0 pounds per cubic foot.

3. Fungi Resistance: Pass ASTM C1338.]

4. Surface Burning Characteristics: UL723.

a. Smoke Developed: 50 or less.
b. Flame Spread: 25 or less.

C. Acoustical Sealant: Non-skinning, non-hardening, flexible type designed for sealing gypsum board, and capable of spanning 1/2-inch wide by 3/8 inch deep gaps; USG "Sheetrock Acoustical Sealant," or equal suitable for use at fire-rated partition perimeter conditions.

D. Spray-Applied Sealant: Acrylic latex spray specifically designed for sealing static or minimally dynamic linear joints and gaps in non-rated construction; SpecSeal “Smoke ‘N’ Sound Spray” by Specified Technologies, Inc., or equal.

E. Acoustical Tape: Low-density PVC foam; "Norseal" V-730 Series by Norton Performance Plastics Corp. or equal.

F. Electrical Box Treatment: Coordinate with Division 26, “Electrical.”

1. Manufacturer: Harry A. Lowry & Associates, Sun Valley, CA, 800-225-8231, or equal.

a. Outlet Box Pads: Polybutene-butyl with inert fillers, minimum 1/8-inch thick; Lowry's "Outlet Box Pads."
b. Sealant: Lowry's "Electrical Box Sealer."

2. See Section 07 8400, "Firestopping," for pads and sealant at fire-rated assemblies.

G. Putty Pads: As specified above for outlet box pads.

H. Sealant Backer Rod: Compressible, rod-stock, polyethylene foam; nongassing, polyethylene-jacketed polyurethane foam; butyl-rubber foam; neoprene foam; or other flexible, permanent, durable, nonabsorptive, closed-cell material as recommended for compatibility with sealant by sealant manufacturer.

I. Miscellaneous Fastenings and Accessories: As acceptable to insulation manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION OF ACOUSTICAL BATT INSULATION

A. Install to fill completely all typical and odd spaces in framing where required.

B. Install snugly between framing members. Fit ends snugly between units and against adjacent construction.

C. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations.

D. At door frames, cut additional strips of insulation, and hand-pack as necessary to fill voids thoroughly.

E. Install batt insulation in otherwise uninsulated wall cavities containing plumbing pipes.

3.02 SOUND ISOLATION

A. Sound insulated partitions are shown on the Drawings.

B. Seal sound-insulated partitions airtight with acoustical sealant, in accordance with ASTM C919 and manufacturer's recommendations. Install acoustical sealant at partitions where indicated on the Drawings.

C. Intersections: Hold gypsum board face layer back a maximum of 1/4 inch from floor or other surfaces, and apply a bead of acoustical sealant. Caulk void full and airtight with acoustical sealant. Provide shiplap joint intersections of multi-layer gypsum board applications.

D. Penetrations:

1. Penetrations by conduits, ducts, pipes, and around electrical junction boxes shall be sealed airtight in accordance with the penetration details.

2. Holes smaller than 1 inch shall be filled with gypsum compound.

3. Holes larger than 1 inch shall be patched with layers of gypsum board equal to breached wall construction.

    a. Where concealed, an over-sized surface patch is acceptable.
    b. Where visible, cut both layers back to framing. Where framing does not occur near hole, cut face layer at least 2-inches beyond base-layer to stagger patch joint.
    c. Apply tape and gypsum compound at joints and finish as specified.

4. Backs of electrical junction boxes in acoustically rated construction shall be sealed airtight with specified pads.

E. Stagger base-layer and face-layer joints at least 16-inches horizontally and vertically at multi-layer gypsum board applications. Provide unfinished tape and gypsum compound to base-layer joints and to face-layer joints at scheduled finish level.

F. Coordinate sealing with requirements of Section 09 2900, "Gypsum Board."

G. Where sound-insulated walls are fire rated, follow requirements of Section 07 8400, "Firestopping."

H. Prior to closing walls, obtain observation by Architect of insulation installation.

3.03 PROTECTION

A. Protect installed insulation from physical abuse. Coordinate with Section 09 2900, "Gypsum Board," for prompt installation of gypsum board.

END OF SECTION 09 8200

SECTION 09 9000
PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Painting and painter's finish on all exposed exterior and interior surfaces, except prefinished items and unless otherwise noted, as required to complete finishing of the Work. The Work includes the following specific items:

   a. Visible interior of ductwork.
   b. Electrical Subpanels: Paint to match adjacent wall surface.
   c. Mechanical and plumbing vents on roof.

B. Surfaces Not To Be Painted:

1. Factory-prefinished items including finished metal surfaces.

2. Walls or ceilings in concealed areas and generally inaccessible areas.

3. Moving parts of operating mechanical and electrical units.

4. Code-Required Labels: Keep equipment identification and fire rating labels free of paint.

5. Plastic smoke stops and weather-stripping at doors.

6. Concealed pipes, conduits, cable trays, J-boxes, ducts, and hangers, steel and iron work.

7. Concrete walls and floors at interior and exterior scheduled to receive an applied coating specified under other Sections.

C. Related Requirements:

1. Interior Architectural Woodwork: Section 06 4023; wood handrails and balustrade infill panels.

2. Wood Ceiling and Wall Panels: Section 09 5426; shop-finished plywood panels.

3. Concrete Floor Sealer: Section 09 6120.

4. Graffiti-Resistant Coatings: Section 09 9623.

5. Painting specified elsewhere and included in respective Sections, including but not necessarily limited to shop priming.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination: Perform painting work in proper sequence with work of other trades so as to avoid damage to finished work.

1.03 ACTION SUBMITTALS

A. Product Data: A complete list of materials proposed for use, together with manufacturer's technical information, including paint label analysis and application instructions.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit EQ 4.2: Printed statement of volatile organic compounds (VOCs) for paints and coatings applied inside the weatherproofing.

1) Include statement indicating costs for each product.

C. Samples: Submit for review of color and texture. Provide list of material and application for each coat of each finish sample.

1. Provide samples of each color and material with texture to simulate actual conditions, on hardboard.

2. Provide samples of wood finishes on actual wood surfaces. Label and identify each as to location and application.

3. Duplicate painted finishes of approved samples on actual wall surfaces and components for approval prior to commencing work.

a. Size: Minimum 100 square feet, located where approved.
b. Components: One full component as directed.
c. Simulate finished lighting conditions for review.

d. Location of mockups will be selected by the Owner's Representative.
e. Install mockup using means and methods identical to those that are going to be employed during full production.
f. Allow coating to cure in accordance with manufacturer's written instructions.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of applicator qualifications.

B. Claims concerning unsuitability of specified products.

1.05 CLOSEOUT SUBMITTALS

A. Extra stock: Not required.

B. Specified warranty.

C. Products List: Complete list of materials used on the Project including those resulting from field changes.

1. List to include manufacturer's code, name, lot number, and paint label analysis or formula.

2. List shall be cross referenced to systems and numbers used in the Contract Documents

1.06 QUALITY ASSURANCE

A. Single-Source Responsibility:

1. To the maximum extent practicable, select a single manufacturer to provide all materials required by this Section, using additional manufacturers to provide systems not offered by the selected principal manufacturer.

2. For each individual system:

a. Provide primer and other undercoat paint produced by same manufacturer as finish coat.
b. Use thinner within manufacturer's recommended limits.

B. Applicator Qualifications:

1. Not less than 5 years of documented experience in painting work similar in scope to work of this Project.

2. Maintain a crew of painters who are fully qualified to satisfy requirements of this Section.

C. Field Mockups:

1. Duplicate painted finishes of approved samples on actual wall surfaces and components for approval prior to commencing work.

a. Size: Minimum 100 square feet, located where approved.
b. Components: One full component as directed.
c. Simulate finished lighting conditions for review.
d. Location of mockups will be selected by the Owner's Representative.

e. Install mockup using means and methods identical to those that are going to be employed during full production.
f. Allow coating to cure in accordance with manufacturer's written instructions.

2. Request review by Owner's Representative for color, texture, and workmanship.

3. Modify selected colors, if requested by Owner's Representative, to achieve desired effect.

4. Use accepted surface as the Project standard for each color scheme.

D. Primers:

1. Provide finish coats that are compatible with prime paints used.

2. Review other Sections of these Specifications in which prime paints are to be provided in order to ensure compatibility of total coatings system for various substrates.

3. Upon request, furnish information to other Sections regarding characteristics of finish materials proposed for use.

4. Provide barrier coats over incompatible primers, or remove and re-prime as required.

5. Notify Owner's Representative, in writing, of any anticipated problems arising from using specified coating systems with substrates primed by other Sections.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original, new, unopened packages and containers bearing the manufacturer's name and label and the following information:

1. Name or title of material.

2. Manufacturer's stock number and date of manufacture.

3. Manufacturer's name.

4. Contents by volume for major pigment and vehicle constituents.

5. Thinning instructions.

6. Application instructions.

7. Color name and number.

B. Store materials in tightly covered containers. Maintain containers in a clean condition, free of foreign materials and residue.

C. Store materials at ambient temperature of between 45 degrees F minimum and 90 degrees F maximum, in a well-ventilated area.

D. Ensure that storage area is neat and orderly.

E. Take precautionary measures to prevent fire and health hazards.

F. Waste Management: As specified in Section 01 7419, “Construction and Demolition Waste Management,” and as follows:

1. Coordinate with manufacturer(s) for take-back program for collection of construction scrap, unused material, and packaging material.

2. Where feasible, separate construction waste,and recycling to further utilize waste reduction programs.

G. Comply with additional requirements specified in Section 01 6000, "Product Requirements,” and Section 01 6600, “Material and Equipment.”

1.08 FIELD CONDITIONS

A. Ambient Conditions:

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.

2. Do not apply finish in areas where dust is being generated.

3. Provide lighting level of at least 80 foot-candles, measured mid-height at substrate surface.

4. Provide continuous ventilation and heating to prevent accumulation of hazardous fumes.

B. Protection: Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

1.09 WARRANTY

A. Color and Life of Film:

1. At the end of 1 year, colors of surfaces shall have remained free from serious fading. Variations (if any) shall be uniform.

2. Materials shall have their original adherence at end of 1 year. There shall be no evidence of blisters, running, peeling, scaling, chalking, streaks, or stains at end of this period.

1.10 EXTRA MATERIALS

A. At completion of the Work, deliver to Owner extra stock of paint of each color used in each coating material used.

B. Containers shall be full, tightly sealed, and clearly marked.

C. Provide the following quantities:

1. Field Colors: One 5-gallon container.

2. Accent Colors: One 1-gallon container.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Products are specified under "Paint Systems" in Part 3 below as the basis of design are manufactured by PPG Glidden Professional except as otherwise indicated. Equivalent first-line, architectural grade, certified zero VOC products manufactured by American Formulating and Manufacturing (AFM), Benjamin Moore, Dunn-Edwards, Vista, or equal are acceptable.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer or shall be acceptable to manufacturer of finish coating for system.

C. If more than one quality level of product type is marketed, use material of highest quality.

2.02 PERFORMANCE CRITERIA

A. Paints and coatings used shall be certified according to the latest “Green Seal Environmental Standard for Paints” (GS-11), Green Seal, Inc. Restricted chemical compounds as defined by the latest GS-11 shall not be used as ingredients in the manufacture of the product.

B. Coatings, primers and undercoats shall satisfy the South Coast Air Quality Management District Rule 1113 for architectural coatings.

2.03 COLORS

A. Owner’s Representative will prepare a color schedule with samples for guidance of painter and reserves right to select, allocate, and vary colors on different surfaces throughout building.

1. Colors selected by Owner’s Representative may be from manufacturer's standard palette or be custom mixed.

B. Submit samples of selected colors as specified in Part 1 above.

C. Colors of paints, including shades of stain, shall match color chips on schedule.

D. Areas or surfaces indicated as black, either on the Drawings or in the Specifications, shall be so painted, unless specifically directed otherwise.

2.04 MIXING AND TINTING

A. Deliver paints and stains ready mixed to jobsite.

B. Accomplish job mixing and job tinting only if required for adjustment to finish applied to field test areas to achieve color acceptable to Owner’s Representative.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence, or quality of work and that cannot be put into acceptable condition through preparatory work as included in Article 3.2, "Preparation."

B. Do not proceed with surface preparation or coating application until conditions are suitable.

3.02 PREPARATION

A. General:

1. Broom-clean rooms and spaces before commencement of the work.

2. Verify that surfaces to be painted are dry, clean, smooth, and free from deleterious materials.

3. Protect hardware, nameplates, switch plates, lighting fixtures, stainless steel, aluminum, and other surfaces that are not to be painted by masking, removal, or by other means to ensure a neat job.

4. Locate and install scaffolding and staging so as not to interfere with the work specified in other Sections.

B. Wood - General:

1. Cleaning and Sanding:

a. Remove handling marks and effects of exposure to moisture with a thorough, final sanding over all exposed surfaces, using 150-grit or finer sandpaper.
b. Clean and vacuum before applying sealer or finish.

2. Wood to Receive Transparent Finish:

a. Remove any material that would adversely affect penetration or appearance of finish.

C. Gypsum board shall be prepared and finished for painting as specified in Section 09 2900, "Gypsum Board."

D. Metals:

1. Remove mill scale, rust, and corrosion.

2. Clean oils, grease, and dust from surfaces.

3. Touch up chipped or abraded areas in shop coatings, using appropriate primer.

4. Soluble Salts: Removal of soluble salts from bare metal and galvanized metal surfaces, both interior and exterior, is required prior to application of primer coats to preclude pre-mature coating failure and accelerated corrosion.

a. Removal shall be in accordance with SSPC-Guide 15, “Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.”
b. Abrasive blasting, where specified as a required surface preparation procedure, shall be performed after removal of soluble salts. Abrasive blasting is not an acceptable procedure for removal of soluble salts.

E. Exposed Metal Deck:

1. Galvanized surfaces shall be cleaned and free of oils, grease, dust, and other contaminants that will inhibit adhesion of field applied paint.

2. Surface shall be tested for presence of any after galvanizing" treatment or “passivator” using a solution of copper sulfate or other acceptable method.

    a. If a “passivator” is not present, clean surfaces in accordance with SSPC SP-1 and then chemically etch using Henkel “Galvaprep 5,” or equal, or brush blast in accordance with ASTM D6386.
    b. If a “passivator” is present, prepare surfacing by brush-off blasting in accordance with ASTM D6386 or other environmentally acceptable method capable of removing the “passivator” unless removal is not required by dry fall coating manufacturer.
    c. Documentation verifying acceptance of the prepared surface by dry fall coating manufacturer is required.

F. Ductwork: Clean visible galvanized portion of ductwork interiors with solvent, and wipe clean.

G. Cementitious Surfaces:

1. Prepare by removing efflorescence, chalk, dirt, grease, oils, and by roughing as required to remove glaze.

2. Determine alkalinity and moisture content of surfaces to be painted.

3. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, neutralize before application of paint.

4. Do not paint over surfaces where moisture content exceeds manufacturer's printed directions.

H. Surfaces that cannot be prepared or painted as specified shall be immediately brought to the attention of the Owner’s Representative, in writing.

1. Starting of work without such notification will be considered acceptance by the Contractor of surfaces involved.

2. Replace unsatisfactory work caused by improper or defective surfaces, as directed by Owner’s Representative.

3.03 FACTORY FINISHING AND PRIMING

A. Pertinent Work and Requirements Specified Elsewhere: Review all Sections for products that are to be factory finished or factory (shop) primed.

B. Touch-up: Touch up abrasions in prime coat immediately after products arrive on jobsite and as required prior to application of finish coats.

3.04 APPLICATION

A. Shop-fabricated and finished metal and millwork items shall be shop spray finished to the greatest extent possible.

B. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.

C. Application:

1. Apply paint with suitable brushes, rollers, or spraying equipment.

2. Stairs, guardrails, steel doorframes, and other exposed metal requiring field finish painting shall be sprayed to the fullest extent conditions will permit. If brush or roller application is used, surface finish shall be subject to review by the Owner's Representative for complying with the appearance requirements specified herein.

3. Apply coatings in accordance with manufacturer's recommendations.

4. Rate of application shall be within limits recommended by paint manufacturer for surface involved.

D. Spray-Gun Application - Standard Coatings:

1. Spray-apply standard paints only with airless sprayer.

2. Apply in fine, even spray, without addition of thinner, using nozzle pattern suitable to surface being painted.

3. When necessary, follow by brushing to ensure uniform coverage and to eliminate wrinkling, blistering, and air holes.

4. If spraying becomes detrimental to equipment or objectionable to personnel, brush painting will be required.

E. Comply with recommendation of product manufacturer for drying time between succeeding coats.

F. Finish coats shall be smooth and free from brush marks, streaks, laps or pileup of paints, and skipped or missed areas.

G. Leave all parts of moldings and trim clean and true to details with no undue amount of paint in corners and depressions.

H. Make edges of paint adjoining other materials or colors clean and sharp, with no overlapping.

I. Refinish whole area where portion of finish is not acceptable.

J. Equipment adjacent to walls shall be disconnected, using workmen skilled in appropriate trades, and moved to permit wall surfaces to be painted. Following completion of painting, they shall be expertly replaced and reconnected.

K. Top and bottom edges of all doors to be field painted shall receive same paint system finish required for door faces.

L. Paint visible surfaces behind vents, registers, or grilles flat black.

1. Prepare exposed metal as specified, then prime and paint as scheduled.

2. Spray-paint wherever practicable.

M. Do not paint over fire-rating labels, fusible links, or sprinkler heads.

N. Exposed Plumbing and Mechanical Items: Items without factory finish such as conduits, pipes, access panels, and items of similar nature shall be finished to match adjacent wall and ceiling surfaces, unless otherwise directed.

3.05 CLEANING

A. Touch up and restore finish where damaged.

B. Remove spilled, splashed, or spattered paint from all surfaces.

C. Do not mar surface finish of item being cleaned.

D. Leave storage space clean and in condition required for equivalent spaces in Project.

3.06 CLEAN-UP, PROTECTION AND REPAIR

A. Clean-up: During progress of work, remove discarded paint materials, rubbish, cans and rags from site at end of each work day.

1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Owner's Representative.

1. Provide "Wet Paint" signs to protect newly-painted finishes.

2. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced painted surfaces.

3.07 PAINT SYSTEMS

A. General:

1. Only major areas are scheduled, but miscellaneous and similar items and areas within room or space shall be treated with suitable system.

2. This Specification shall serve as guide and is meant to establish procedure and quality. Confer with the Owner's Representative to determine exact finish desired.

3. Number of coats scheduled is minimum. Additional coats shall be applied at no additional cost as required to hide base material completely, produce uniform color, and provide required and satisfactory finish.

B. Acceptance of Final Colors: Final coat of paint for both exterior and interior shall not be applied until colors have been accepted by the Owner's Representative.

C. Gloss and Sheen Ratings: Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following limits in conformance with Master Painters Institute, Inc. (MPI) Standards according to ASTM D523. Not all of the Gloss Levels listed are necessarily scheduled or used on this Project.

1. Gloss Level 1: Matte or Flat; not more than 5 units at 60 degrees and 10 units at 85 degrees.

2. Gloss Level 2: Velvet or Low Sheen; not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.

3. Gloss Level 3: Eggshell; 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.

4. Gloss Level 4: Satin; 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.

5. Gloss Level 5: Semi-gloss; 35 to 70 units at 60 degrees.

6. Gloss Level 6: Gloss; 70 to 85 units at 60 degrees.

D. Clarification of System Terminology:

1. Interior paint Systems are specified and identified herein by initial letters “INT.”

2. Exterior paint Systems are specified and identified herein by initial letters “EXT.”

3. The numbers following “INT” and “EXT” for each System identifies the substrate to be coated.

4. Letter following substrate numbers identify the general finish coat chemistry summarized as follows:

CODE	DESCRIPTION
A	Standard acrylic
B	Dryfall acrylic
H	Aliphatic acrylic polyurethane
K	Clear urethane polymer
M	Premium performance acrylic polymer
Q	Clear acrylic urethane

5. Hyphenated suffix identifies the topcoat gloss levels.

E. Interior Painting Systems:

INT 5.1A-5
Standard Performance Acrylic on Shop Primed Metal - Gloss Level 5

2	coats	LM9200 “Dulux Lifemaster”	Acrylic Semi-Gloss

INT 5.3A-5
Standard Performance Acrylic on Galvanized Metal - Gloss Level 5

1	coat	4020-1000	DTM Metal Primer-Red
2	coats	LM9200 “Dulux Lifemaster”	Acrylic Semi-Gloss

INT 5.1M-5
Premium Performance Acrylic on Metal - Gloss Level 5

Surface Preparation and Shop Primer		As specified in Section 05 7000, "Decorative Metal"
1 coat	Tnemec Series 1029 "Enduratone"	High dispersion pure acrylic polymer applied 2.0 to 3.0 mils DFT

Note: Provide additional topcoat if required to achieve complete hiding.

INT 5.3B-2
Dry Fall Waterborne Acrylic on Pre-primed Galvanized Metal Decking

1 coat	Tnemec "Uni-Bond DF"	Hydrophobic Acrylic

Notes: Tint to match scheduled color.
Apply using low-pressure airless sprayer in accordance with manufacturer's instructions including DFT, environmental conditions, and dry fallout distance.
Apply additional coats if required to provide complete hiding.

INT 6.3K-4
Clear Waterborne Urethane on Paneling and Millwork – Gloss Level 4
As specified in Section 06 4023, "Interior Architectural Woodwork."

INT 9.2A-1
Acrylic on Gypsum Board - Gloss Level 1

1 coat	"Lifemaster" 9116-1200	Vinyl Acrylic Primer
2 coats	"Lifemaster" 9100-XXXXN	Acrylic Flat

INT 9.2A-3
Acrylic on Gypsum Board – Gloss Level 3

1 coat	"Lifemaster" 9116-1200	Vinyl Acrylic Primer
2 coats	"Lifemaster" 9300-XXXX"	Acrylic Eggshell

F. Exterior Painting Systems:

EXT 3.1Q-1
Acrylic on Concrete - Gloss Level 1

1 coat	AFM "Safecoat WaterShield"	Waterborne Acrylic Polymer

EXT 5.1A-5
Acrylic on Shop Primed Ferrous Metal - Gloss Level 5

2 coats	"Fortis 350" 2406-XXXXV	Acrylic Semi-gloss

EXT 5.1H-5
High-Performance Acrylic Polymer over Epoxy on Shop Primed Decorative Metal, Gloss Level 5

Pretreatment		As specified in Section 05 7000, "Decorative Metal"
1 coat	Tnemec 27WP	Two-component, water-based epoxy tinted to match color of topcoat (if primer not shop applied)
1 coat	Tnemec Series 1029	High dispersion acrylic polymer

Note: Provide additional topcoat if required to achieve manufacturer's recommended total DFT (primer plus finish coats), or to achieve complete hiding for selected color.

EXT 5.3A-5
Acrylic on Galvanized Metal - Gloss Level 5

Pretreatment (SSPC SP-1)	Devprep 88	Heavy-duty cleaner (if not shop primed)
1 coat	Devoe “Devflex” 4020PF	Primer (if not shop primed)
2 coats	“Fortis 350” 2406-XXXXV	Acrylic Semi-gloss

END OF SECTION 09 9000

SECTION 09 9623
GRAFFITI-RESISTANT COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Non-sacrificial, high-performance, protective general maintenance and anti-graffiti coating at exterior exposed concrete and metal panels at locations shown on the Drawings.

B. Related Requirements:

1. Mockups: Section 01 4339.

2. Cast-in-Place Concrete: Division 03.

3. Metal Wall Panels: 07 4243.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

B. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. Closeout Submittals shall be submitted in accordance with Section 01 7836, “Guarantees,” and Section 01 7839, “As-Built Documents.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications, installation instructions, and general recommendations for specified coating materials. Include instructions and recommendations for cleaning and preparation of concrete surfaces, coating and recoating application techniques, equipment to be used, coverage rates, accessory materials, and special removal procedures.

B. Samples: 12-inch-square of metal panel with graffiti-resistant coating, with coating applied to half of each sample.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of applicator qualifications.

B. Letter documenting work has been applied in compliance with specifications and manufacturer's written instructions and that specified field testing has been satisfactory.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranty.

B. Maintenance materials.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Approved in writing by the manufacturer with documented experience in application of similar graffiti-resistant coatings.

B. Mockup:

1. Treat and evaluate a minimum eight square foot area of completed metal wall panel prepared for the off-site mockup as specified in Section 01 4339, “Mockups.

2. Apply coating to mockup to verify surface preparation and compatibility with shop-applied higher performance coating on the metal panels.

3. Remove graffiti applied to an area of the mockup using products and procedures recommended by the graffiti-resistant coating manufacturer and to the satisfaction of the Owner’s Representative.

4. Application on completed building metal panels shall not proceed unless mockup is acceptable to Owner’s Representative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials at site in protected location, and away from flame, excessive heat, at temperatures above 50 degrees F.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements,” and Section 01 6600, “Material and Equipment.”

1.08 FIELD CONDITIONS

A. Do not apply specified coatings when surfaces or ambient air temperature is below 45 degree F or over 90 degrees F or otherwise outside the limits required by the coating manufacturer.

1.09 MAINTENANCE

A. At completion of the Work, deliver to Owner specified cleaning and application solution sufficient to clean and recoat a minimum of 500 square feet of coated wall surface.

B. Stock shall be in factory sealed and clearly labeled containers.

C. Stock shall be delivered and stored as requested by the Owner.

1.010 WARRANTY

A. Manufacturer: Provide Owner with manufacturer’s written limited warranty, signed by the manufacturer, agreeing to repair or replace work that exhibits defects in materials or workmanship. Defects are defined to include failure to withstand complete graffiti removal, ghosting, shadowing, chemical stain, yellowing, and normal environmental effects.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

A. The coating shall not darken, stain, or discolor substrate surfaces.

B. The coating shall be non-yellowing.

2.02 MATERIALS

A. Graffiti-Resistant Coating: Zero VOC, 2-part, water based, aliphatic polyurethane designed for anti-graffiti applications; “GCP 1000” by Geneis Coatings, Inc., 800-533-4273, or equal listed in "MPI Approved Products List" for non-sacrificial anti-graffiti coatings.

B. Application Equipment: Medium-to-large-capacity airless sprayer and hoses or other equipment as recommended by the coating manufacturer for each surface, conditions of application, and used on accepted mockup.

C. Graffiti-Removal Cleaners: Nontoxic remover as provided by graffiti-resistant coating manufacturer and designed to clean graffiti from painted and porous surfaces.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are dry, clean, and free of dust, dirt, grime, oils, alkali or acid residues, and other contaminants or compounds unacceptable to the graffiti-resistant coating manufacturer.

3.02 PREPARATION

A. Clean and prepare substrates in accordance with graffiti-resistant coating manufacturer's instructions.

B. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk.

1. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

2. Contractor shall allow for the application of a sealer coat to concrete surfaces if required to control pH or eliminate potential pinholes.

3. Testing before Application: At least one test shall be carried out before application of materials to ensure that:
   a. surface moisture conditions of concrete satisfy the manufacturer’s recommendations;
   b. moisture content of concrete is free of water back pressure to satisfy the manufacturer’s recommendations.

C. Cover and protect adjacent surfaces not to receive coating from spillage, or blow-over if spray application is used.

3.03 APPLICATION

A. Apply graffiti-resistant coating following manufacturer's recommendations and procedures for each surface type and as used on the accepted mockup.

B. Do not exceed the manufacturer's recommended wet-film thickness. The wet film thickness shall be checked in accordance with ASTM D4414.

C. Avoid runs or applying coating to heavily to avoid impairing transparency of cured material. Runs or sags on masonry surface shall be immediately brushed out using a clean soft brush.

D. Immediately clean spillage from adjacent surfaces immediately after spillage. Correct any damage by cleaning as acceptable to the Owner's Representative.

3.04 ADJUSTMENT

A. If the coating is too thin, shows evidence of having been applied under unfavorable conditions, the workmanship is poor, or the specified requirements are not fulfilled, the surface shall be re-treated to the extent required by the Owner's Representative at no additional cost to the Owner.

END OF SECTION

SECTION 10 1100
MARKER AND TACK BOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wall-mounted full-height porcelain enamel marker boards.
2. Door-mounted framed porcelain enamel marker boards.
3. Fabric-wrapped wall-mounted and framed tack boards.
4. Hardware and accessories for complete installation.

B. Related Requirements:

1. Miscellaneous Rough Carpentry: Section 06 1053; wood backing.
2. Non-Structural Metal Framing: Section 09 2216; metal backing.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

B. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."
2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."
3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings:

1. Provide dimensioned elevations of each configuration of marker and tack board.
2. Show joint locations where required by layout or board size.
3. Show sections of trim members; key to elevations.
4. Show anchors, grounds, reinforcement, and accessories.
5. Show layout and installation details.

B. Product Data:

1. Manufacturer's technical data for marker boards, tack boards, aluminum trim, and magnetic chalk trays.

2. Manufacturer's installation and breaking-in instructions for porcelain enamel.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

c. Credit EQ 4.1: Printed statement of volatile organic compounds (VOCs) for adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

d. Credit EQ 4.4: Product data from manufacturer of composite wood and agrifiber materials stating that they contain no added urea-formaldehyde resins.

1) Include statement indicating costs for each product.

D. Samples:

1. Marker Boards: 5 by 8 inches, full thickness, illustrating core, backing, and porcelain enamel color and finish.

2. Tack Boards: 5 by 8 inches, full thickness, illustrating cork, backing, fabric facing, and wrapped square edge.

3. Trim: Each profile, minimum 8 inches long, complete with concealed mounting components and clips. Trim sample shall be applied to two edges of each board sample showing mounting and corner condition.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturer's certification that materials furnished comply with specified requirements.

1.05 CLOSEOUT SUBMITTALS

A. Manufacturer's cleaning and maintenance instructions covering both routine (daily or weekly) and long-term (yearly or longer) operations.

B. Extended warranty.

1.06 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Marker boards shall conform to CCR, Title 19, Article 42.

1.07 FIELD CONDITIONS

A. Environmental Requirements: Install boards only when interior air and substrates have reached equilibrium moisture and temperature approximating that of normal occupied conditions.

B. Take field measurements prior to shop fabrication where necessary in order to ensure proper fitting of work.

1.08 DELIVERY AND STORAGE

A. Wrap or otherwise package boards and components for protection against damage during shipment and storage.

B. Store porcelain enameled steel panels on edge in a manner to prevent bowing, warping, or other irregularities.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.09 WARRANTY

A. Manufacturer: Furnish manufacturer's written 20-year warranty agreeing to replace boards that do not retain their original writing and erasing qualities, that become slick and shiny, or that exhibit crazing, cracking, or flaking, provided manufacturer's instructions with regard to handling, installation, protection, and maintenance have been followed.

1. Replacement may be limited to material replacement only.

2. Labor for removal and reinstallation may be excluded.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Marker Board Cover Coat Finish: Gloss from wear test.

1. Test equipment shall consist of a machine designed to slide a loaded eraser with reciprocal motion in a straight line across specimen with strokes 12 inches long at 35 cycles per minute, eraser by Weber Costello or equal loaded with a 7-1/2-pound steel block, and abrasive of precipitate chalk (calcium carbonate, CP).

2. Surface of eraser shall be charged with abrasive at beginning of each test period. Fresh abrasive shall be added each hour during test.

3. Subtract measured 60-degree gloss of surface before testing from measured 60-degree gloss of surface after testing. Report difference as increase in gloss.

B. Marker and tack boards shall have a Class A (1) fire rating.

2.02 MANUFACTURER

A. Acceptable Manufacturers: Claridge Products and Equipment Company, PolyVision Corp., Platinum Visual Systems, or equal

2.03 FIXED MARKER BOARDS

A. Board: Porcelain writing surface manufactured specifically for use with liquid marker systems.

1. Basis of Design: "Marker Wall" with "LCS" panels by Claridge Products and Equipment Company.

2. Size and Configuration: Custom, as shown on the Drawings and approved shop drawings.

3. Surface shall be magnetic.

4. Multiple panels shall butt together with splined joints at wall locations to form continuous writing surface.

B. Construction: Balanced, high-pressure-laminated, 3-ply construction with facing sheet, core, and backing; meeting the following requirements.

1. Facing Sheet: Enameling grade steel sheet coated on exposed face with three-coat process of primer, ground coat, and color cover coat, and on concealed face with two-coat process of primer and ground coat with ground coat and cover coat fused to steel at firing temperatures standard with manufacturer but not less than 1,200 degrees F (649 degrees C).

a. Facing Sheet Thickness: Minimum 20 gage.
b. Cover Coat Finish: Manufacturer's low gloss writing surface intended for use with liquid chalk markers and suitable for projection and writing surface where indicated; Claridge "LCS II," or equal.

1) Color: To be selected by Owner's Representative.

2. Core: 7/16 inch thick manufactured from 100 percent reclaimed or recycled wood fiber, including 3 percent post-consumer wood fiber, and with no added urea-formaldehyde resins; Claridge "Duracore," or equal.

3. Balance porcelain writing surface with aluminum sheet backing. Aluminum foil is not acceptable.

4. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

C. Perimeter Trim: Aluminum, as specified.

1. Provide at entire perimeter at door-mounted boards; profile as selected by Owner's Representative.

2. Provide at top and bottom of full-height wall mounted boards; Claridge #1016, or equal.

2.04 TACK BOARDS

A. Board: Pure grain natural fine-grained, dense, self-healing cork at least 1/4 inch thick (without burlap backing) on 1/4 inch hardboard backing; "Designer Fabric" by Claridge Products and Equipment Company, or equal

1. Size and Configuration: Custom, as shown on the Drawings.

2. Joints:

a. Locate where required by board length and shown on approved shop drawings.
b. Profile: Square butt with fabric facing wrapping edge.

3. Facing: Manufacturer's polyester stain resistant fabric.

a. Color and Pattern: As selected by Owner's Representative.

B. Perimeter Trim: Aluminum, as specified.

2.05 ALUMINUM TRIM AND ACCESSORIES FOR MARKER AND TACK BOARDS

A. Material: Aluminum; 6063-T5 alloy extrusions.

1. Finish: Clear anodized, AA designation M12C22A31.

2. Provide trim in single lengths wherever possible, otherwise keep joints to a minimum.

B. Frames (Trim): Extruded aluminum of at least 0.062 inch wall thickness, concealed fastening.

1. Framed Units: Fabricate one piece units without joints unless sizes indicated are not available as one piece units.

2. Multiple Units: Provide joints located as approved by Owner's Representative; concealed splice joints typical.

3. Factory fabricate as single units, except where too large for shipping.

4. Provide trim in single lengths wherever possible, otherwise keep joints to a minimum.

C. Magnetic Marker Trays: Manufacturer's standard ribbed section, solid extrusion with exposed ends smoothly curved; "Magtray" by OptiMA Inc., or equal.

1. Length: As selected by Owner's Representative from manufacturer's standard lengths.

2. Provide one tray for each wall layout.

D. Attachment Hardware: Manufacturer's standard fully concealed attachment system for securing units to wall surfaces.

E. Additional Accessories: As selected by Owner's Representative and typically available from manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are true and plumb, and that backing is in place. Correct inadequate substrates before installation of boards.

B. Verify that moisture and temperature levels of substrate and environment have stabilized.

3.02 INSTALLATION

A. Install boards in location and at mounting heights or full height as indicated and in accordance with manufacturer's mounting instructions.

1. Keep perimeter lines straight, plumb, and level.

2. Join parts with a neat, precise fit.

B. Joints are not permitted in boards less than 12 feet long.

C. Aluminum Trim:

1. Provide neat, tightly closed, bend-around mitered corners spliced only if over 16-foot lengths with no single piece less than 4 feet long.

2. Fasten to walls with concealed fasteners as recommended by manufacturer.

D. Multiple Units: Provide flush, butt, hairline joints to ensure a smooth writing surface between whiteboards.

3.03 PROTECTION

A. Cover completed work with plastic sheet or other covering recommended by manufacturer.

B. Protect boards from damage until acceptance by Owner.

END OF SECTION 10 1100

SECTION 10 1400
SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General requirements for signage as indicated complete with attachment devices and accessories as required for complete installation including:

1. Code required signage.

2. Exterior building identification.

3. Glass-mounted decal entry signs for accessibility.

B. Related Requirements:

1. Fire Protection Specialties: Section 10 4400; fire extinguisher cabinet graphics.

2. Electric Traction Elevator: Section 14 2100; elevator fire signage.

3. Drawing G0.4: Signage diagrams.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, “Guarantees,” and Section 01 7839, “As-Built Documents.”

B. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1.03 ACTION SUBMITTALS

A. Shop Drawings:

1. Full-scale drawings for each sign indicating materials, lettering layout, and colors.

2. Large-scale drawing and details of custom logo and lettering. Include mounting details.
   a. Include plans, elevations, and large-scale sections of typical members and other components.
   b. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

B. Product Data: Furnish manufacturer's literature and indicate each sign type, style, color, and method of attachment.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. EQ 4.1: Printed statement of volatile organic compounds (VOCs) for adhesives and sealers applied inside the weatherproofing.

1) Include statement indicating costs for each product.

D. Samples:

1. Appropriately label and identify each sample.

2. Color Verification:

a. Size: Not less than 6-inches square.
b. Samples shall be prepared on same base material to be used in fabrication.

3. Submit one sample of each sign type.

a. Interior signs shall be full size.
b. Plaques may be 6-inches x 6-inches with lettering from prior similar work.
c. Acceptable full-size samples may be installed as part of the work.

4. Only one individual letter, for each size and type face, of exterior building identification signage shall be submitted.

E. Sign Schedule: Use same designations specified or indicated on Drawings and coordinated with shop drawings.

1.04 CLOSEOUT

A. Extended warranty.

1.05 QUALITY ASSURANCE

A. Contractor shall assure that the vendor shall be responsible for the quality of materials and workmanship of any firm acting as the vendor's subcontractor.

B. Furnish products of a single manufacturer for all sign types and graphic image processes indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver signs safely packed to prevent damage during shipment. Package separately or in like groups of names, labeled as to names enclosed; include installation template, attachment system and installation instructions.

1.07 FIELD CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication. Indicate measurements on shop drawings.

1.08 WARRANTY

A. Contractor: Furnish a written extended 5-year guarantee for signage against all defects in materials and workmanship, including without limitation against yellowing, cracking, crazing, and other visible and performance defects.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Unless otherwise specified or shown, signage shall conform to the following standards and publications:

1. ANSI A-117.1 and the Americans with Disabilities Act (ADA) Standards.

2. The Architectural and Transportation Barriers Compliance Board (ATBCB) Design Guidelines for Signage in relation to the Americans with Disabilities Act.

3. California Code of Regulations, Titles 19 and 24. California Grade 2 Braille shall be used whenever Braille symbols are specifically required. Refer to CBC Section 1117B.5.2. All signage shall conform to CBC Sections 1111 1115B and 1117B.5.

4. Uniform Sign Code.

2.02 MATERIALS - GENERAL

A. General: Not all materials required for fabrication of signage are specified and not all specified materials will necessarily be required.

B. Mounting Tape: Double sided acrylic adhesive closed cell urethane; 3M Series A20, #4016, or equal.

C. Metal Finishes:

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

3. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples and are assembled or installed to minimize contrast.

2.03 MATERIALS FOR CODE REQUIRED AND ROOM IDENTIFICATION SIGNAGE

A. Standard of Design: ASI, "In-Tac Eco" system, or equal.

B. Sign Face: Class A (ASTM E84), wood-based product consisting of 70 percent virgin wood fiber produced from renewable sources, and is recyclable/reusable.

1. Thickness: 0.25 inches (0.635 mm).

2. Certifications:

a. GEI GREENGUARD Indoor Air Quality Certified.
b. GREENGUARD Children & Schools SM Certified.

3. Finish: Matte, non-glare; ADA compliant; graffiti-resistant.

4. Material Edges: Black.

C. Applied Lettering and/or Numerals: Made from agri-based plant bio-polymer product consisting of a plant material with starches removed.

1. Thickness: 0.03125 inches (0.79375 mm).

2. Copy Color: Painted; color as selected by Owner’s Representative from Pantone Matching System (PMS).

D. Braille Application: Precisely formed, uniformly opaque to comply with relevant ADA regulations and the requirements indicated for size, style, spacing, content, positions and colors

1. Braille to be relieved 1/32 inch minimum from plaque surface by manufacturer's photomechanical stratification processes.

2. Translation of sign copy to be the responsibility of the manufacturer.

E. Colors: As selected by Owner’s Representative from the manufacturer's high contrast standards.

1. Surface Texture: Matte.

2. Adhesive: Non-VOC adhesive as recommended by sign manufacturer.

2.04 CODE REQUIRED SIGNAGE

A. Material and Mounting: See above.

B. Size and Layout: As shown on Drawings and as required by Code.

C. Text: As required by Code.

2.05 ROOM NUMBERS AND IDENTIFICATION

A. Material and Mounting: See above.

B. Size and Layout: As shown on Drawings and as required by Code.

C. Text: As provided by the Owner's Representative for each room name.

2.06 BUILDING ID SIGNAGE LANGUAGE

A. Material: Stainless steel.

B. Face Finish: Satin brushed, No. 4.

C. Edge Finish: Polished.

D. Mounting: Pin mounted, held off bottom or rear surface as shown.

E. Type Style and Spacing: To be finalized by Owner's Representative and in accordance with approved in shop drawings.

F. Building Numerical Address: "1810."

1. Dimensions: 8 inches high by 3/8 inch deep.

2. Location: East Elevation where indicated.

G. Text: "JACOBS HALL."

1. Dimensions: 12 inches high by 3/8 inch deep.

2. Locations: East and West Elevation, over Lobby Doors.

2.07 FABRICATION - GENERAL

A. Fabricate signage to remain flat under installed conditions.

B. Fabricate with smooth, mechanically finished edges. Ease corners slightly for plastic signs.

C. Graphic Elements for Plaques: All text and symbols shall be thermoformed acrylic panels with integrally raised text, braille and other graphics. Applied elements are not acceptable.

D. Attachment Method: Concealed fasteners or mounting tape as recommended by sign manufacturer for mounting signs on substrates involved. Do not use exposed fasteners unless specifically noted Drawings or accepted by the Owner's Representative.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which signage is to be installed.

B. Beginning installation signifies acceptance of substrates and conditions.

3.02 INSTALLATION

A. General:

1. Use concealed mounting in compliance with manufacturer's written recommendations.

2. Install signs level and plumb at height indicated, with sign surfaces free from distortion or other defects in appearance.

3. Locate signage where shown and scheduled. Where location is not shown, locate as selected by University Representative or required by code.

B. Plaques: Mount to wall and door surfaces with specified mounting tape.

C. Dimensional Characters:

1. Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, supporting construction, and condition of exposure indicated.

2. Mount characters at projection distance from wall surface using stainless steel spacers.

3. Locate with spacing based on full size computer generated installation drawings on heavy paper template to establish character spacing and to locate holes for fasteners.

4. Location shall be finalized in field by University Representative based on full size drawings.

D. Applied Copy Signs and Graphics:

1. Examine surfaces and construction for conditions adversely affecting installation, performance and quality of work.

2. Apply signage and graphics centered and level, in line, in accordance with manufacturer's recommendations.

3.03 CLEANING AND PROTECTION

A. At completion of installation, clean soiled surfaces in accordance with the manufacturer's instructions.

B. Protect signage from damage until acceptance by the Owner.

3.04 SIGNAGE SCHEDULE

A. Refer to information on the Drawings.

END OF SECTION 10 1400

SECTION 10 2113
PHENOLIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SUMMARY

1. Floor-supported, overhead-braced, solid phenolic toilet partitions.

2. Wall-hung solid phenolic urinal screens.

B. Related Requirements:

1. Miscellaneous Rough Carpentry: Section 06 1053.

2. Non-Structural Metal Framing: Section 09 2216.

3. Tiling: Section 09 3000.

4. Toilet Accessories: Section 10 2813.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Show elevations of partitions with relationship to adjacent construction, full-size sections, attachment to other work, details of construction, hardware, and other related items and installation details.

B. Product Data: Manufacturer's data sheets for partition and screen components, parts list, installation instructions, and maintenance procedures.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

D. Samples:

1. 6-inch-square or larger sample of panel corner, showing core, edge treatment, and corner treatment.

2. Hardware samples if requested by Owner's Representative.

1.04 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.05 QUALITY ASSURANCE

A. Conform to ANSI A117.1 code for accessibility.

B. Brace partitions to structure as required to meet seismic code.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from damage during handling and storage on site; work showing dents, deformations, or other defects will not be accepted.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.07 FIELD CONDITIONS

A. Coordinate with placement of support framing and anchors in walls. Furnish inserts and anchoring devices that are required to be built into masonry. Coordinate delivery with other work to avoid delay.

1.08 WARRANTY

A. Manufacturer: Provide Owner with manufacturer's written 10-year warranty agreeing to repair or replace partitions and hardware that fail in materials or workmanship. Failure includes but is not limited to corrosion, warpage, breakage and delamination.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Toilet Compartment System: Phenolic; "Color Thru" by Global Partitions Corp. as specified, or equal.

1. Color: #7450C, “Persian Blue.”

B. Toilet Enclosure Style: Floor-supported, overhead-braced.

C. Urinal-Screen Style: Wall hung flat panel.

2.02 MATERIALS AND COMPONENTS

A. Panels, Pilasters, and Doors: Water-resistant, nonabsorbent, solid phenolic formed by fusing multiple sheets of resin-impregnated Kraft paper at high temperature and pressure.

1. Phenolic core color shall be the same as the surface sheets.

2. Panels shall not have visible glue lines or seams.

3. Minimum Finished Thickness:

a. Panels: 1/2 inch.
a. Pilasters: 3/4 inch.
b. Doors: 3/4 inch.

4. Panel Edge Treatment: Finished and polished.

B. Hardware and Fittings: Extra-heavy-duty stainless steel.

1. Wall Brackets: 1 Stirrup or two-ear "T" style, 1-inch stock. Angle may be used where "T" style will not fit in space available.

2. Door Hardware:

a. Continuous Piano-Type Hinges: Self-closing, swing as indicated, gravity-return movement, adjustable to hold door open.
b. Latch: Combination rubber-faced door strike and keeper, equipped for accessible and emergency access.
c. Coat Hook: Combination unit with hook and rubber-tipped pin; mounted 48 inches above finish floor.
d. Door Pull: Inswing-door type on inswinging doors, outswing door type on outswinging doors. Install on both sides, below latch, of door to accessible compartments.
e. Hardware shall be ADA and accessibility compliant.

C. Pilaster Shoes: Stainless steel plinths, one piece, 3 inches high, hemmed top and bottom, formed to fit pilaster, with concealed clips.

1. Coat Hook: Combination unit with hook and rubber-tipped pin. Provide on inside of each compartment door in accordance with Title 24, Sec. 5-912.

2. Hardware shall be ADA accessibility compliant.

D. Headrail shall be provided to bridge all compartments and brace the end freestanding pilasters to the wall; anodized aluminum with satin finish, contoured to provide anti-grip features.

E. Fasteners: As recommended by partition manufacturer and the following:

1. Use through-bolted stainless steel hardware to attach panel-to-stile brackets, coat hooks, and latch keepers.

2. Provide factory-installed threaded brass inserts for installing door hinges, door latch, and door stops.

3. Exposed Bolts and Screws: Theft-resistant, one-way heads, stainless steel, pinhead Torx screws.

F. Other Components: Non-corroding metal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check areas to receive partitions for correct dimensions, plumbness of walls and soundness of wall surfaces that would affect installation of holding brackets.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partition rigidly, straight, plumb, and level.

B. Provide uniform clearances of not over 1/2 inch between wall and panels and between wall and end pilasters.

C. Secure compartment and partition panels to walls with at least two wall brackets per panel attached near top and bottom of panel.

D. Attach panels and pilasters to brackets with tamper-resistant through bolts and nuts.

E. Conceal evidence of drilling, cutting, and fitting to room finish.

F. Secure pilasters to supporting ceiling with pilaster supports secured to structural framing or concrete above. Conceal ceiling fastenings with pilaster shoes.

G. Level, plumb, and tighten installation. Adjust for floor variations.

H. Set tops of doors to be parallel with top of pilasters and overhead brace when doors are in closed position.

I. Bottom of doors and partition panels shall be 12 inches above finished floor.

3.03 ERECTION TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTMENT AND CLEANING

A. Make final adjustments to leveling devices.

B. Adjust and align hardware to uniform clearance at vertical edges of doors not exceeding 3/16 inch. Lubricate hardware for proper operation after installation.

1. Doors shall swing freely.

2. Doors on accessible compartments shall be out-swinging and shall return to closed position.

C. Remove protective maskings.

D. Clean exposed surfaces and partitions, hardware, fittings, and accessories.

END OF SECTION 10 2113

SECTION 10 2813
TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Contractor furnished and installed toilet accessories.

2. Owner-furnished Contractor-installed toilet accessories.

B. Related Requirements:

1. Joint Sealants: Section 07 9200.

2. Non-Structural Metal Framing: Section 09 2216; metal backing plates.

3. Tiling: Section 09 3000.

4. Metal Toilet Compartments: Section 10 2113.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination:

1. Coordinate submission of installation instructions so backing, blocking, and framing can be properly installed and work of other trades will not be delayed.

2. Coordinate accessory locations with other work to avoid interference and to ensure proper operation and servicing of accessory units.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices and cutout requirements in other work.

B. Product Data: Manufacturer's catalog cuts and data sheets, complete parts list, and installation requirements for each accessory item specified.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

D. Schedule: Indicate type, quantities, sizes, and locations for accessories.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data and operating instructions.

B. Keys for each locking unit.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Meet applicable requirements of CBC and Americans with Disabilities Act Standards (ADAS).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials in original packaging to prevent soiling, physical damage, or wetting.

B. Protection:

1. Maintain protective covers until installation is complete.

2. Remove protective covers at final cleanup of installation.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, “Material and Equipment.”

PART 2 - PRODUCTS

2.01 GENERAL

A. Surface-Mounted Accessories are to be furnished and installed by Contractor except for those noted to be furnished by Owner and installed by Contractor.

B. Contractor Furnished and Installed Accessories: Products specified are by Bobrick Washroom Equipment, Inc., except as otherwise noted. Equivalent products by American Specialties, Inc. (ASI), Bradley Washroom Accessories, or equal, may be submitted as substitutions.

2.02 TOILET ACCESSORIES – CONTRACTOR FURNISHED AND INSTALLED

A. T-7: Surface-Mounted Sanitary Napkin Disposal; Bobrick B-254.

B. T-9: Surface-Mounted Waste Receptacle; ASI Model 20826, one for each Restroom.

C. T-10: Two-wall grab bars, stainless steel, satin finish, 1-1/2 inch diameter, with snap flanges for concealed mounting; B-6897.

D. T-11: Glass Mirror, custom complying with requirements specified in Section 08 8000, “Glazing.”

1. Sizes: As shown on the Drawings.

2. Provide with continuous stainless steel bottom channel.

E. T-12: Coat Hook: As specified in Section 10 2113, “Phenolic Toilet Compartments.”

F. T-13: Surface-Mounted Stainless Steel Shelf: B-296; custom depth and length shown, with 3/4-inch return.

G. T-14: Flexible vinyl pipe wrap at exposed undercounter plumbing; “Lav-Guard 2" by Truebro Inc., Collierville, TN, or equal.

1. Series: As recommended by manufacturer for pipe trap type.

2. Color: White.

2.03 TOILET ACCESSORIES – OWNER-FURNISHED/CONTRACTOR INSTALLED

A. T-4: Soap Dispenser; Stoko Stockhausen 30290; two at each Restroom.

B. T-5: Paper Towel Dispenser; Tork 5510282; one at each Restroom.

C. T-6: Toilet Seat Cover Dispenser: Georgia Pacific GP57710; one at each stall.

D. T-8: Toilet Tissue Holder: Georgia Pacific GP59206; one at each stall.

2.04 FABRICATION

A. Fabricate recessed units with seamless one-piece flange on exposed face.

B. Locked Dispensing Units: Key alike for all accessories.

C. Weld corners, leaving no open miters.

D. Provide mounting hardware appropriate to substrate.

E. Typical Metal Finish: Satin stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check substrates and recesses for correct dimensions, plumbness of blocking or frames, and preparation and also other conditions that would affect installation of accessories.

B. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.

3.02 INSTALLATION

A. Install accessories in locations and at heights indicated on the Drawings.

B. Install accessories in accordance with manufacturer's recommendations and code accessibility requirements, plumb, true to line, complete with all required fasteners and accessories, securely anchored to backing, blocking, or building structure.

C. Drill holes to correct size. Cut openings for recessed items with 1/4-inch tolerance so that cut is concealed by flange after application of item.

D. Mount recessed accessories into wall openings with wood screws through cabinet side into wood blocking or sheet metal screws into metal blocking or backing.

E. Mount surface-mounted accessories to solid backing or blocking; plumb and align.

F. Sealants: Comply with requirements of Section 07 9200, "Joint Sealants."

1. Apply behind toilet accessories as necessary to ensure sanitary and watertight integrity of surfaces.

2. Conceal sealants.

G. Framed Mirrors: Secure to concealed wall hanger in accordance with manufacturer's instructions for theft-resistant mounting.

H. Attach grab bars to backing installed in walls to withstand loads prescribed by CBC.

3.03 ADJUSTMENT AND CLEANING

A. Remove protective coverings in accordance with manufacturer's instructions.

B. Adjust accessories for proper operation.

C. After completion of installation, clean and polish exposed surfaces.

D. Deliver keys and instruction sheets to Owner.

END OF SECTION 10 2813

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire extinguisher cabinets.

2. Fire extinguisher mounting brackets.

3. Installation of Owner-furnished extinguishers.

B. Related Requirements:

1. Painting and Coating: Section 09 9000; finishing of fire extinguisher cabinets.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for fire extinguishers and cabinets to be used.

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

1.04 QUALITY ASSURANCE

A. Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

B. Fire extinguishers shall be listed and labeled for type, rating, and classification by Factory Mutual (FM) or another independent testing agency acceptable to authorities having jurisdiction and to Owner's insurance company.

C. Meet ADAS requirements for mounting height and projection from wall.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Fire Extinguishers: Furnished by Owner and installed in each cabinet and at each wall hook by Contractor.

B. Mounting Brackets for Surface-Mounted Extinguishers at Utility/Service Rooms: J.L. Industries “MB” Series as applicable for extinguishers provided by Owner.

C. Fire Extinguisher Cabinets: J.L. Industries “Ambassador” Series, or equal.

1. Size: Model 1015, 10-1/2 inches wide x 24 inches high x 5-3/4 inches deep.

2. Cabinet Type: Recessed.

3. Cabinet Trim: Flat, 3/8 inch.

4. Door Style: Solid, “S2,” with manufacturers’ optional ADAG compliant flush pull.

5. Hinge: Continuous.

6. Latching Device: Self-adjusting roller catch.

7. Finish: Shop prime with white baked enamel. Cabinets shall be shop spray painted to match adjacent wall color.

8. Lettering: Die cut black letters reading “FIRE EXTINGUISHER,” meeting CBC requirements, and applied vertically after painting.

   a. Provide with fill in color as selected by Owner’s Representative.

9. At Rated Partitions: Same as above, but provide rated box.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

B. Fire extinguisher cabinets shall be located where shown and as required by the University's Fire Marshal. Wherever exact location of units is not shown, assume one extinguisher per 75-foot radius (maximum 75-foot travel distance from any given point to an extinguisher). Exact locations shall be coordinated with the Owner's Representative.

C. Install Owner-furnished fire extinguisher in each fire extinguisher cabinet. Provide specified mounting brackets for extinguishers not located in cabinets.

D. Install fire-rated cabinets in rated walls as required to maintain fire separation integrity of partition.

E. Owner will be responsible for inspecting, charging, and tagging fire extinguishers before date or inspection by Fire Marshal.

END OF SECTION 10 4400

SECTION 10 7173
SUN CONTROL DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Delegated Design criteria for:

1. Custom fabricated exterior vertical and horizontal sunshades.

2. Light shelves mounted on interior of curtain wall and storefront framing.

B. Related Requirements:

1. Alternates: Section 01 2300; alternates affecting the work of this Section.

2. Delegated Design: Section 01 3325.

3. Mockups: Section 01 4339.

4. Aluminum-Framed Storefronts: Section 08 4313.

5. Glazed Aluminum Curtain Walls: Section 08 4413.

1.02 REFERENCE STANDARDS

A. Curtain wall systems shall comply with the following standards. When conflicts arise between standards and requirements of this Section, the more stringent shall apply.

1. Aluminum Architectural Manufacturers Association (AAMA).

a. AAMA 611 - Voluntary Specifications for anodized architectural aluminum.

2. American Welding Society (AWS):

a. AWS D1.2: "Structural Welding Code – Aluminum."

3. American Welding Society- AWS

a. D1.2, Structural Welding Code-Aluminum.

4. American Society for Testing and Materials (ASTM): Standards as specified.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, “Special Environmental Requirements.”

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, “Guarantees,” and Section 01 7839, “As-Built Documents.”

1.04 ACTION SUBMITTALS

A. Shop Drawings representing Designer's intent: Plans, elevations, sections, details with profiles, styles, part numbers, dimensions, materials, finishes, connections, method of anchorage, type of anchors and backing supports.

1. Differentiate between shop fabrication and field installation.

2. Indicate substrates and adjacent work specified in related sections with which the exterior sun control devices must be coordinated.

3. Indicate connections to Curtain Wall Framing, and weatherseals.

B. Product Data:

1. Standard components, sizes, shapes, and hardware description.

2. Sun Control manufacturer's data sheets on each product to be used, including:

a. Finish manufacturer's data sheet showing physical and performance characteristics.
b. Storage and handling requirements and recommendations.
c. Installation instructions and recommendations.
d. Specimen warranty for finish, as specified herein.
e. Maintenance instructions.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

~~a. Credit EA 1: Energy and Atmosphere: Optimize Energy Performance. Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.~~
~~b. Credit EQ 3.1: Indoor Environmental Quality Credit: Construction IAQ Management Plan, During Construction. Reduce indoor air quality resulting from the construction/renovation process in order to help sustain the comfort and well being of construction workers and building occupants.~~

~~c.~~**a.** Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

~~d.~~**b.** Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

D. Samples: Submit **the following** samples~~, as requested, of each component~~, and **exposed** fasteners**,** to be utilized in Sun Control assembly with ~~appropriate~~ **specified** finish~~.~~**:**

1. Airfoil Shape: 12 inches long, with bracket attachment.

2. Perforated aluminum sheet for horizontal sunshade and mounting bracket.

E. Delegated Design: Calculations prepared by the engineer in responsible charge retained by the Contractor shall be submitted for mounting brackets to demonstrate compliance with CBC and specified performance requirements. Where specifications and code differ, the more severe requirements shall govern.

1.05 INFORMATIONAL SUBMITTALS

A. Certifications: Manufacturer's certification that Sun Control meets design criteria, Drawings and specification requirements.

1.06 CLOSEOUT SUBMITTALS

A. Warranty: Provide copy of manufacturer's written warranty form.

1.07 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Qualifications:

1. Engineer in Responsible Charge: A professional engineer lawfully eligible in the State of California to design the element or component and to seal the design in accordance with state law and having a minimum of 10 years' experience in providing engineering services of the kind required.

2. Manufacturer: Company specializing in manufacturing products specified in this section with continuous experience of 5 years.

3. Installer: Experienced in performing work of the type specified in this Section with minimum 3 years of documented experience in installation of exterior sun control devices similar to the Work of this Section and approved by sun control device manufacturer.

C. Welding Qualifications: Any welding performed either in the fabrication of the sun control devices or brackets shall follow AWS welding standards.

D. Mockup:

1. Provide a mockup for evaluation of fabrication workmanship as part of the partial building mockup as specified in Section 01 4339, "Mockups."

2. Provide units finished as specified.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Protect finishes by applying heavy duty removable plastic film during production.

2. Package for protection against transportation damage.

3. Provide markings to identify components consistently with drawings.

4. Exercise care in unloading, storing and installing sun control devices to prevent bending, warping, twisting and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1.09 WARRANTY

A. Manufacturer: Provide Owner with an extended 2-year warranty for sun control devices against defects in design, materials, and workmanship. Defects include, but are not limited to, deterioration of metals and other materials beyond normal weathering.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design: System performance and profiles reflect the design intent and Owner’s project requirements and are generally based on the products specified.

B. Products by both listed and non-listed manufacturers shall meet the specified design and performance criteria.

2.02 EXTERIOR SUN SHADE SYSTEMS

A. Horizontal Sunshades: Custom fabricated, pre-finished aluminum sun control devices by C.R. Laurence Co, Inc. or equal.

1. Outriggers: Aluminum plate, ASTM B209, 5052-H32 alloy, tapered square configuration.

a. Projection: 48 inches, including tapered nose fascia.

2. Mounting Brackets: Manufacturer’s standard curtain wall bracket for direct mounting to curtain wall mullion.

3. Fascia: 1/8 inch thick aluminum extrusion, ASTM B 221, 6063-T5 alloy, tapered nose profile.

4. Infill: Perforated aluminum sheet.

a. Perforation Pattern: Round straight holes in size to be selected by Owner’s Representative.

B. Vertical Sunshades: Fixed, custom fabricated, extruded aluminum blades supported by extruded aluminum angles and pins by The Airolite Company, LLC, or equal.

1. Blades: Extruded aluminum Alloy 6063-T5 “tear drop” airfoil profile.

a. Width: As noted on the Drawings.

2. Brackets: Manufacturer’s standard for direct mounting to curtain wall mullion.

3. Mounting and Alignment Pins: As standard with manufacture.

4. Vertical Spacing: As shown.

C. Fasteners: Stainless steel bolts, studs, sheet metal screws, and other types of size and spacing as recommended by manufacturer for specific installation conditions and as detailed on approved shop drawings.

2.03 INTERIOR LIGHT CONTROL DEVICES

A. Light Shelf: Horizontal light shelf attached to interior side of curtain wall and storefront framing where shown on the Drawings; Kawneer “InLighten” Light Shelf, or equal.

1. Projection: 2 feet deep by full width of glazed opening.

2. Thickness: 2 inches.

3. Nose Profile: Square.

4. Panel: Perforated aluminum sheet **at top of sandwich panel** to match exterior horizontal sunshade pattern**, and solid aluminum at underside of sandwich panel**.

5. Provide with slide and swing option for glass and shelf maintenance.

6. Finish on Panel and Aluminum Components: Clear anodized to match window wall framing.

2.04 FABRICATION

A. Prior to fabrication, field-verify required dimensions.

B. Provide fixed sun control devices and accessories of design, material, sizes, depth, arrangement, and thickness as indicated on Drawings and as required for optimal performance with respect to strength; durability; and uniform appearance.

C. Fabrication tolerances: Maximum allowable tolerances.

1. Bow: Plus or minus 1/4 inch.

2. Dimensional width or length: Plus or minus 1/8 inch.

3. Squareness: Plus or minus 1/8 inch.

2.05 FINISHES

A. Concealed Ferrous Metal, if Required:

1. Hot-dip galvanize in accordance with ASTM A123 after fabrication. Do not galvanize portions of items completely embedded in concrete. Touch up damaged galvanized surfaces and welds with zinc-rich paint.

2. Contractor's Option: In lieu of hot-dip galvanizing, use SSPC Paint 20, Type II zinc-rich urethane with not less than 80 percent zinc in dried film; Tnemec "90-97," or equal, applied as follows:

   a. Surface Preparation: Joint Surface Preparation Standard SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   b. Application: Apply primer before rust bloom appears but not more than 8 hours after cleaning. Minimum dry film thickness, 2.5 mils.

B. Exposed Aluminum: Architectural Class I clear anodic coating conforming to AA-M12C22A41.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate conditions in areas to receive the work.

B. Verify dimensions, tolerances, and interface with adjacent work.

C. Do not proceed until any unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate Sun Control installation with curtain wall to ensure proper structural support is provided, attachment of sun control devices is compatible with curtain wall manufacturer's requirements, and weather tightness of exterior envelop is maintained.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations for installation of the work.

B. Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated and fitted to the structure.

C. Anchor sun control devices to curtain wall framing as indicated on approved shop drawings, and as specified.

D. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of galvanic action between metals.

E. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.

F. Set units level, plumb and true to line, with uniform joints.

G. Sun Control Device installation:

1. Layout and verify centerline dimensions prior to setting outriggers and wall brackets.

2. Install the two outer most outriggers and wall brackets plumb and level to the substrate.

3. Then, shoot a line from outrigger to outrigger to find the depth dimension of the outer line.

4. Proceed with the installation by attaching the middle outrigger, shimming as required.

5. Shims: Non-ferrous, as recommended by manufacturer. Verify centerline dimensions after shims are installed.

H. Erection Tolerances:

1. Variation from Level: Plus or minus 1/8 inch maximum in 20 feet, non-cumulative

2. Maximum Offset from True Alignment between Adjacent Members Butting or In-Line: Plus or minus 1/32 inch.

I. Do not field cut or trim units.

J. Cut and trim component parts during erection only with the approval of the manufacturer, and in accordance with its recommendations. Remove and replace members where cutting and trimming has impaired the strength, finish, or appearance of the assembly as determined by the Owner's Representative.

3.04 CLEANING

A. Clean aluminum surfaces in accordance with recommendations found in AAMA 609 and 610. Do not use aggressive alkaline, TSP, acid cleaners, or abrasive cleaners.

END OF SECTION 10 7173

SECTION 10 8123
BIRD CONTROL DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Bird gel deterrent for protection of building exterior as shown.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Indicate layout, components, attachments, anchorage, and other required accessories. Coordinate with shop drawing requirements of related Sections.

B. Product Data: Manufacturer's descriptive literature and installation recommendations.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 5: Documentation for regionally manufactured products.

1) Include statement indicating costs for each product.

D. Samples: Bird control material, 12 inches long, applied to a suitable backing.

1.04 QUALITY CONTROL

A. Coordinate with work of other Sections to ensure proper sequencing and fitting of construction.

B. Mockups:

1. Provide bird control on free standing site mock-up specified in Section 01 4339, "Mockups."

2. In addition, the first installed installation condition, if not illustrated by free-standing site mockup, shall serve as a mockup for review and approval by Owner's Representative of workmanship, visual effect, effectiveness at bird control and interface with adjacent construction.

PART 2 - PRODUCTS

2.01 MANUFACTURED SYSTEMS

A. Bird Control: Sticky, non-toxic, transparent gel; "Bird Gel" by Bird B Gone, Inc., or equal.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Design system to deter pigeons from perching and nesting on ledges, without injury to birds or people.

B. System shall be visually inconspicuous at normal viewing distances.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify surfaces are ready for installation surface finishing is complete. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean installation surfaces thoroughly. Remove bird droppings and related refuse.

B. Surface shall be clean and dry before installation.

3.03 INSTALLATION

A. Install bird control in accordance with manufacturer's written installation instructions.

B. Apply the gel in a "zigzag" pattern in about 3 inch long segments leaving periodic spaces for water drainage.

C. Do not use bird gel where birds have been nesting.

D. Gel shall only be used on flat surfaces.

E. Put painter's tape down to protect surfaces.

F. Inspect finished installation and make adjustments as required to conform to manufacturer's recommendations.

G. Completely remove all excess material, drips and spillage; leave surfaces clean.

H. Typical Locations:

1. Along top of steel members at upper roof canopy where overhanging building edge below.

2. At roof of Third Floor bays along south façade.

3. At exposed beams and tray at underside of Second Floor Bridge.

END OF SECTION 10 8123

SECTION 11 1630
LOCK BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Wall-set lock boxes.

B. Related Requirements:

1. Joint Sealants: Section 07 9200.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications, standard detail drawings, and installation instructions.

B. Certificates: Manufacturer's forms to be signed by local fire department.

1.04 FIELD CONDITIONS

A. Coordination: Contractor shall obtain required forms from manufacturer and forward them to the local fire department for signature. Manufacturer will not ship lock boxes until they receive executed forms from the Fire Department.

B. The Owner is currently using the specified lock boxes.

1. Verify with the Owner’s Representative, if additional keys will be required for these new boxes.

2. If required, notify manufacturer, who will then ship keys directly to local fire department.

C. Locations of lock boxes are approximate. Verify exact locations where lock boxes are required with local fire department and the Owner’s Representative prior to installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lock Boxes: Extra-heavy-duty, recessed, steel; "Knox-Box" by The Knox Company, Phoenix, AZ, 800-552-5669.

1. Provide the following models:

a. One 3200 Series box with hinged door, recessed mounted at Second Floor, East end of the Building, adjacent to entry as shown.

1) Provide with manufacturer's recessed mounting kit.
2) Finish: Manufacturer's standard primer and polyester powder coat, factory applied.

a) Color: "Aluminum."

b. Two Model 1300 boxes to be surface-mounted in recess at First Floor Northwest Corner of Building as shown.

1) Depth: 7 inches.
2) Provide with manufacturer's weather protective housing.
3) Finish: Manufacturer's standard primer and polyester powder coat, factory applied.

a) Color: "Light Gray."

2. Door shall be weatherstripped.

B. Silicone Sealant: One-part, neutral-cure, gun grade, as specified in Section 07 9200, "Joint Sealants."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install lock box where shown and in accordance with manufacturer's directions.

B. Seal around lock box frame, if required, with silicone sealant.

END OF SECTION 11 1630

SECTION 11 3100
APPLIANCES AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Installation of Owner-furnished appliances.

2. Utility rough in for Owner-furnished appliances and equipment.

B. Related Requirements:

1. Architectural Wood Casework: Section 06 4100; casework.

2. Stainless Steel Countertops: Section 12 3616.

3. Division 26: Electrical.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordinate installation with work of other Sections including casework, countertops, and stub-out locations and outlets for utilities.

1.03 CLOSEOUT SUBMITTALS

A. Guarantee and warranty certificates, including manufacturer's operating and maintenance instructions, included with packaging of appliances installed by Contractor.

1.04 QUALITY CONTROL

A. Gas appliances shall be equipped with 100 percent automatic safety shut-off devices.

B. Provide seismic restraints to comply with the SMACNA “Kitchen Equipment Fabrication Guidelines”, Appendix 1, “Guidelines for Seismic Restraints of Kitchen Equipment,” unless otherwise indicated.

C. Accessibility: Installation of Residential Grade appliances shall comply with accessibility of the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.01 APPLIANCES

A. General:

1. Dimensions and utility requirements for each Mode shall be verified with Owner’s Representative and manufacturer.

2. Provide tubing, piping and electrical connections and other accessories for connection of appliances to stub-out of utilities and as necessary for their proper operation.

3. Electrical Rating Requirements: 120/220 volt, single phase.

B. Owner-Furnished Contractor-Installed Appliances:

1. Undercounter Refrigerator.

C. Owner-Furnished Owner-Installed Appliances:

1. Countertop microwave oven.

2. Vending Machines: Floor mounted, no water hookup required.

3. Equipment Rooms: See Drawings for equipment list and locations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install appliances and equipment in accordance with manufacturer's instructions, reviewed submittals and governing authorities.

B. Insulate sufficiently to prevent electrolysis between dissimilar metals.

C. Installation shall be plumb, true, and accurately related to adjacent equipment, casework, and partitions.

D. Do not use plastic piping and drain hoses for connecting utilities.

E. Adjust installed equipment to operate in manner satisfactory to Owner’s Representative.

END OF SECTION 11 3100

SECTION 12 2400
WINDOW SHADES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Manually-operated single shade system.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. LEED Submittals shall be submitted in accordance with Section 01 3560, "Special Environmental Requirements."

3. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Prepare and submit overall floor plan drawings showing shade locations and divisions at openings and the following additional information.

1. Details for each mounting condition and each location, showing brackets, anchorage to substrate, and relationship to adjacent materials.

2. Field-measured dimensions of openings scheduled to receive shades.

B. Product Data: Manufacturer's descriptive literature of shades, attachment brackets, shade materials, and installation instructions.

C. Samples: 12-inch square of each shade material.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of installer's qualifications.

1.05 CLOSEOUT SUBMITTALS

A. Specified warranties for mechanism and shade cloth.

B. Furnish for inclusion in Owner's Operations and Maintenance Manual two copies of manufacturer's recommended maintenance procedures for each type of shade, control, and two sets of any special tools that are required.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Employee of shade manufacturer or certified in writing by manufacturer as an installer of shade system.

B. Turn-Key Single-Source Responsibility for Window Shade Systems:

1. Provide a system which has been designed, developed, and manufactured as a totally integrated unit.

2. The system shall be furnished by a single-source supplier with a certification that all components including shade fabrics that have been designed and tested as a compatible system and will be available in the future for either replacement or add-on requirements.

C. Mockup: Install window shade mock up at one location for each type of shade to show full operation and appearance. Coordinate location with Owner's Representative.

1.07 WARRANTY

A. Manufacturer:

1. Tracks, gear-and-sprocket mechanism, and accessories for shades shall be warranted for 5 years against defects in materials and workmanship which inhibit proper and intended functioning of products.

2. Ten year warranty for shadecloth with the provision that it will not deteriorate, sag or warp and will remain fit for use for the full warranty period.

B. Contractor: Warranty shall include removal and replacement of other work, as required, which has been connected to or superimposed on materials to be replaced, including removal, storage, and reinstallation of shades during the Contractor's Contract warranty period.

PART 2 - PRODUCTS

2.01 SHADES

A. Acceptable Manufacturers: MechoShades Systems Inc., Hunter Douglas Contract, Skyco Shading Systems, or equal. All products, including hardware, accessories, mounting brackets, trim, and fastenings, shall be from the same manufacturer. Shade system specified to establish required level of performance, quality, and appearance is "Mecho/5 Standard" by MechoShades Systems Inc.

B. Operation: Hand chain.

C. Configurations: Single, top down.

2.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Removal of shade shall not require disassembly of shade unit.

B. Shade Cloth: Interwoven non-combustible fiber, inherently flame-retardant and permanently flame-resistant.

1. Shade cloth shall hang flat, without buckling or distortion.

2. Edge, when trimmed, shall hang straight without raveling.

3. An unguided roller shade cloth shall hang true and straight, without shifting sideways more than 1/8 inch in either direction due to warp distortion or weave design.

4. Flame Retardance:

   a. Shade fabric shall be certified by an independent testing laboratory to pass NFPA 701, Test Methods 1 and 2, and applicable code requirements.
   b. Flame Retardant Materials: Approved by California State Fire Marshal's Office.
   c. Fire Rating: NFPA Class A.

5. Blackout shade materials shall be Greenguard certified and PVC-free.

C. Each shade shall fully cover the opening where it occurs.

D. Shades shall have no seams, except where approved in advance in writing by Owner’s Representative.

2.03 MATERIALS AND COMPONENTS

A. Shade Materials: PVC-free polyester.

1. Light Filtering: 100 percent thermoplastic olefin (TPO); “EcoVeil” 1350 Series.

   a. Openness: 5 percent.

2. Blackout: 75 percent vinyl (coating), 25 percent fiberglass (yarn); “Classic Blackout” 0700 Series.

3. Fabric Colors: As selected by Owner’s Representative from manufacturer's available contract colors.

B. Drive Assembly: Engineered heavy duty chain drive pulley operating system consisting of metal clutch housing and locking plug.

1. Chain tensioner to be compliant with WCMA safety standard A100.1 and shall prevent the clutch system from moving the roller shade through lowering and raising if not properly installed as specified in ANSI Standard Section 6.5.2.

2. Components will be maintenance free from adjustments or lubrication for trouble-free operation

3. Factory set for size and travel of shades.

4. Capable of field adjustment from the exterior of the shade unit without disassembling the hardware.

5. Provided with a built-in shock absorber system to prevent chain breakage under normal use conditions.

C. Fascia: Extruded aluminum with specified custom paint finish. Provide snap-on type without exposed fasteners where shade roll is visible.

D. Bottom Bar: Extruded aluminum weight in a sealed fabric hem pocket.

E. Chain Operator: No. 10 stainless steel bead chain formed in a continuous loop with a breaking strength of 110 lbs.

F. Guide Channels: Not required.

G. Miscellaneous Brackets, Fastenings, and Accessories: As detailed, or if not detailed, as recommended by shade manufacturer for conditions indicated on the Drawings or encountered.

2.04 FABRICATION

A. Workmanship: Fabricate shades in accordance with manufacturer's specifications and as detailed, complete with accessories necessary for specified operation.

B. Sewing: Locked or blind stitch, done on power machines using tension and spacing as required to be permanent and to avoid pulling.

1. Thread: Match fabric color.

2. Seams: Flat double back or lock-over-lock, with hems and seams free from pucker.

3. Length: Finish length so bottom clearance is by 1 inch, with 1/4 inch tolerance acceptable.

4. Room-darkening shades shall be hemmed top and bottom, with both hems double needle stitched and backstitched at edges. Hems shall be turned so that stitching passes through three thicknesses of fabric.

5. Provide sufficient length of material to allow two complete wraps around roller when shade is fully extended and to prevent fabric from being pulled off roller.

C. Fabric shall be attached to rollers by double wide staples. No adhesive is allowed.

D. Coordinate pocket closure trim as shown on the Drawings with fabrication of aluminum curtain wall and storefront framing.

E. Factory Finish on Exposed Aluminum: Manufacturer’s standard baked-on paint system.

1. Color: Custom, to match aluminum window framing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and openings to receive shades and conditions under which they are to be installed.

3.02 INSTALLATION

A. Install shades in accordance with manufacturer's installation instructions.

1. Mount in pockets and enclosures as shown on the Drawings.

2. Assure adequate clearance to permit unencumbered operation.

3. Position units plumb and true, and securely anchor in place with brackets, clips, and fasteners.

B. Each shade shall extend the full height and width of the window opening where it occurs.

3.03 ADJUSTMENT AND CLEANING

A. Verify operation. Adjust clearances to ensure free operation.

B. Remove protective coverings and devices.

C. Clean soiled shade surfaces and components.

D. Replace damaged items with new material.

END OF SECTION 12 2400

SECTION 12 3623
PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Plastic laminate faced countertops and backsplashes.

B. Related Requirements:

1. Architectural Wood Casework: Section 06 4100; wood veneer-faced casework.

2. Joint Sealants: Section 07 9200.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

1.03 ACTION SUBMITTALS

A. Shop Drawings: Prepare for each countertop in accordance with Section 1 Article entitled "Submittals" of the AWS document referenced below.

1. Show items interfacing with countertops including relationship to supporting casework.

2. Identify materials to be used.

3. Shop drawings for countertops may be submitted as part of shop drawings prepared and submitted under Section 06 4100, "Architectural Wood Casework."

B. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

b. Credit MR 7: Certificates of chain-of-custody signed by millwork manufacturer certifying that wood products were obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

1) Include evidence that millwork manufacturer is certified for chain-of-custody by an FSC-accredited certification body.
2) Include statement indicating costs for each certified wood product.

c. Credit EQ 4.1:

1) Printed statement of volatile organic compounds (VOCs) for adhesives and sealers applied inside the weatherproofing.
2) Include statement indicating costs for each product.

d. Credit EQ 4.4:

1) Product data from manufacturer of composite wood and agrifiber materials stating that they contain no added urea-formaldehyde resins.
2) Include statement indicating costs for each product.

C. Samples: 8 x 10 inch piece of selected pattern and color of plastic laminate.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of fabricator qualifications if not submitted for approval under other Sections.

1.05 QUALITY ASSURANCE

A. Standard for Materials and Workmanship: Comply with Section 11, "Countertops," and applicable requirements of Appendix A of the "Architectural Woodwork Standards (AWS)," published jointly by WI, AWI, and AWMAC and all current revisions (hereinafter also referred to as the "woodworking standard"). Where Contract Documents indicate requirements that conflict with or augment the woodworking standard, comply with the conflicting or augmenting requirements.

B. Fabricator Qualifications: Active member of WI or AWI. Other fabricators will be considered for approval upon submission of verifiable evidence of experience in successful completion of work similar to work of this Project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until wet work, painting, and similar operations in storage and installation areas which could damage or soil work have been completed.

B. Coordinate delivery with fabrication and installation of supporting casework.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

PART 2 - PRODUCTS

2.01 PLASTIC MATERIALS

A. High-Pressure Plastic Laminate: Conforming to NEMA LD3.1 and ISO 4586-2.

B. Grades:

1. Horizontal Surfaces and Backsplash: ISO 10/HGS; horizontal, general purpose.

2. Backing Sheet: ISO 91/BKL; backer, light duty.

C. Manufacturers, Colors and Patterns: To be selected by Owner's Representative.

2.02 PANEL MATERIALS

A. Medium-Density Fiberboard (MDF): ANSI A208.2, formaldehyde free; "Medite II," 3/4 inch thick, by SierraPine Composite Solutions, Roseville, CA, or equal.

2.03 ACCESSORIES

A. Grommets: Doug Mockett & Co. Inc., Manhattan Beach, CA, 310-318-2491, or equal.

1. Type: SG Series, or EPP Series; coordinate with data connection requirements.

2. Material and Color: As selected by Owner's Representative.

B. Fasteners: Type and size as required.

C. Adhesives: VOC compliant. Do not use adhesives that contain urea formaldehyde.

2.04 FABRICATION

A. Obtain field measurements and verify dimensions before fabricating work.

B. Comply with AWS Custom Grade requirements and ANSI A161.2.

C. Return substrate and plastic laminate at bottom edge of self-edged countertops.

D. Provide 4-inch high backsplashes and returns where shown.

E. Provide joints only were maximum available lengths or countertop configuration requires a joint and where interfacing with existing. If new joints are required, balance and center.

F. To greatest extent possible, complete fabrication and assembly before shipment to site.

1. Disassemble components only as necessary for shipment and installation.

2. Where necessary for fitting at site, provide extra borders and edges so as to allow scribing and trimming to fit.

G. Precut openings for applied fixtures and fitting, where possible. Field cuts shall be performed by the fabricator.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install countertops in accordance with Section 11 of the AWS standard and requirements shown on the Drawings.

B. Make joints neatly, with uniform appearance.

C. Install work plumb, level, true, and straight, with no distortions using concealed fasteners. Install with no variation in flushness of adjoining surfaces. Shim as required, using concealed shims.

D. Scribe and cut to fit adjoining work.

E. Sealant: Install sealant as specified in Section 07 9200, "Joint Sealants," as required to close any small unavoidable gaps between counter and abutting surfaces. Sealant shall not be a substitute for tightly scribed work.

END OF SECTION

SECTION 12 4819
ENTRANCE FLOOR GRATINGS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Recessed entrance gratings at interior and exterior of entrances at First and Second Floors.

2. Frames for entrance gratings.

B. Related Requirements:

1. Cast-in-Place Concrete: Section 03 3000.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures,” and Section 01 7836, “Warranties.”

1.03 ACTION SUBMITTALS

A. Shop Drawings: Show plan and details of grating including bar pattern, joints in grating, anchors, junction between grating and adjacent stone flooring, relationship to entrance doors, and accessories. Coordinate shop drawing submittal for recessed grating with stone work to ensure proper placement of grating frame.

B. Product Data: Manufacturer's descriptive literature of grating, frame, and recommended installation and maintenance instructions.

C. Sustainable Design (LEED):

1. General:

a. Submit information necessary to establish and document compliance with the LEED Certification goals for this Project.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance.

2. The following information shall be provided:

a. Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1) Include statement indicating costs for each product having recycled content.

D. Samples: Frame and grating, not less than 12 inches by 12 inches.

1.04 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.05 WARRANTY

A. Manufacturer: Provide Owner with manufacturer extended 2-year warrant for entrance gratings against defects in materials and installation.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Rolling Load: 1000 pounds minimum per wheel.

B. Uniform Load: 1000 psf minimum.

C. Slip Resistance: Minimum wet DCOF AcuTest value of 0.42 in accordance with ANSI A137.1-2012.

D. Corrosion Resistance: Grille shall withstand corrosion to salt when tested in accordance with ASTM B117 for 1000 hours of salt fog without any noticeable changes.

2.02 GRATING AND FRAME

A. Walk-Off Grating: Extruded 6105-T5 aluminum alloy tread rails joined mechanically by extruded 6106-T6 aluminum alloy key lock bars, and 100 percent nylon fiber wiper blades and scraping PVC inserts; “Dual Track” foot grille by Mats Inc., Stoughton, MA, or equal.

1. Colors:
   a. Vinyl Scraping Insert: As selected by Owner’s Representative from manufacturer’s standard available colors.
   b. Drying Inserts: As selected by Owner’s Representative from manufacturers full range of available colors.

2. Panel Size: As standard with manufacturer.

3. Grating Depth: 1-1/2 inches.

B. Frame: Recessed type integral with concrete with top flush with finished floor surface; “VV Frame” by Mats Inc., or equal.

1. Minimum Recycled Content of Aluminum: 43 percent pre-consumer and 14 percent post-consumer.

2. Depth: 1-5/8 inches.

3. Aluminum frame shall be pre-assembled at factory incorporating welded construction for all joints.

4. Top shall be flush with finished floor surface.

5. Finish: Mill.

C. Blockout Depth for Grille: 1-5/8 inches.

2.03 FABRICATION

A. Shop-fabricate floor grates and frames to sizes shown and on reviewed shop drawings.

B. Where joints in grate are necessary, space symmetrically and away from normal traffic lanes.

C. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

D. Verify sizes by field measurement before shop fabrication.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces scheduled to receive grating for deviations beyond allowable tolerances.

B. Check that dimensions of completed recesses conform to grate sizes.

C. Do not begin installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Set recessed frames prior to placement of concrete slabs with top of frame flush with top of finish floor.

B. Provide temporary filler of plywood or fiberboard in recess and protect frames with protective flooring after completion of frame installation.

C. Do not set grating until just prior to Substantial Completion of the work.

1. Install grate in accordance with manufacturer's written instructions.

2. Fit grating neatly into recess with correctly aligned edges and secure with hidden lock down assembly.

D. Leave grate and frame in clean condition.

END OF SECTION 12 4819

SECTION 12 9300

SITE FURNISHINGS AND FEATURES

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Provide site furnishings, and install complete, including footings, fittings and materials, as shown, and as specified.

1. Bicycle Rack
2. Metal Planters
3. Salvaged Stone Wall Cap

B. Products Installed But Not Furnished Under This Section:

1. Section 03 0000 - Cast In Place Concrete
2. Section 32 1800 - Concrete Flatwork and Sitework
3. Section 32 8400 - Planting Irrigation
4. Section 32 9113 - Soil Preparation
5. Section 32 9200 - Planting,

1.02 REFERENCES

A. "Standard Specifications" - Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS

B. ACI - American Concrete Institute Manual of Concrete Practice

C. ASTM - American Society for Testing and Materials

D. SPIS - Society of Plastic Industry Standards

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Show not less than five (5) years successful and continuous experience in work of the type(s) shown on the Drawings.

B. Code Requirements

1. Access: Comply with California Building Code and Americans with Disabilities Act Accessibility Guidelines requirements.
2. Code: Comply with requirements of applicable codes.

C. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication, where possible; do not delay job progress; allow for trimming and fitting where necessary. Provide full size templates as required.

D. Installer Qualifications:

1. Installer shall have a minimum of five (5) years experience with successfully completed site furnishings work similar in material, design and extent to that indicated for this project.

2. Supervisory personnel with experience on projects of similar size and extent shall supervise the work.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's literature for each type of factory fabricated products and accessories required including, but not limited to:

1. Bicycle Rack

2. Metal Planters

B. Shop Drawings: Indicate component details, materials, finishes, connecting and joining methods, and relationship to adjoining work.

1. Submit large scale (minimum 3/8 inch) shop drawings for fabrication and erection of:

a. Metal Planters

2. Show plans, elevations, sections and details of assembly, mounting, inserts, and signs.

a. Verification and coordination:
   1) Verify all measurements at the job site. Where items must fit and coordinate with finished surfaces and/or constructed spaces, take measurements at site and not from drawings.
   2) Where concrete, metal or other materials must be set to exact locations to receive work, furnish assistance and direction necessary to permit other trades to properly locate their work.
   3) Setting Diagrams for Welded Connectors, Concrete, or Masonry Inserts: Where required to receive work, show exact locations and furnish all such Drawings to the trades responsible for installing the connectors or inserts.
b. Indicate component details, materials, finishes, dimensions, sizes, thicknesses, gauges, connecting and joining methods, attachments, and relationship of work to adjoining construction
c. Indicate support layout. Support layout shall not impair the integrity or functioning of the waterproofing, drainage, irrigation or any other systems where pedestal systems are required.
d. Catalogue Work Sheets: Show illustrated cuts of item to be furnished, scaled details and dimensions.

C. Samples:

1. Approved samples shall represent standard of quality for workmanship, material and finish.

a. Metal planter wall with color, 12" square - two pieces of each type
b. Filter fabric, 12" square – two pieces of each type

D. Submit Operations and Maintenance Manuals, Data, Keys and Codes for all manufactured systems.

1.05 WARRANTY

Item	Warranty Length
Bicycle Rack	Two (2) Years
Metal Planter	Two (2) Years

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging and Labeling: Furnish materials in manufacturer's unopened, original packaging, bearing original labels showing quantity, description and name of manufacturer. Verify that all materials and components are adequately padded and securely bound in such a manner that no damage occurs to the product during delivery and unloading at the site.

B. Storage: Damaged materials will be rejected. Remove damaged materials from the job site immediately, and pay cost of replacement. Determination of damage shall be the sole authority of the Owner.

C. Handling: Lift materials using lifting inserts provided by manufacturer.

D. Painted Finishes: Provide non-scratching, non-staining, firmly-bound covering for all shop-painted finishes until installed and accepted.

1.07 SEQUENCING AND SCHEDULING

A. Acceptance: Do not install site furnishings and features prior to acceptance by Landscape Architect of area to receive such materials.

B. Coordination: Coordinate with the work of other sections to insure the following sequence of construction.

1. Planters: Deliver to site prior to delivery of planting materials.

1.08 MAINTENANCE

A. Maintenance Service:

1. General: Immediately remove all stains to materials or surrounding site improvements. Do not use cleaning solvents harmful to site materials. Do not permit cleaning agents to contaminate planted areas.

2. Metal Planter: Immediately restore all planters which develop poor drainage. Replace all damaged plant materials.

B. Extra Materials:

1. General: Provide all items necessary to re-tighten, clean up, restore or replace all items as required to ensure continued operation of specified products.

2. Painted Finishes: Provide one gallon can of each primer and finish coat for use in touch-up. Clearly label cans with all batch mixture numbers required to duplicate painted finishes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bike Racks

1. Basis of Design: "Welle Series Rack", model as noted on Drawings, by Palmer Group (www.bikeparking.com, 415.333.6428).
   a. Bicycle Rack shall be 18.375" wide x 36" tall single stainless steel (304 SS Alloy) loop, 2 3/8" o.d. schedule 40 pipe, 0.154" wall thickness as per
   b. Finish: Stainless steel

2. Mounting: Surface mounted onto pavement per manufacturer instructions.

B. Metal Planter

1. Provide metal planter to conform with the Drawings and reviewed Shop Drawings and Mockups. Metal Planter shall be welded rigid steel wall sections without flange or lip. Units shall be impervious to long term soil moisture corrosion.
   a. Finish: Galvanized, primed and painted.
   b. Color: to be approved by Landscape Architect

2. Materials:
   a. Steel panels.
      1) Provide complete metal wall panel assembly incorporating trim, copings, fasciae, parapet caps, sills, inside and outside corners, and miscellaneous flashings. Fabricate accessories in accordance with SMACNA Manual. Provide manufacturer's factory-formed clips, shims, flashings, and caps for a complete installation.
      2) Fasteners: Self-tapping 300 series stainless steel screws, No. 14 minimum, hex-head, and other acceptable fasteners recommended by panel manufacturer.
   b. Metal shapes, fasteners and appurtenances as required for a secure, stable features with inconspicuous connections, and finished to match components.
   c. Structural steel plates, shapes, bars and sheets:
      1) Steel Plate: ASTM A36 (ASTM A306, Grade 65)
      2) Structural sizes, shapes and plates: ASTM A36, except for plates to be bent or cold-formed.
      3) Bars and bar-size shapes: ASTM A36.

3. Other materials, as indicated on the Drawings; accessories, finishes, fabrication and metalwork shall conform with applicable Sections in the project Specifications

C. Salvaged Stone Cap (for concrete wall)

1. Salvaged stone cap shall be cleaned and reviewed for any breaks, holes or any disfigurement that may reduce its effectiveness. Clean stone surfaces which have become dirty or stained to remove soil, stains, old mortar and foreign materials.

2. Surfaces shall be finished, and caps cut as needed for re-installation as stone cap onto new concrete walls.

3. Provide drilled setting holes and stainless steel dowels for secure, stable installation. Anchors, dowels, ties and other inserts shall be Type 302 or 304 stainless steel of sizes and configurations required for support of stone and applicable superimposed loads.

2.02 ACCESSORIES

A. Fastenings: All bolts, nuts, screws, clips, washers, and any other fastenings necessary for proper erection of items specified herein.

1. Ferrous Metal: ASTM A307, Grade A, stainless steel or galvanized.

2. Other Metals: Zinc-coated or cadmium-plated for exterior use.

B. Concrete Inserts: ASTM A47 malleable iron or ASTM A27 cast steel, threaded or wedge type, galvanized ferrous castings. Provide ASTM A153 hot-dipped galvanized bolts, washers and shims as required.

C. Setting Mortar: Comply with ASTM C 270, Proportion Specification, for types of mortars and applications required, unless otherwise indicated:

1. For masonry below grade, in contact with earth, and where indicated, use Type M.

2. For reinforced masonry and where indicated, use Type S

3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pointing Mortar: Provide pointing mortar complying with requirements indicated above for setting mortar including type.

E. Grout

1. Type: Non-shrinking, non-staining grout.

2. Color: Match adjacent concrete paving.

3. Product: "Embeco 153" by Master Builder's, (216) 831-5500; "Metal-Mix Grout", by Conrad Sovig's, (415) 863-3803; "Ferrolith G Redi-Mixed Grout" by Sonneborn Building Products, (415) 889-9899 or (612) 835-3434 or "Upco Non-shrink", by Upco Co., (216) 881-0033.

F. Drainage material and soil for planter pots: See Section 32 9300 - Planting.

G. Concrete Footings

1. Provide concrete materials, mixes and components to conform to Sections 03 00 00 Cast-In-Place Concrete and 03 30 53 Site Concrete.

2.03 FABRICATION

A. Manufactured items: Comply with manufacturers' most recent published manuals for shop assembly, shop/factory finishing, and tolerances.

B. Custom fabricated items: Comply with applicable Sections in the project Specifications and the following.

1. Shop Assembly:
   a. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly.
   b. Tolerances: Provide all surfaces free of file marks, dents, hammer marks, wire edges or any unsightly surface defects.
   c. Bends, twists, open joints in finished members, and projecting edges or corners at connections not permitted.

2. Welding:
   a. Standards: Weld all shop joints per AWS Code D1.0. (ASTM A36 for structural steel.)
   b. Preparation: Remove all rust, paint, scale and other foreign matter. Wirebrush all flame-cut edges. Clamp members as required and alternate welds, all as necessary to prevent warping or misalignment.
   c. Exposed Welds: Uniformly make and ground smooth all welds normally exposed to view in the finished work.
   d. Galvanized Units: Do not weld after fabrication.
   e. Faulty and Defective Welding: Chip out and replace all welding showing cracks, slag inclusion, lack of fusion, bad undercut or other defects ascertained by visual or other means of inspection. Replace and reweld at no cost to Owner.

3. Shop Factory/Finishing:
   a. Cleaning:
      1) Thoroughly clean all mill scale, rust, dirt, grease and other foreign matter from ferrous metal prior to any galvanizing, (hot phosphate treatment) or painting.
      2) Conditions which are too severe to be removed by hand cleaning methods, shall be cleaned per SSPC "Surface Preparation Specifications", "Solvent Cleaning, SSPC SP-1"; "Power Tool Cleaning, SSPC-SP"; or "Brush-Off Blast Cleaning, SSPC-SP7" as required.
   b. Exterior Ferrous Metal:
      1) Grind smooth all welds, burrs, and rough surfaces. Clean and hot-phosphate treat completed assembly. Hot phosphate treatment not required on items which are not exposed in the finish work or on those items where size prohibits such treatment.
      2) Shop coat ferrous metal items unless specified; use metal primer as specified. Do not shop coat galvanized items or portions to be embedded in concrete.
      3) Indicate on shop drawings where treatment is proposed to be omitted, if any.
   c. Hot Phosphate Treatment: SSPC-PT-4.
   d. Hot-Dip Galvanizing: Iron and steel hardware: ASTM A123 (Fabricated Assemblies: ASTM A386)

4. Painting:
   a. Prime Coat: After material has been properly cleaned and treated, immediately apply two shop prime coats, each of a different color, to all surfaces except galvanized finished, those to be field welded, and those encased in concrete or masonry. Apply all paint per manufacturer's current printed instructions. Spot paint all abrasions and field connections after assembly. Dry shop coats prior to shipment to job site.
   b. Finish Coats: Apply two (2) coats per manufacturer's current printed instructions. May be shop applied where applicable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Locations: Verify that all site and street furnishings can be installed at locations as shown on Drawings.

B. Conditions: Verify that no defects or errors exist in the work of other sections which would lead to defective installation or latent defects in workmanship and function of items in this section. Do not start site furnishings work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Locate and layout all site furnishings. Obtain Landscape Architect's acceptance of layout prior to installation.

B. Coordinate the installation of on-structure site furnishings with the installation of embeds in the structural slab and the related waterproofing system.

C. Surface Preparation: Provide proper subgrade preparations and grades.

D. Concrete Pads and Footings:

1. Coordinate with grading and pavement installation for related site furnishings.

2. Layout: Accurately lay out all pads and footings as called for in the Drawings.

3. Installation: Excavate form as required and fill for pads and footings as specified in Site Concrete - Section 03 30 53

3.03 INSTALLATION

A. General

1. Locations: Verify that all site furnishings can be installed at locations as shown on Drawings. Provide all necessary concrete footings and pads where applicable. Install all site furnishing plumb and true.

2. Conditions: Verify that no defects or errors exist in the work of other sections which would lead to defective installation or latent defects in workmanship and function of items in this section, as follows:
   a. Planters: Install drainage materials, soil mix, irrigation and planting for pots.

3. Fabricate per reviewed Shop Drawings, free from distortion and defects detrimental to appearance and performance. Preassemble items in shop in largest practical sections, to greatest extent possible to minimize field splicing and assembly.

4. Coordinate the installation of the work with the installation of the building structural, waterproofing and drainage systems. Do not damage waterproofing system, drainage system, irrigation system or any other installed work during installation. Report any damage immediately to the Landscape Architect.

5. Erect work square, set products accurately in location, alignment and elevation, plumb, level and true measured from established lines and levels, and free from distortion or defects detrimental to appearance and performance.

6. Provide temporary bracing or anchors as required for items which are to be built into concrete, masonry or similar construction.

7. Install all site furnishings in accordance with Drawings, and manufacturer's written instructions unless otherwise indicated.

8. Restore protective coverings which have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.

9. Touch up all metalwork, hardware, fasteners and areas where shop coat finish has been damaged with primer and paint in matching color.

B. Bicycle Racks:

1. Review of Locations: Landscape Architect to review and accept final locations of bicycle racks on-site prior to installation.

2. Coordinate the installation of the bicycle racks with the installation of the paving work.

3. Install per Drawings, secured in place, and free from rocking, distortion and defects detrimental to appearance and performance.

4. Secure bicycle racks plumb and level with concealed surface mounting per manufacturer’s written recommendations.

C. Metal Planters

1. Coordinate the installation of the work with the installation of the building construction including structural, mechanical and electrical work, waterproofing and drainage systems, and planting, irrigation and soils work.

2. Prior to planter fabrication, the contractor shall verify as-built dimensions of site, and ensure proper size, fit and quantity required

3. Install per Drawings, reviewed Shop Drawings, and manufacturer’s written specifications, free from distortion and defects detrimental to appearance and performance.

4. Set all items in their correct locations as shown in the details level, square, plumb, at proper elevations and in alignment with other work in accordance with the reviewed Shop drawings.

5. Maintain vertical and top alignment of fences during placement and finishing operations.

6. Touch up all metalwork, hardware, fasteners and areas where shop coat finish has been damaged with primer and paint in matching color.

D. Salvaged Stone Cap (on concrete wall)

1. Coordinate the installation of the salvaged stone cap with the installation of the concrete wall work. Execute stonework by skilled workers, and employ skilled stone fitters at the site to do necessary field cutting as stones are set. Use power saws to cut stones

2. Place stone in accordance with the Drawings and where not specifically indicated, secure Landscape Architect's review of proposed layout, cuts, margins, etc. before proceeding with the Work. . Do not impair appearance or strength of stone work.

3. Install supports, and other attachments indicated or necessary to secure stonework and level in place.

4. Adjust supports and accessories to set stones accurately in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.

5. Mix mortar per ASTM C270-92a. Follow manufacturer's instructions for admixtures.
   a. Use mortar within 1-1/2 hours of the initial mixing.
   b. Butter joints solidly or rake out to form a depth of 1/2" and fill solidly with a uniform pointing of pointing mortar.
   c. Fill dowel holes completely with mortar.

6. Fill joints with pointing mortar and/or sealant system as indicated on Drawings.
   a. Grout joints with pointing mortar after stone is firmly set. Force grout into joints, strike flush and tool slightly concave. Wet joint surface, if dry, prior to grouting. Use industry standards, avoiding harm to stone work and adjacent construction, to prevent grout color from staining the face of the stone.
   b. Point joints and seal expansion joints and intersection of stone and rigid dissimilar materials with sealant. Clean joints free of loose mortar, dirt, and debris before installing sealant system. Neatly tool sealants to slight concave surface. Comply with the requirements of the manufacturer's written specifications.
   c. Rake joints per Drawings.

E. Concrete Footings

1. Coordinate with grading and pavement installation for related site furnishings.

2. Install per Drawings, plumb and level.

3. Top of footings shall be as indicated in the Drawings.

3.04 STAINING, FIELD AND TOUCH UP PAINTING

A. Cover and protect finished work and surfaces not to be painted. Use drop cloths of adequate size to protect adjacent areas.

B. Mix and prepare staining and painting materials in accordance with manufacturer's directions.

C. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be stained or painted, or provide surface applied protection. Reinstall removed items when final coat is thoroughly dry.

D. Paint all metal hardware with approved paint and primer to match approved paint color.

E. Do not paint over dirt, rust, scale, grease, moisture, voids and blemishes, or other conditions detrimental to formation of a durable paint film.

F. Apply stain or paint in accordance with manufacturer's directions. Use techniques best suited for substrate and type of material being applied.

G. Apply material evenly without runs, sags, or other defects. Make edges of stain or paint adjoining other materials or colors sharp and clean, without overlaps.

H. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by the manufacturer.

I. Drying Time: Minimum time recommended by manufacturer. Do not apply succeeding coats until the undercoat is thoroughly dry.

J. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint. Final finish shall have uniform color and appearance.

3.05 SHOP COAT REPAIR

A. Touch up painted steel abrasions and welds with the specified primer and paint over SSPC SP2 Surface preparation.

B. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

3.06 PROTECTION AND CLEANUP

A. Wrappings: Do not remove protective wrappings from furnishings until instructed by Landscape Architect.

B. Protect work from damage or theft until Final Acceptance. Repair or replace damaged work to original condition**.**

C. Keep site clean during construction. At Final Acceptance, site furnishings shall be in place, clean and in perfect condition, ready for use.

D. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris and equipment

END OF SECTION

SECTION 14 2100
ELECTRIC TRACTION ELEVATOR

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Machine-room-less (MRL) electric traction passenger elevator with controller in remote closet as shown on the Drawings.

2. Provision and installation of accessories and wiring by the elevator contractor.

B. Related Requirements By Other Trades:

1. Metal Fabrications: Section 05 5000; support for, and installation of, lifeline beam and hoistway beam provided by elevator contractor.

2. Resilient Flooring: Section 09 6500; cab flooring.

3. Heating, Ventilating, and Air Conditioning: Division 23 (15); temperature and humidity control in elevator shaft and remote controller closet.

4. Electrical: Division 26.

5. Hoistway Construction & Rail Supports: All tube steel rail supports & machine supports.

6. Site Safety Requirements.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

2. Closeout Submittals shall be submitted in accordance with Section 01 7836, "Guarantees," and Section 01 7839, "As-Built Documents."

B. Coordination: Coordinate interface between elevator work and work of other Sections as required for proper installation and operation of elevator.

1.03 SYSTEM DESCRIPTION

A. Definitions:

1. Where a device or a part of equipment is referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.

2. Terms used in this Section shall have meanings as defined in American National Standards Institute (ANSI) A17.1/ASME A17.1.

B. Sound Control: Provide effective sound isolation for all equipment to prevent noise transmission. Provide all isolated connections with neoprene grommets and washers where bolted connects are used, or as noted below.

1. Controller Room:

a. Provide filters on SCR power converter and regulation units to attenuate acoustic and structure-borne noise. Sound isolation to limit ambient noise at the equipment to an A-weighted sound pressure level not exceeding 60 dB, when measured three feet from any component under all loading conditions.
b. Power converter and regulation unit shall be designed for floor or machine mounting; do not mount on wall.
c. Isolate the power converter and regulation unit on vibration isolators equivalent to Mason Industries Model BR with a 0.2-inch static deflection.
d. Isolate sheave beams on vibration isolators equivalent to Mason Industries Model RB or SWM pads (0.1-inch compression) with neoprene washer bushings Mason HG (or approved equal.)

2. Wiring: Provide flexible power connections to all isolated equipment; “Seal-Tite” or equal.

3. Control Switches: Provide optical or solid-state control switches in hoistways were allowed by code, to eliminate structure-borne noise associated with mechanical switches.

4. Equipment shall suppress or minimize noise, including but not limited to:

a. Rattle, bump, or slam in car travel or door operation.
b. Squeak, whine, or friction noises from bearings or rotational drive equipment.
c. Electrical squeal, whine, or clicking or other contact make/break noises.

C. Additional Design Criteria:

1. Seismic Requirements: Meet seismic requirements of local code.

2. Performance:

a. Contract Speed: Speed variation under any loading condition in either direction shall be no more than 5 percent.
b. Leveling:

1) Within 1/4 inch under any loading condition.
2) Car shall level into floor, and shall not overrun floor and then level back.

3. Vibration Control:

a. Provide vibration isolation for platform.
b. Isolate machine from building structure to prevent objectionable noise transmission to occupied building spaces.

D. Elevator Requirements:

1. Machine: Electric traction type.

2. Capacity: 4,000 pounds.

3. Car Speed: 150 feet per minute, up or down.

4. Travel and Openings and Shaft Size: As shown on Drawings. All elevator hoistway equipment shall fit within the limitations of the hoistway dimensions shown on Drawings. If equipment requires modifications to any hoistway dimensions, include anticipated dimensional and other modification requirements with bid submittal.

5. Cab Inside Height: 9'-0". Ceiling minimum 7'-9" to 8'-5" high.

6. Car Platform Dimensions: Approximately 5'-6" wide x 7'-7" deep depending on manufacturer; service orientation, stretcher accessible as required by Codes.

7. Car and Hoistway Entrance: 4'-0" wide x 7'-0" high, two speed, side opening.

8. Control: Microprocessor, selective collective automatic operation, with independent service.

E. Additional Performance Requirements:

1. One Floor Run: Assuming12'-0" travel, not over 15 seconds from start of doors closing until doors are ¾ open & car is level & stopped at next floor.

2. Door Operating Times, Complete Motion:

   a. Open: Not over 3.1 seconds.
   b. Close: as required by code.

3. Doors shall not rock, chatter, vibrate, slam or make objectionable noises.

4. Adjust force close to gently close doors if obstructed within 20 seconds from time they reach fully open position.

5. Provide separate adjustments for the time doors remain open after responding to a hall demand or a call registered in elevator. Time shall be easily adjustable. Include adjustment during Warranty Period.

   a. Provide for automatic adjustment to conform to traffic movement, in coordination with specified door protection device.

F. Cab Materials and Finishes:

1. Wall: Manufacturer's standard textured stainless steel panels.

   a. Basis of Design: "Scottish Quad" by Kone; "Rigidized Stainless Steel" by Otis, or approved equal.

2. Front Return Panel: Stainless steel, brushed finish.

3. Ceiling: Stainless steel panels with satin finish; with LED downlights.

   a. Basis of Design: LF94 by Kone; FC-4 by Otis.

4. Cab Floor: To be provided under Section 09 6500, "Resilient Flooring."

5. Cab Doors: Stainless steel, brushed finish.

6. Cab Door Frame: Stainless steel, brushed finish.

7. Cab Thresholds: Extruded aluminum, , with grooved surface.

8. Stainless steel handrail at back wall, satin finish, 1.5-inch round handrail, as required by code.

9. One set of protective pads and hooks.

G. Hoistway Entrance: UL "B" label.

1. Hoistway Doors and Frames: Stainless steel, brushed finish, 16 gauge minimum.

2. Hoistway Thresholds: Extruded aluminum, with grooved surface.

H. Signals: Vandal Resistant Type; stainless steel finish. Basis of Design: KSS 140 by Kone; Otis standard “Comfort” line; or approved equal.

1. Hall Stations: Provide one-stop hall stations at each floor with tri-flame “In Case of Fire Emergency, Elevators are Out of Service” language and diagram.

a. Illuminated hall push button station with vandal-resistant push buttons.
b. Engraved fire signage on faceplate of hall push button station.

2. In Car:

a. Illuminated car push button station with vandal-resistant push buttons.
b. Call direction lantern with gong mounted in car door jamb. Gong shall ring once for "UP" and twice for "DOWN."
c. Digital car position indicator, LED type.
d. ADA compliant, built-in, flush-mounted, hands-free telephone with trail cables.
e. Alarm bell.
f. Wiring to elevator controller for telephone and alarm bell.
g. Firefighters Phase 2 instructions.
h. Lantern and chime.

I. Mechanical/Electrical: By Electrical Trades, not Elevator Contractor, except as noted:

1. Main Power Supply: Alternating current, 120/240 volts plus or minus 5 percent of normal, single phase, 60 Hz, with a separate equipment grounding conductor.

a. Verify capacity and confirm service prior to order.

2. Car Lighting Power Supply: Alternating current, 120 volts, 60 Hz, single phase.

3. Power Exhaust Fan by Elevator Contractor: 2 speed, 120 volt fan. Fan shall be mounted to the structural ceiling to facilitate in-car air circulation, meeting A17.1 code requirements…

a. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise.
b. A switch shall be provided in the car-operating panel to control the fan.

4. Meet Elevator Manufacturer's Requirements: Elevator shaft and remote controller closet need to be maintained at a temperature between 41 degrees F and 104 degrees F for proper equipment operation. Maximum allowed humidity is 95 percent non-condensing.

J. Emergency and Inspection Features:

1. Special emergency service as required by governing authorities.

2. Emergency Lighting: An emergency power unit employing a 6 volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car and provide current to the alarm bell in the event of building power failure; except that "Halo Light Unit" mounted at bottom front return or operating panel is acceptable substitution, if acceptable to the local Authority Having Jurisdiction

3. Key operated switch at First Floor landing call button stations to shut down elevator.

4. Key operated "Independent Service" switch in car.

5. Emergency exits, including emergency top exit, interlocked as required by code.

K. Other Features:

1. Electronic door edge.

2. Braille floor designations.

1.04 ACTION SUBMITTALS

A. Shop Drawings:

1. Plan and section of hoistway, pit and machinery space.

a. Include seismic, static and dynamic loads imposed on building structure.
b. Show required clearances around equipment.

2. Details of cab, fixtures, entrances, equipment and other details.

3. Data; Show on Layouts or Separate Data Sheets:

a. Electric motor heat release.
b. Power requirements.

4. Seismic calculations.

B. Product Data; Manufacturer's Catalog Cut Sheets:

1. Hall and car buttons and position indicators.

2. Ceiling panels with lighting.

3. Independent control switches in locked service cabinet.

C. Samples: 6 inch square panels and 12 inch lengths (or Manufacture's standard sample sizes) of materials and finishes exposed to view. Provide samples of additional materials if specifically requested.

1.05 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications, including installer's licensing certificate, if requested by Owner's Representative.

B. Certification for each welder.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance contract.

B. Extended warranty.

C. Single-line electrical wiring diagram for elevator system.

1. In addition to copies required by Division 01, provide one extra set in Elevator Equipment Closet.

2. Wiring diagrams shall be "as built," specific for this installation, and reference identification on Drawings shall match points identified on terminals of controller.

D. Operation Data: Include description of method of operation and control and special features provided. Provide technical information for servicing operating equipment.

E. Maintenance Data: Provide parts catalogs, legible schematic wiring diagrams, one copy of master schematic and lubrication chart.

F. Test and approval certificates issued by jurisdictional authorities.

G. Reports of tests conducted under "Field Quality Control" Article of this Section.

H. Certification that installed system meets specified design and performance requirements.

I. "As Built" drawings, same information as specified for shop drawings.

J. Belt Monitor: If belts are used for hoisting.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's representative or authorized agent of elevator equipment manufacturer.

B. Welder Qualifications: Certified and qualified in accordance with procedures specified in American Welding Society Standard in accordance with AWS D1.1, using procedures, materials, and equipment of the type required for the work.

C. Requirements of Regulatory Agencies:

1. California Title 8, State Elevator Safety Order 3041c, and other applicable state and local codes.

2. "American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks," ANSI A17.1.

3. Provide barrier-free access for accessibility as required by CCR Title 24, Chapter 5 with amendments, the Americans with Disabilities Act (ADA) requirements, and CBC Chapter 30. Comply with most restrictive requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials in original protective packaging; prevent soiling, physical damage, or wetting..

B. Fully protect equipment from time of delivery until machine room is completed.

1. Protect equipment and exposed finishes during transportation and erection.

2. Ship in crated sections, sized to permit passing through available spaces.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements," and Section 01 6600, "Material and Equipment."

1.09 FIELD CONDITIONS

A. Space Requirements:

1. Drawings show space requirements for installation of elevator equipment.
   a. Comply with space shown. If different space is required to accommodate equipment of manufacturer, submit drawings showing required revisions at time of Bid Submittal.Owner reserves the right to reject space requirements different than those shown if, in Owner's opinion, they would have a detrimental effect on the Project.

B. Sequencing and Scheduling: Mutually agree on schedule and coordinate related work by other Sections.

C. Temporary Use of Elevator: Only for testing and demonstrating operation. Use by Owner or Contractor prior to completion shall be as mutually agreed upon with Elevator Contractor ..

1.010 WARRANTY

A. Provide 60 months labor and materials extended warranty for entire system; only if maintenance is for 60 months; otherwise, 12 months standard Manufacturer's Warranty shall be provided.

1.011 MAINTENANCE

A. Furnish full protective maintenance on entire elevator equipment during the first 60 months of Warranty Period. Maintenance shall consist of monthly systematic examination, adjustment or repair or replacement, and lubrication of all elevator components.

1. Inspect, clean, lubricate, and provide lubricants to door-operator equipment, including linkages, drive motor, speed-reduction unit, safety-shoe and light-ray devices, electromechanical valves, controller equipment, interlocks, coils, contacts, resistors, magnet frames, contact-switch assemblies, braid, springs, controller fuses, insulators, solenoids, resistor grids, and other mechanical parts.

2. Make necessary adjustments that can be made during regular inspections.

3. Examine and make minor adjustments to accessory equipment, including relamping signal equipment, as follows:

   a. Car stations.
   b. Electric door operators.
   c. Interlocks.
   d. Door hangers.
   e. Safety edge and photoelectric cells.

4. Provide, when necessary, carbon and copper-and-silver contacts where contacts are renewable, contact insulations, contact springs, and shunts for controller switches.

5. Repair or replace electrical and mechanical parts of elevator equipment whenever required, using only standard parts produced by original manufacturer of equipment.

6. Replace parts and components as often as necessary to maintain an adequate factor of safety, and provide and maintain normal operation and service.

7. Check operation of fire service and emergency power in coordination with Building Management, at times which do not interfere with necessary elevator operation.

8. Repairs necessitated by negligence, improper use, vandalism or misuse of equipment, except ordinary wear and tear, are not a responsibility of this maintenance requirement.

B. Perform maintenance with trained competent personnel under supervision of and in direct employ of elevator installer during regular working hours, unless prior arrangements involving premium overtime work are made.

C. Provide emergency call-back service, 24 hours per day, 7 days a week, at no additional cost.

   1. Response Time for Emergency Callbacks:

      a. Regular Hours: Within one hour.
      b. Overtime hours: Within 1-1/2 hours.
      c. Trap Call, 24 hours a day, 7 days a week: Within one hour.

D. Contractor will be paid for overtime portion of labor for repairs performed during overtime hours. A repair is defined as work requiring more than one technician to perform the work.

E. Prior to expiration of maintenance service included in Contract, make a thorough check of:

   1. Car rails.

   2. Motor.

   3. Car alignment.

   4. Make adjustments as required for a smooth car ride.

   5. Demonstrate that all equipment and components are operating in accordance with specified requirements. Provide a written report showing test reports for performance times.

1.012 PERMITS, TESTS, AND INSPECTIONS

A. Obtain and pay for all required permits and inspections. Elevator Contractor shall be paid for all Temporary Use inspections.

B. Perform tests as required by legal requirements, regulatory agencies and Owner.

C. Belt Monitor: Provide & leave for Owner, if belts are used.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer and System: Provide machine room-less (MRL) traction passenger elevator; KONE, Otis, or approved equal product and system that conforms to the limitations of the hoistway dimensions shown on Drawings.

B. Basis of Design: "EcoSpace" by KONE; or "Gen2" by Otis. System shall include:

1. An AC gearless electric motor using embedded permanent magnets, mounted on guide rail at top of hoistway.

2. Polyurethane coated steel belts, or steel cables, as standard with manufacturer for elevator hoisting.

2.02 MATERIALS

A. Structural Steel Shapes and Plates: ASTM A36.

B. Structural Tubing: ASTM A500 Grade B, or A501.

C. Sheet Steel:

1. Exposed: ASTM A366; stretcher-leveled, cold-rolled, commercial quality carbon steel, matte finish.

2. Unexposed: ASTM A569; hot-rolled, commercial-quality carbon steel, pickled and oiled.

D. Stainless Steel: ASTM A167, 300 Series, with standard tempers and hardness required for fabrication, strength and durability.

E. Aluminum:

1. Extrusions or Cast: ASTM B221.

2. Sheet and Plate: ASTM B209.

F. Extruded Nickel Silver: ASTM B151, alloy UNS No. C74500, polished finish.

G. Bolts, Nuts, and Washers: ASTM A325.

H. Welding Materials: AWS D1.1; type required for materials being welded.

I. Protective Coating for Unexposed Steel and Iron: Manufacturer's standard rust-resistant primer.

2.03 HOISTWAY ENTRANCE

A. Rating: UL "B" Label.

B. Frames: Square profile, 16 gauge stainless steel #441, finish as specified.

1. Bolt to form one piece with concealed fasteners and to provide neat appearance from corridor side.

2. Key switches shall be manufacturer's standard, faceplate mounted.

C. Doors: Flush solid panels; 16 gage stainless steel, finish as specified.

D. Additional Design and Finishes: Refer to Part 1, System Description.

2.04 CAR ENCLOSURE

A. Design and Finishes: Refer to Part 1, System Description.

2.05 ELEVATOR EQUIPMENT

A. Door Protection: Multi-beam, infrared full screen electronic sensing device projecting across entrance to prevent car and hoistway doors from closing if a light ray is interrupted.

1. When a stop is made, door shall remain in open position for a predetermined interval, unless closing is initiated by interruption and reestablishment of the light ray, by registration of a car call, or by pushing door close button.

2. Doors shall not close when a light ray is interrupted. Doors shall stop and reopen if a light ray is activated. After an adjustable time period, doors shall close.

3. Self-contained control circuitry shall override and disable sensing unit to allow door closure when infrared device indicates an obstruction for an adjustable time period. Doors shall close at reduced speed. Comply with ASME A17.1.

B. Automatic Two-Way Leveling:

1. Provide an automatic two-way leveling device so that cars will approach landing stops at reduced speed from either direction of travel.

2. Leveling device shall, within its zone, be entirely independent of operative device and shall automatically stop and maintain cars approximately level with landings, regardless of change in load.

C. Emergency stop switch in car shall cut off current supply to motor and bring car to rest, independent of regular operating devices. Comply with ASME A17.1.

D. Car Operating Panel: Flush-mounted in car; containing call-registration buttons for each landing, emergency stop switch, alarm button, and light switch.

E. Signals: Refer to Part 1, System Description.

F. Limit Switches:

1. Terminal limit switches shall automatically stop car at terminal landing.

2. Final hoistway limit switches shall automatically cut off power should car travel beyond terminal landings.

G. Inspection Switch: Continuous pressure switch with "UP" and "DOWN" direction buttons; mounted on top of car.

1. Switch shall permit car to be operated at slow speed in both directions for inspection.

2. Car shall not respond to landing calls during inspection operation.

H. Emergency stop switch in elevator pit shall cut off current supply to motor and prevent operation of elevator. Provide emergency stop switches as required by ASME A17.1.

I. Alarm Bell: Electric signal bell in or adjacent to elevator hoistway as directed; connected to alarm button in car operating panel.

J. Emergency power unit, using a 12 volt, sealed, rechargeable battery and totally static circuits, shall adequately illuminate car and provide current to alarm bell in event of power failure.

K. Guide Rails: Planed steel tees erected plumb and securely fastened to hoistway framing by heavy steel brackets.

1. Ends of guides shall be tongued and grooved, forming matched joints and shall be connected with steel splice plates.

2. Provide stanard slide guides.

3. Support will be vertical tube steel.

L. Slide Guides: Mount on the top and the bottom of the car and counterweight.

1. Car guides shall be at top and bottom of the car.

2. The counterweight guides shall be at the top and the bottom.

M. Coated Steel Belts: Polyurethane coated belts with high-tensile grade, zinc-plated steel cords, if used.

N. Buffers: Spring-return oil buffers mounted on pit floor, with supports and necessary blocking. Provide buffer switches.

O. Counterweights:

1. Sectional metallic weights securely fastened in structural frames.

2. Face of frames shall clear rail by no more than 1/4 inch.

P. Car Frame and Safety: Flexible guide clap type to be mounted on underside of car frame.

Q. Governor: Tension type.

R. Governor Rope: Steel and shall consist of at least eight strands wound about a sisal core center.

S. Sheaves and Sheave Beams: Provide all sheaves and sheave beams as required.

1. Beams shall be same as typical structural steel.

2. Fasten beams to structure to prevent tipping against acceleration of 1.0 G.

3. Sheaves shall be cast iron with uniformly machined sheave grooves and roller bearings.

4. Provide structural supports for deflector sheaves to resist acceleration of 1.0 G.

5. Provide guards to prevent cables from leaving sheave grooves during an earthquake.

T. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted on guide rail or at the top of the hoistway.

U. Car Frame and Platform:

1. Car frame supporting elevator platform and enclosure shall be made of structural steel.

2. Platform shall consist of steel subfloor to receive finish flooring.

V. Elevator Pit Ladder: By Elevator Contractor Pit Ladder shall comply with OSHA and other regulatory requirements.

2.06 OPERATION REQUIREMENTS

A. Provide manufacturer's standard microprocessor operation system for Single Elevator: "Selective Collective Automatic Operation" as defined in ASME A17.1.

B. Independent Service: Provide independent service so that, by means of a switch located in car panel, car can be operated with an attendant.

1. Attendant shall have full control of starting, stopping, and direction of car travel. Car shall respond only to car buttons.

2. Hall signals shall not operate for cars on Independent Service.

C. Operation under Fire or Other Emergency Conditions: As defined in ASME A17.1 and California Title 8.

1. Home Floor: Second Story Level.

2. Alternate Floor: First Story Level.

D. Operation under Earthquake Conditions: As defined in ASME A17.1.

1. Provide sensing and derailment device on counterweights to register distortion of counterweight frame or its departure from rail.

a. Device shall be mechanical and shall not destruct upon operation, unless the counterweight leaves its rails.

b. When device is activated elevator shall immediately stop, then move at approximately 150 feet per minute to next floor and stop.

2. Provide a clearly identified reset switch in remote cabinet with controller.

2.07 ADDITIONAL COMPONENTS AND ACCESSORIES

A. Signage:

1. Braille and Arabic Symbol Plates: Provide standard plaques on both sides of hoistway entrance frames at 60 inches to center line above floor, to locate entrance and identify floor on which entrance occurs.

a. Provide 2 inch Arabic numerals and Braille numerals raised 1/16 inch minimum, or per Code requirements.
b. Plates shall have contrasting background and be fastened to frames with flush screws or rivets.
c. Comply with ADA requirements.

2. Engraved sign to read "In case of fire use stairway for exit. Do not use elevator." Text size shall be minimum 3/8 inch capital height, unless otherwise required by governing authorities.

3. See additional requirements specified in Section 10 1400, “Signage,” and the Drawings.

B. Struts and Closer Angles: Structural steel of sufficient size to accommodate door closers. Angles shall be continuous and securely bolted to sills and building beams above.

C. Hanger Supports or Headers: 16 gauge formed steel sections galvanized or painted black, securely bolted to the strut angles or closer support angles.

D. Hanger Cover Plates: 16 gauge steel galvanized or painted black.

1. Extend full travel of doors.

2. Covers shall be made in sections for access.

3. Sections above door openings shall be removable from within elevator car.

E. Fascia : 16 gauge steel galvanized or painted black. Reinforce to ensure a flat surface. Securely fasten to hanger supports and sill above.

F. Dust Covers: 16 gauge steel galvanized or painted black. Extend over hanger support the width of jamb opening plus jamb flanges at the top landing for which fascia plates are not supplied.

G. Toe Guards: 16 gauge steel galvanized or painted black. Provide at bottom landing. Extend to wall on a gradual bevel from sill nosing.

2.08 FINISHES

A. Stainless Steel 441: No. 4 satin finish unless otherwise shown or specified.

1. Follow Federal and NAAMM nomenclature for texture and reflectivity required. Protect with adhesive plastic film or paper covering.

2. Finishes specified as "satin" shall be manufacturer's standard directional polish that complies with AISI No. 4 requirements.

B. Hoistway Sheet Metal: One coat machine black unless galvanized.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation of elevator equipment, examine the following and verify that no irregularities exist that would affect quality of execution of work.

1. Hoistway size and plumbness.

2. Sill pockets.

3. Anchor brackets.

4. Sill supports.

3.02 INSTALLATION

A. General:

1. Install elevator in accordance with accepted manufacturer's directions and ANSI A17.1/ASME A17.1.

2. Install Controller Cabinet equipment with clearances complying with ANSI C1 and ASME A17.1.

3. Install items so that they may be removed for easy maintenance.

B. Alignment:

1. Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars.

2. Where possible, delay installation of sills and frames until car is operable in shaft.

3. Reduce clearances to minimum, safe, workable dimension at each landing. Provide minimum clearances to comply with ASME A17.1.

C. Welded Construction: Provide welded connections where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards.

D. Set sills flush with finished floor surface at landings. Fill space under sills solidly with nonshrink, nonmetallic grout. Comply with acoustical installation and noise emission requirements specified.

3.03 FIELD QUALITY CONTROL

A. Provide all personnel, equipment and instruments required for inspection and testing.

B. Inspect and test elevator system to verify compliance with specified design and performance requirements, including noise and vibration requirements.

C. Inspections by Regulatory Authorities:

1. Have acceptance inspection required by local authority performed by enforcing agency.

2. In addition to inspections and test required by local authority, perform all applicable inspections and test contained in Part I and II of ANSI A17.2.

3. Schedule tests with agencies and Owner's Representative and Contractor present.

4. Final inspection shall be after elevator installation, hoisting enclosures and machine room are complete.

D. Make a final check of elevator with Owner's Representative present prior to turning elevator over for use. Verify that control systems and operating devices are functioning properly. Adjust as required.

3.04 ADJUST AND CLEAN

A. Adjustments:

1. Adjust equipment to operate to within accepted design tolerances.

2. Adjust car-leveling devices.

3. Lubricate all equipment in accordance with accepted manufacturer's instructions.

B. Cleanup and Touchup:

1. Remove from hoistway surfaces all materials and filings, rust, and construction debris.

2. Clean machine-room floor of dirt, oil, and grease.

3. Touch up finish on machine room and hoistway equipment.

END OF SECTION 14 2100

SECTION 220500
BASIC MATERIALS AND METHODS - PLUMBING

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and Division 01 - General Requirements, and shall include all Plumbing Sections specified herein.

1.2 SCOPE OF THIS SECTION

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:

1. Compliance with all codes and standards applicable to this jurisdiction.
2. Shop Drawings for Equipment
3. Coordination Documents
4. Record Drawings
5. Start-up Service and Building Commissioning
6. Instruction, Maintenance, and O & M Manuals
7. Work associated with Delivery, Storage, and Handling of products
8. Work associated with provision of Temporary Facilities
9. Preparation of Posted Operating Instructions
10. Meeting Project Safety and Indemnity requirements
11. Proper Cleaning and Closing
12. Supplying proper Warranty information
13. Supply specified Guarantee documentation
14. Design and provision of Supports and Anchors
15. Design and provision of Seismic Restraints and Vibration Isolation
16. Pipe Portals
17. Equipment Rails
18. Access Panels and Doors
19. Identification Markers
20. Coordination of Electrical requirements for equipment provided

1.3 DESCRIPTION OF WORK

A. The Contract Documents, including Specifications and Construction Drawings, are intended to provide all material and labor to install complete plumbing systems for the building and shall interface with all existing building systems affected by new construction.

B. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the fixtures, equipment, and pipe lines and are not to be scaled; all dimensions and existing conditions shall be checked at the building.

C. The Contractor shall comply with the project closeout requirements as detailed in General Requirements of Division 01.

D. Where project involves interface with existing building and site systems, every effort has been made to note existing utilities and services. However, the Contractor should thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available as to concealed conditions, which exist in portions of the existing building affected by this work.

1.4 DESCRIPTION OF BID DOCUMENTS

A. Specifications:

1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.

B. Drawings:

1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
2. Before proceeding with work check and verify all dimensions.
3. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
4. Make adjustments that may be necessary or requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
5. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts. Verify exact location and elevation of existing piping prior to any construction.
6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible, including during bidding period.

1.5 DEFINITIONS

A. "Above Grade": Not buried in the ground and not embedded in concrete slab on ground.

B. "Actuating" or "Control" Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

C. "Below Grade": Buried in the ground or embedded in concrete slab on ground.

D. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.

E. "Connect": Complete hook-up of item with required service.

F. "Exposed": Not installed underground or "concealed."

G. "Furnish": To supply equipment and products as specified.

H. "Indicated," "Shown" or " "Noted": As indicated, shown or noted on Drawings or Specifications.

I. "Install": To erect, mount and connect complete with related accessories.

J. “Lead Free”: Materials containing not more than 0.2 percent lead when used with respect to solder and flux and not more than a weighted average of 0.25 percent when used with respect to the wetted surfaces of pipes and pipe fittings, plumbing fittings, and fixtures, providing a specified definition and formula for determining “weighted average”.

K. "Motor Controllers": Manual or magnetic starters (with or without switches), individual push buttons or hand-off-automatic (HOA) switches controlling the operation of motors.

L. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

M. "Provide": To supply, install and connect as specified for a complete, safe and operationally ready system.

N. "Reviewed," "Satisfactory" or "Directed": As reviewed, satisfactory, or directed by or to Architect/Engineer/Owner.

O. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.

P. "Shall": An exhortation or command to complete the specified task.

Q. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified products.

R. "Supply": To purchase, procure, acquire and deliver complete with related accessories.

S. “Typical” or “Typ”: Exhibiting the qualities, traits, or characteristics that identify a kind, class, number, group or category. Of or relating to a representative specimen. Application shall apply to all other similarly identified on plan or detail.

T. "Will": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall."

U. "Wiring": Raceway, fittings, wire, boxes and related items.

V. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

1.6 RELATED WORK SPECIFIED ELSEWHERE

A. All Division 22 Plumbing sections included herein.

B. Division 02: Existing Conditions

1. Coordination of excavation of trenches and the installation of mechanical systems and piping on site.

C. Division 03: Concrete.

1. All concrete work for Plumbing Division shall be included in Division 22 under the appropriate Sections and shall include:

a. Concrete curbs and housekeeping pads for the mechanical equipment.
b. Thrust blocks, pads, and boxes for mechanical equipment.
c. Coordination of floor drain and floor sink installations in sloped floors.

D. Division 05

E. Division 07: Thermal and Moisture Protection.

1. Flashing and sheet metal
2. Sealants and caulking
3. Firestopping

F. Division 09: Finishes:

1. Division 22 installers shall perform all painting, except where specifically stated otherwise in Division 09.
2. Painting of all exposed steel, piping, insulation, equipment, and materials.
3. All exposed gas piping located interior and exterior to the building must be painted yellow.

G. Division 26: Electrical is related to work of:

1. Power connections to all plumbing equipment
2. Life safety provisions

1.7 CODES AND STANDARDS

A. The Contractor is cautioned that code requirements not explicitly detailed in these specifications or drawings, but which may be reasonably inferred or implied from the nature of the project, must be provided as part of the contract.

B. Perform all tests required by governing authorities and required under all Division 22 Sections. Provide written reports on all tests.

C. Electrical devices and wiring shall conform to the latest standards of NEC; all devices shall be UL listed and labeled.

D. All plumbing work shall comply with the Americans with Disabilities Act (ADA).

E. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

F. Provide in accordance with rules and regulations of the following:

1. Building Codes enforced by the Authority Having Jurisdiction in California:

    a. 2010 Building Standards Administrative Code, Part 1, Title 24 C.C.R.
    b. 2010 California Building Code (CBC), Part 2, Title 24 C.C.R. (2009 International Building Code and 2010 California Amendments)
    c. 2010 California Electrical Code (CEC), Part 3, Title 24 C.C.R. (2008 National Electrical Code and 2010 California Amendments)
    d. 2010 California Mechanical Code (CMC) Part 4, Title 24 C.C.R. 2009 Uniform Mechanical Code and 2010 California Amendments)
    e. 2010 California Plumbing Code (CPC), Part 5, Title 24 C.C.R. (2009 Uniform Plumbing Code and 2010 California Amendments)
    f. 2010 California Energy Code (CEC), Part 6, Title 24 C.C.R.
    g. 2010 California Fire Code, Part 9, Title 24 C.C.R. (2009 International Fire Code and 2010 California Amendments
    h. 2010 California Green building Standards Code (CALGreen), Part 11, Title 24 C.C.R.
    i. 2010 California Referenced Standards, Part 12, Title 24 C.C.R.
    j. Title 19 C.C.R. Public Safety, State Fire Marshal Regulations.

G. Provide in accordance with appropriate referenced standards of the following:

1. NFPA - National Fire Protection Association
2. CSA - Canadian Standards Association
3. ADC - Air Diffuser Council
4. ANSI - American National Standards Institute
5. ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers
6. ASME - American Society of Mechanical Engineers
7. ASTM - American Society for Testing Materials
8. AWS - American Welding Society
9. AWWA - American Water Works Association
10. FM - Factory Mutual
11. MSS - Manufacturer's Standardization Society
12. NEMA - National Electrical Manufacturer's Association
13. SMACNA - Sheet Metal and Air Conditioning Contractors National Association

14. UL - Underwriter's Laboratories
15. ADA - Americans with Disabilities Act
16. ETL - Electrical Testing Laboratories
17. ASSE - American Society of Sanitary Engineers
18. PDI - Plumbing and Drainage Institute
19. IAPMO - International Association of Plumbing and Mechanical Officials
20. CISPI - Cast Iron Soil Pipe Institute

1.8 QUALITY ASSURANCE

A. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or Type 304 stainless steel sheet, not less than 20 USG (0.0375”), riveted or bolted to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.

B. Current Models. All work shall be as follows:

1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
2. Replacement parts shall be readily available and stocked in the USA.

C. Experience: Unless more stringent requirements are specified in other sections of Division 22, manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than one year prior to the date of bidding for this project.

1.9 GENERAL REQUIREMENTS

A. Examine all existing conditions at building site.

B. Review contract documents and technical specifications for extent of new work to be provided.

C. Provide and pay for all permits, licenses, fees and inspections.

D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. This work shall include furnishing and installing all access doors required for mechanical access.

E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to Equipment Specifications in Divisions 02 through 48 for rough-in requirements.

F. Coordinate mechanical equipment and materials installation with other building components.

G. Verify all dimensions by field measurements.

H. Arrange for chases, slots, and openings in other building components to allow for plumbing installations.

I. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

J. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

K. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Contractor to provide for all cutting and patching required for installation of his work unless otherwise noted.

L. Where mounting heights are not detailed or dimensioned, install plumbing services and overhead equipment to provide the maximum headroom possible.

M. Install plumbing equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, without interference with other installations.

N. Coordinate the installation of plumbing materials and equipment above ceilings with ductwork, piping, conduits, suspension system, light fixtures, cable trays, sprinkler piping and heads, and other installations.

O. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

P. Coordinate with Owner in advance to schedule shutdown of existing systems to make new connections. Provide valves in new piping to allow existing system to be put back in service with minimum down time.

Q. All materials (such as insulation, piping, wiring, controls, etc.) located within air plenum spaces, air shafts, and occupied spaces shall have a flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing, or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.

R. Coordinate installation of floor drains and floor sinks with work of other trades, such that finished floor slopes to drains and floor sinks are flush with surrounding floor.

S. Products made of or containing lead, asbestos, mercury or other known toxic or hazardous materials are not acceptable for installation under this Division. Any such products installed as part of the work of the Division shall be removed and replaced and all costs for removal and replacement shall be borne solely by the installing Contractor.

T. Pipes, pipe fittings, plumbing fittings and fixtures that come into contact with the wetted surface of a public water system or any plumbing in a facility providing water for human consumption shall be “Lead Free”.

1.10 MINOR DEVIATIONS

A. The Drawings are diagrammatic and show the general arrangements of all plumbing work and requirements to be performed. It is not intended to show or indicate all offsets, fittings, and accessories which will be required as a part of the work of this Section.

B. The Contractor shall review the structural and architectural conditions affecting his work. It is the specific intention of this section that the contractor's scope of work shall include

1. Proper code complying support systems for all equipment whether or not scheduled or detailed on drawings or in these specifications
2. Minor deviations from the plumbing plans required by architectural and structural coordination.

C. The Contractor shall study the operational requirements of each system, and shall arrange his work accordingly, and shall furnish such fittings, offsets, supports, accessories, as are required for the proper and efficient installation of all systems from the physical space available for use by this section. This requirement extends to the Contractor's coordination of this section's work with the "Electrical Work." Should conflicts occur due to lack of coordination, the time delay, cost of rectification, demolition, labor and materials, shall be borne by the Contractor and shall not be at a cost to the Owner.

D. Minor deviations in order to avoid conflict shall be permitted where the design intent is not altered.

E. Advise the Architect, in writing, in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

1.11 PRODUCT SUBSTITUTIONS

A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
4. Maintenance and service parts available locally are readily obtainable for the proposed substitute.

B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.

C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to this proposed substitution.

1.12 SHOP DRAWINGS AND EQUIPMENT SUBMITTALS

A. Prior to construction submit for review all materials and equipment in accordance with Division 01 requirements.

B. After approval of preliminary list of materials, the Contractor shall submit Shop Drawings and manufacturer's Certified Drawings to the Architect for approval.

C. The Contractor shall submit approved Shop Drawings and manufacturer's equipment cuts, of all equipment requiring connection by Division 26, to the Electrical Contractor for final coordination of electrical requirements. Contractor shall bear all additional costs for failure to coordinate with Division 26.

D. Submittals and Shop Drawings shall be submitted as a complete package bound in a 3-ring binder with tabs for each specification section. The approved submittals shall be converted into Operations & Maintenance Manuals at the completion of the project. Submit six (6) typed copies of submittals. Refer to Division 01 for additional requirements.

1.13 UNIT PRICING SUBMITTALS

A. Prior to construction submit for review all materials and equipment in accordance with Division 01 requirements.

B. Preliminary List of Materials and Unit Price Items: Within thirty (30) days after awarding of the Contract, submit to architect for preliminary approval a complete list of manufacturer’s names and model numbers of proposed materials and equipment. Also include proposed list of unit price items for review.

1. Indicate substituted items.
2. Identify test and balancing agency.
3. Identify independent testing laboratory for water analysis.

C. The Contractor shall submit with preliminary list of materials a unit price list for each item furnished on this project. Included with price shall be labor cost index.

D. Submittals and Shop Drawings shall be submitted as a complete package bound in a 3-ring binder with tabs for each specification section. Submit six (6) typed copies of submittals. Refer to Division 01 for additional requirements.

1.14 COORDINATION DOCUMENTS

A. The Contractors shall prepare coordinated Shop Drawings to coordinate the installation and location of all equipment, piping and all system appurtenances with other trades. The Drawings shall include all equipment rooms and floor plans. The Drawings shall be Overlay Drawings showing each discipline on a single sheet. The Drawings shall be keyed to the structural column identification system, and shall be progressively numbered. Prior to completion of the Drawings, the Contractor shall coordinate the proposed installation with the Architect and the structural requirements, and all other trades (including HVAC, Fire Protection, Electrical, Ceiling Suspension, and Tile Systems), and provide reasonable maintenance access requirements. When conflicts are identified, modify system layout as necessary to resolve. Do not fabricate, order or install any equipment or materials until coordination documents are approved by the General Contractor, Architect, and Owner. Within thirty (30) days after award of Contract, submit proposed coordination document Shop Drawing schedule, allowing adequate time for review and approval by parties mentioned above. Drawings should be prepared and submitted for approval on a floor-by-floor basis to phase with building construction.

B. The Drawings shall be prepared as follows:

1. The Sheet Metal (Mechanical) Contractor shall prepare Drawings to an accurate scale of 1/4" = 1'-0" or larger, on reproducible media sheets (vellum) or AutoCAD disks. Obtain reproducibles or AutoCAD files of the HVAC design from the Architect, or Engineer, at cost plus. Drawings are to be same size as Contract Drawings and shall indicate location, size and elevation above finished floor, of all HVAC equipment, ductwork, and piping. Plans shall also indicate proposed ceiling grid and lighting layout, as shown on electrical plans and reflected ceiling plans.
2. The Plumbing Contractor shall obtain reproducible plans or AutoCAD disks from the Mechanical Contractor, and indicate all plumbing lines including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
3. The Fire Protection Contractor shall obtain reproducible plans or AutoCAD disks with the detailed mechanical and plumbing work shown. The Sprinkler Contractor shall indicate location of all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.
4. Plans are to incorporate all addenda items and change orders.
5. Distribute plans to all trades and provide additional coordination as needed.

C. Advise the Architect in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

D. Provide means of access to all valves, controllers, operable devices, and other apparatus that may require adjustment or servicing.

E. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Architect of any discrepancies between those indicated on the Drawings and those existing in the field prior to any installation related thereto.

F. Final Coordination Drawings with all appropriate information added are to be submitted as Record Drawings at completion of project.

G. Provide copy of Record Drawings to Testing and Balancing Contractor for their use when doing their work.

1.15 RECORD DRAWINGS

A. Before commencing installation, obtain an extra set of prints from Architect, marked "Record." Keep this set of Drawings at the job site at all times, and use it for no other purpose but to mark on it all the changes and revisions to the Contract Drawings resulting from coordination with other trades. At the completion of the project:

1. Obtain a clean set of reproducibles from the Architect or Engineer, at cost plus, and transfer the revisions to these reproducibles in a neat and orderly fashion.

OR

2. Edit project electronic image files, such as AutoCAD/Revit, to incorporate all site markups, changes, and revisions to the Contract Drawings. Submit plots of Record Drawings and six copies CD Roms labeled with all record electronic image drawing files.

B. Provide copy of Record Drawings to Testing and Balancing Contractor for use when doing his work.

C. Mark Drawings to indicate revisions to piping size and location, both exterior and interior; including locations of control devices, valves, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e. – valves, traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

D. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

E. Refer also to Special Conditions in Division 01 for full scope of requirements.

1.16 START-UP SERVICE AND BUILDING COMMISSIONING

A. Prior to start-up, be assured that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrication, venting, controls, and installed and properly set relief and safety valves.

B. Provide services of factory-trained technicians for start-up of temperature controls, boilers, pumps, and other major pieces of equipment. Certify in writing compliance with this Paragraph, stating names of personnel involved and the date work was performed.

C. Refer to other Division 01 Sections for additional requirements.

1.17 INSTRUCTION, MAINTENANCE, AND O&M MANUALS

A. O&M Manuals: Upon completion of the work, the Contractor shall submit to the Architect complete set of operating instructions, maintenance instructions, part lists, and all other bulletins and brochures pertinent to the operation and maintenance for equipment furnished and installed as specified in this section, bound in a durable binder. Refer to Division 01.

B. The Contractor shall be responsible for proper instruction of Owner's personnel for operation and maintenance of equipment, and apparatus installed as specified in Division 22 to be no less than 2 hours for each piece of equipment.

1.18 DELIVERY, STORAGE AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials in an environmentally controlled area at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage. Piping shall be stored in bundles covered with visqueen. Piping showing signs of rust shall be removed from site and replaced.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.19 TEMPORARY FACILITIES

A. Refer to Division 01 for the requirements of temporary water and sewer for construction and safety. Provide temporary water, and sewer, etc. services as necessary during the construction period and as required to maintain operation of existing systems.

1.20 POSTED OPERATING INSTRUCTIONS

A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. Attach or post operating instructions adjacent to each principal system and equipment including start-up, operating, shutdown, safety precautions and procedure in the event of equipment failure. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal.

1.21 SAFETY AND INDEMNITY

A. The Contractor shall be solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal hours of work.

B. No act, service, Drawing, review, or Construction Review by the Owner, Architect, the Engineers or their consultants, is intended to include the review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify and defend the Owner, the Architect, the Engineers and their consultants, and each of their officers, employees and agents from any and all liability claim, losses or damage arising, or alleged to arise from bodily injury, sickness, or death of a person or persons, and for all damages arising out of injury to or destruction of property arising directly or indirectly out of, or in connection with, the performance of the work under the Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the Construction Contract Documents; but not including the sole negligence of the Owner, the Architect, the Engineers, and their consultants or their officers, employees and agents.

1.22 CLEANING AND CLOSING

A. All work shall be inspected, tested, and approved before being concealed or placed in operation.

B. Upon completion of the work, all equipment installed as specified in this section, and all areas where work was performed, shall be cleaned to provide operating conditions satisfactory to the Architect.

1.23 WARRANTIES

A. All equipment shall be provided with a minimum one-year warranty to include parts and labor. Refer to individual Equipment Specifications for extended or longer-term warranty requirements.

B. Provide complete warranty information for each item, to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.

C. Service during warranty period: Contractor shall provide maintenance as specified elsewhere during the 12-month warranty period.

1.24 GUARANTEE

A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of one (1) year after the Date of Final Acceptance, ordinary wear and tear excepted.

B. Contractor shall be responsible for and pay for any damages caused by or resulting from defects in his work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.

B. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturers' names used herein, unless specifically noted that substitutes are not allowed.

2.2 SUPPORTS AND ANCHORS

A. General: Comply with applicable codes pertaining to product materials and installation of supports and anchors, including, but not limited to, the following:

1. UL: Provide products which are UL listed.
2. FM: Provide products which are FM approved.
3. ASCE 7-05: "American Society of Civil Engineers."
4. 2006 International Building Code (IBC)
5. MSS Standard Compliance: Manufacturer's Standardization Society (MSS).
6. SMACNA: "Seismic Restraint Manual: Guidelines for Mechanical Systems."
7. NFPA: Pamphlet number 13 and 14 for fire protection systems.
8. Provide copper plated or plastic coated supports and attachment for copper piping systems. Field applied coatings or tape is unacceptable.
9. Manufacturer: B-Line, Anvil International, Michigan, Tolco, Kin-Line, Simpson, or Superstrut.

B. Horizontal Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated hangers and supports of one of the following MSS types listed.

1. Adjustable Steel Clevis Hangers: MSS Type 1.
2. Adjustable Steel Swivel Band Hangers: MSS Type 10.
3. U-Bolts: MSS Type 24.
4. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
    a. Plate: Unguided type.
    b. Plate: Guided type.
    c. Plate: Hold-down clamp type.
5. Pipe Saddle Supports: MSS Type 36, including steel pipe base support and cast iron floor flange.
6. Pipe Saddle Supports with U-Bolt: MSS Type 37, including steel pipe base support and cast iron floor flange.
7. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast iron floor flange.
8. Single Pipe Roller with Malleable Sockets: MSS Type 41.

9. Adjustable Roller Hangers: MSS Type 43.
10. Pipe Roll Stands: MSS Type 44.
11. Pipe Guides: Provide factory-fabricated guides of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

C. Horizontal Cushioned Pipe Clamp: Where pipe hangers are called out to absorb vibration or shock install a piping clamp with thermoplastic elastomer insert. Cush-A-Clamp or equal.

D. Vertical Piping Clamps: Provide factory-fabricated two-bolt vertical piping riser clamps, MSS Type 8.

E. Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments of one of the following MSS types listed.

1. Steel Turnbuckles: MSS Type 13.
2. Steel Clevises: MSS Type 14.
3. Swivel Turnbuckles: MSS Type 15.
4. Malleable Iron Eye Sockets: MSS Type 16.
5. Steel Weldless Eye Nuts: MSS Type 17.

F. Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments of one of the following types listed.

1. Concrete Inserts: MSS Type 18 or Blue Banger Hanger by Simpson
2. Steel Brackets: One of the following for indicated loading:

   a. Light Duty: MSS Type 31.
   b. Medium Duty: MSS Type 32.
   c. Heavy Duty: MSS Type 33.

3. Horizontal Travelers: MSS Type 58.
4. Internally Threaded Expansion Shell Anchors: By Simpson or approved equal.
5. Concrete Screw Anchors: Titen HD by Simpson or approved equal.
6. Anchor Bolts: Heavy duty, drilled-in concrete expansion wedge anchor bolts, Hilti or Red Head.

G. Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

1. Pipe Covering Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
2. Insulation Protection Shields: MSS Type 40, 18" minimum, or of the length recommended by manufacturer to prevent crushing of insulation. High-density insulation insert lengths shall match or exceed shield length.
3. Thermal Hanger Shields: Constructed of 360° insert of waterproofed calcium silicate (60 psi flexural strength minimum) encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation. Shield length shall match or exceed length of calcium silicate insert. Alternately Polyisocyanurate Urethane with a minimum flexural strength of 60psi, fully encased in 360 PVC (1.524 mm thick) SNAPPITZ. Provide assembly of same thickness as adjoining insulation.
4. Thermal Hanger Couplings: Constructed of high strength plastic coupling to retain tubing and join insulation at clevis hangers and strut-mounted clamps. Klo-Shure Insulation Coupling or equal.

H. Miscellaneous Materials:

1. Metal Framing: Provide products complying with NEMA STD ML1.

2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A36.
3. Cement Grout: Portland Cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand by volume, with minimum amount of water required for placement and hydration.
4. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required. Weld steel in accordance with AWS standards.
5. Pipe Brackets: "HoldRite" copper plated brackets. Insulate brackets attached to metal studs with felt.

2.3 PIPE PORTALS

A. Where pipe portals are not provided by other sections of Specification, provide prefabricated insulated pipe portals as required for piping penetrating through the roof where shown on plans. Field built pipe portals are acceptable alternatives - provide detail of construction for review.

B. Standard pipe portals, unless otherwise noted, shall be constructed as follows:

1. Curb shall be constructed of heavy gauge galvanized steel with continuous welds on shell seams.
2. Insulation to be 1-½" thick, 3 lb density rigid fiberglass.
3. Curb to have a raised 3" (minimum), 45° cant.
4. Curb to have 1-1/2" x 1-1/2" wood nailer (minimum).
5. Curb height to be 8" (minimum) above roof deck.
6. Cant shall be raised to match roof insulation thickness.
7. Cover or flashing to be constructed of galvanized steel or other suitable material to provide sturdy weather tight closure. Provide collars and rubber nipples with draw bands of sizes required by piping. Size curb, cover and nipples per manufacturer's recommendations.
8. Manufacturer: Roof Products Systems or Pate.

2.4 EQUIPMENT/PIPING RAILS

A. Where equipment/pipe rails are not provided by other sections of Specification, provide prefabricated reinforced equipment rails as required for support of equipment and piping. Field built curbs are acceptable alternatives - provide detail of construction for review.

B. Standard equipment rail, unless otherwise noted, shall be constructed as follows:

1. Construct of heavy gauge galvanized steel with continuous welds on shell seams.
2. Provide internal reinforcing supports welded as required to meet application requirements.
3. Equipment rails to have raised 3" (minimum), 45° cant.
4. Equipment rails to have 1 1/2" x 1 1/2" wood nailer (minimum) and counterflashing.
5. Equipment rail height to be 6" (minimum) above roof deck.
6. Cant shall be raised to match roof insulation thickness.

C. Equipment rails to be constructed to meet equipment size and weight requirements. Provide tapered rails to match roof pitch where required.

D. Manufacturer: Pate, Vent Products, Thy Curb or Roof Products Systems.

2.5 ACCESS PANELS AND ACCESS DOORS

A. Provide all access doors and panels to serve equipment under this work, including those which must be installed, in finished architectural surfaces. Frame of 16-gauge steel, door of 20 gauge steel. 1" flange width, continuous piano hinge, key operated, prime coated. Refer to Architectural Specifications for the required product Specification for each surface. Contractor is to submit schedule of access panels for approval. Exact size, number and location of access panels is not shown on Plans. Access doors shall be of a size to permit removal of equipment for servicing. Access door shall have same rating as the wall or

ceiling in which it is mounted. Provide access panel for each trap primer or concealed valve. Use no panel smaller than 12” x 12” for simple manual access, or smaller than 24" x 24" where personnel must pass through. Provide cylinder lock for access door serving mixing or critical valves in public areas.

B. Included under this work is the responsibility for verifying the exact location and type of each access panel or door required to serve equipment under this work and in the proper sequence to keep in tune with construction and with prior approval of the Architect. Access doors in fire rated partitions and ceilings shall carry all label ratings as required to maintain the rating of the rated assembly.

C. Acceptable Manufacturers: Milcor, Karp, Nystrom, or Elmdor/Stoneman.

D. Submit markup of architectural plans showing size and location of access panels required for equipment access for approval by Architect.

2.6 IDENTIFICATION MARKERS

A. Mechanical Identification Materials: Provide products of categories and types required for each application as referenced in other Division 22 Sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category. Stencils are not acceptable.

B. Plastic Pipe Markers:

1. Snap-On Type: Provide pre-printed, semi-rigid snap-on, color coded pipe markers, complying with ANSI A13.1.
2. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers, complying with ANSI A13.1. Secure both ends of markers with color coded adhesive vinyl tape.
3. Insulation: Furnish 1” thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2” beyond each end of plastic pipe marker.
4. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

C. Underground-Type Plastic Line Markers: Provide 6” wide x 4 mils thick multi-ply tape, consisting of solid metallic foil core between 2 layers of plastic tape. Markers to be permanent, bright colored, continuous printed, intended for direct burial service.

D. Valve Tags:

1. Brass Valve Tags: Provide 1 1/2" diameter 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4” high letters and sequenced valve numbers 1/2” high, and with 5/32” hole for fastener. Fill tag engraving with black enamel.
2. Plastic Laminate Valve Tags: Provide 3/32” thick engraved plastic laminate valve tags, with piping system abbreviations in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32” hole for fasteners.
3. Valve Tag Fasteners: Provide solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
4. Access Panel Markers: Provide 1/16” thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8” center hole to allow attachment.
5. Non-potable Water Tags: 1/16” thick, engraved, plastic tags as indicated on Drawings.

E. Plastic Equipment Signs:

1. Provide 4-1/2” x 6” plastic laminate sign, ANSI A.13 color coded with engraved white core lettering.

2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
3. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters, such as pressure drop, entering and leaving conditions, rpm, etc.

F. Acceptable Manufacturers: Craftmark, Seton, Brady, Marking Services, Inc., or Brimar.

2.7 ELECTRICAL

A. General:

1. All electrical material, equipment, and apparatus specified herein shall conform to the requirements of Division 26.
2. Provide all motors for equipment specified herein. Provide motor starters, controllers, and other electrical apparatus and wiring which are required for the operation of the equipment specified herein.
3. Set and align all motors and drives in equipment specified herein.
4. Provide expanded metal or solid sheet metal guards on all V-belt drives to totally enclose the drive on all sides. Provide holes for tachometer readings. Support guards separately from rotating equipment.
5. Provide for all rotating shafts, couplings, etc., a solid sheet metal, inverted "U" cover over the entire length of the exposed shaft and support separately from rotating equipment. Cover shall extend to below the bottom of the shaft and coupling, and shall meet the requirements of the State Industrial Safety Regulations.
6. Specific electrical requirements (i.e., horsepower and electrical characteristics) for plumbing equipment are scheduled on the Drawings.

B. Quality Assurance:

1. Electrical components and materials shall be UL or ETL listed/labeled as suitable for location and use - no exceptions.

C. Motors:

1. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment Specifications.
2. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
3. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Unless otherwise noted on plans, all motors ½ HP or larger shall be rated for 208 or 460 volt, 3-phase, operation. Unless otherwise noted on plans, all motors less than 1/2 HP shall be rated for 120 volt, single phase operation.
4. Temperature Rating: Motor meets class B rise with class F insulation.
5. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
6. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.

    a. Frames: NEMA Standard No. 48 or 56; use driven equipment manufacturer's standards to suit specific application.
    b. VFD driven motors. To be provided rated for inverter duty (NEMA Standard MG-1, Part 31) and equipped with a shaft grounding device or as an insulated bearing motor.
    c. Bearings:

1) Ball or roller bearings with inner and outer shaft seals.
2) Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
3) Designed to resist thrust loading where belt drives or other drives product lateral or axial thrust in motor.
4) For fractional horsepower, light duty motors, sleeve type bearings are permitted.
5) Enclosure Type:

a) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
b) Guarded drip-proof motors where exposed to contact by employees or building occupants.
c) Weather protected Type I for outdoor use, Type II where not housed.

d. Overload Protection: Built-in thermal overload protection where external overload protection is not provided and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
e. Noise Rating: "Quiet."

f. Efficiency:
1) Motors shall have a minimum efficiency per governing State or Federal codes, whichever is higher.
2) Motors shall meet the NEMA premium efficiency standard.
g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

D. Starters and Electrical Devices:

1. Motor Starter Characteristics:

a. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs.
b. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.

2. Manual switches shall have pilot lights and all required switch positions for multi-speed motors. Overload Protection: Melting alloy or bi-metallic type thermal overload relays, sized according to actual operating current (field measured).
3. Magnetic Starters:

a. Heavy duty, oil resistant, hand-off-auto (HOA), or as indicated, and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
b. Trip-free thermal overload relays, each phase, sized according to actual operating current (field measured).
c. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division 23 Controls sections.
d. Built-in primary and secondary fused control circuit transformer, supplied from load side of equipment disconnect.
e. Externally operated manual reset.
f. Under-voltage release or protection for all motors over 20 hp.

4. Motor Connections: Liquid tight, flexible conduit, except where plug-in electrical cords are specifically indicated.

E. Low Voltage Control Wiring:

1. General: 14 gauge, Type THHN, color coded, installed in conduit.
2. Manufacturer: General Cable Corp., Alcan Cable, American Insulated Wire Corp., Senator Wire and Cable Co., or Southwire Co.

F. Disconnect Switches:

1. Fusible Switches: For equipment 1/2 HP or larger, provide fused, each phase; heavy duty; horsepower rated; spring loaded quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.
2. Non-Fusible Switches: For equipment less than 1/2 horsepower, switch shall be horsepower rated; toggle switch type with thermal overload quantity of poles and voltage rating as required.

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.

B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal or otherwise irregular work, unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

3.3 INSTALLATION

A. Coordinate the work between the various Plumbing Sections and with the work specified under other Divisions. If any cooperative work must be altered due to lack of proper supervision or failure to make proper and timely provisions, the alternations shall be made to the satisfaction of the Engineer and at the Contractor’s cost.

B. Inspect all material, equipment, and apparatus upon delivery and do not install any damaged or defected materials.

3.4 SUPPORTS AND HANGERS

A. Prior to installation of hangers, supports, anchors, and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives, (if any), installers of other work with requirements specified.

B. Installation of Building Attachments: Install building attachments at required locations within concrete or on structural steel for proper piping support. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed. Fasten insert securely to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through opening at top of inserts.

C. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors, and other building structural attachments.

D. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

E. Install hangers within 12 inches of every change in piping direction, end of pipe run or concentrated load, and within 36 inches of every major piece of equipment. Hangers shall be installed on both sides of flexible connections. Where flexible connection connects directly to a piece of equipment only one hanger is required.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

G. Support gas independently of other piping.

H. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

I. Hanger Spacing in accordance with following minimum schedules (other spacings and rod sizes may be used in accordance with the SMACNA Seismic Restraint Manual using a safety factor of five):

1. Steel Pipe (Water Filled):

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 1 1/4"	5 feet	3/8"
1 ½" to 2"	7 feet	3/8"
2 ½" to 3"	10 feet	1/2"
4" and larger	12 feet	5/8"

2. Steel Pipe (Gas/Air Filled):

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 1 1/4"	6 feet	3/8"
1 ½" and larger	10 feet	1/2"

3. Copper Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	6 feet	3/8"
2 ½" and larger	8 feet	1/2"

4. Glass Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	6 feet	3/8"
2 ½" and larger	8 feet	1/2"

5. Plastic/Fiberglass Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	4 feet	3/8"
2 ½" and larger	6 feet	1/2"

6. Caulked Bell and Spigot and Glass Pipe: Provide hanger for each section of pipe, located at shoulder of bell. Where an excessive number of fittings are installed between hangers, provide additional reinforcing.

J. Sloping, Air Venting, and Draining:

1. Slope all piping as specified and as indicated, true to line and grade, and free of traps and air pockets. Unless indicated otherwise, slope piping in the direction of flow as follows:

Service	Inclination	Slope
Domestic Water	Down	1" per 100'
Heating Water	Up	1" per 40'
Steam	Down	1" per 40'
Soil and Waste	Down	1/4" per foot (1/8" per foot as necessary and/or as allowed by AHJ)
Storm Water	Down	1/4" per foot (1/8" per foot as necessary and/or as allowed by AHJ)
Sanitary Vent	Up (towards roof terminal)	1/4" per foot (1/8" per foot)

2. Slope all compressed air branch piping down toward main risers at 1” per 10’.
3. Provide eccentric reducers in horizontal piping for all sizing changes:
4. Provide drain valves and hose adapters at all low points in piping.
5. Provide vents at all high points in water piping.

K. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connecting equipment.
3. Insulated Piping: Comply with the following installation requirements:

   a. Clamps: Attach clamps, including spacers, (if any), to piping with clamps projecting through insulation.
   b. Shields: Where low compressive strength insulation or vapor barriers are indicated on cold water piping, install shields or inserts.
   c. Saddles: Where insulation without vapor barrier is indicated install protection saddles.

L. Installation of Anchors:

1. Install anchors at proper locations to prevent excessive stresses and to prevent transfer of loading and stresses to connected equipment.
2. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure.
3. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
4. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends.

M. Equipment Supports:

1. Provide all concrete bases, unless otherwise furnished as work of Division 03. Furnish to Division 03 Contractor scaled layouts of all required bases, with dimensions of bases, and location to column centerlines. Furnish templates, anchor bolts, and accessories necessary for base construction.
2. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks.

N. Adjusting:

1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
3. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 ROOF CURBS, EQUIPMENT RAILS, PIPE PORTALS

A. Install per manufacturer's instructions.

B. Coordinate with other trades so units are installed when roofing is being installed.

C. Verify roof insulation thickness and adjust raise of cant to match.

3.6 ELECTRICAL REQUIREMENTS

A. Plumbing Contractor shall coordinate with Division 26 work to provide complete systems as required to operate all mechanical devices installed under this Division of work.

B. Installation of Electrical Connections: Furnish, install, and wire (except as may be otherwise indicated) all plumbing, motors and controls in accordance with the following schedule and in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC, and NECA's "Standard of Installation" to ensure that products fulfill requirements. Carefully coordinate with work performed under the Plumbing Division of these Specifications.

C. Division 22 has responsibilities for electrically powered or controlled plumbing equipment which is specified in Division 22 Specifications or scheduled on Division 22 Drawings. The specific division of responsibilities between Division 22 and 26 for furnishing or wiring this equipment is as follows:

1. Division 22 Plumbing Responsibilities:

a. MOTORS: Furnish and install all motors necessary for plumbing equipment.
b. MAGNETIC STARTERS: Furnish all magnetic starters whether manually or automatically controlled which are necessary for mechanical equipment. Furnish these starters with all control relays or transformers necessary to interface with plumbing controls. If the starter is factory installed on a piece of Division 22 equipment, also furnish and install the power wiring between starter and motor.
c. VARIABLE FREQUENCY DRIVES: Provide all VFD's associated with plumbing equipment. If the drive is installed on a piece of factory assembled equipment the wiring between motor and drive is to be provided as part of the factory equipment.
d. DISCONNECTS: Provide the disconnects which are part of factory wired Division 22 plumbing equipment. Factory wiring to include wiring between motor and disconnect or combination starter/disconnect.
e. CONTROLS: Division 22 Contractor (including the temperature controls installer) is responsible for the following equipment in its entirety. This equipment includes but is not limited to the following:

1) Control relays necessary for controlling Division 22 equipment.
2) Control transformers necessary for providing power to controls for Division 22 equipment.
3) Low or non-load voltage control components.
4) Non-life safety related valve.
5) Float switches.
6) Solenoid valves, EP and PE switches.

D. Division 26 has responsibilities for electrically powered or controlled equipment which is specified in Division 22 Specifications or scheduled on Division 22 Drawings. The specific division of responsibilities between Division 22 and 26 for furnishing or wiring this equipment is as follows:

1. Division 26 Electrical Responsibilities:

a. MOTORS: Provide the power wiring for the motors.
b. MAGNETIC STARTERS: Except where magnetic starters are factory installed on Division 22 factory assembled equipment, Division 26 is to install magnetic starters furnished by Division 22 and install the necessary power wiring to the starter and from the starter to the motor. In the case of factory installed starters, Division 26 is to install the necessary power wiring to the starter.
c. VARIABLE FREQUENCY DRIVES: Physically mount all VFD's, which are not specified to be installed on Division 22 factory assembled equipment. Provide the necessary power wiring to the VFD and from the VFD to the motor except in the case of factory installed VFD's where wiring between the motor and VFD is to be by Division 22. Where disconnects are installed between a VFD and a motor provide the interlocking wiring between the disconnect and VFD to insure that the drive is shutdown simultaneously with motor.
d. DISCONNECTS: Provide all disconnects necessary for Division 22 mechanical equipment which are not provided as part of factory wired Division 22 equipment. Provide power wiring to all disconnects. In addition provide power wiring between motor and disconnect when the disconnect is not factory installed. See also Variable Frequency Drive above for special wiring requirements.
e. CONTROLS: Division 26 Contractor is responsible for providing power to control panels and control circuit outlets.

2. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
3. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
4. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
5. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
6. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

E. Motors and Motor Control Equipment: Conform to the standards of the NEMA. Equip motors with magnetic or manual line starters with overload protection. Motor starters and line voltage controls shall be installed under Electrical Section but located and coordinated as required under this Section of the work. Starters shall be combination type with non-fusible disconnect switches. All single phase fractional horsepower motors shall have built-in overload protection.

3.7 PAINTING

A. All painting shall be provided under this Division work, unless otherwise specified under Division 9: Painting. Painting schemes shall comply with ANSI A13.1. Paint all exposed materials such as piping, equipment, insulation, steel, etc. Exposed gas piping inside and outside the building shall be painted with

two coats of "Rust-O-Leum" Yellow. Exposed copper indirect waste piping serving food service equipment shall be painted metallic chrome.

B. All exposed work under Division 22 shall receive either a factory finish or a field prime coat finish, except:

1. Exposed copper piping.
2. Aluminum jacketed outdoor insulated piping.

3.8 IDENTIFICATION MARKERS

A. General: Where identification is to be applied to surfaces which require insulation, painting, or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Piping System Identification:

1. Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
2. Locate pipe markers as follows:

a. Near each valve and control device.
b. Near each branch, excluding short take-offs for fixtures; mark each pipe at branch, where there could be question of flow pattern.
c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
d. At access doors, manholes, and similar access points which permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.
f. Spaced horizontally at maximum spacing of 20' along each piping run, with minimum of one in each room. Vertically spaced at each story transversed.

C. Underground Piping Identification: During backfilling/topsoiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6” to 8” below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16”, install single line marker.

D. Plumbing Equipment Identification: Locate engraved plastic laminate signs on or near each major item of plumbing equipment and each operational device. Provide signs for the following:

1. Main control and operating valves, including safety devices.
2. Meters, gauges, thermometers, and similar units.
3. Pumps, compressors and similar motor-driven units.
4. Hot water system mixing valves and similar equipment.
5. Boilers, heat exchangers and similar equipment.
6. Tanks and pressure vessels.
7. Strainers, filters, treatment systems and similar equipment.

E. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations. Equipment signs shall include an identification of the area or other equipment served by the equipment being labeled.

F. Gas pressure regulators shall have metal tags attached stating, "Warning: <<2>> lbs. upstream natural gas pressure. Do not remove."

3.9 VIBRATION AND DYNAMIC BALANCING

3.10 TESTING

A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.

END OF SECTION 22 0500

SECTION 220501
PLUMBING

PART 1 - GENERAL

1.01 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods

B. Section 230700: Mechanical Insulation

C. Section 222113: Plumbing Piping, Valves and Specialties

D. Section 226313: Medical Gas and Vacuum Systems

E. Section 224000: Plumbing Fixtures

F. Section 221123: Plumbing Equipment

1.03 SCOPE

A. All work includes <removing and modifying existing and> providing new plumbing. Systems as specified under this section shall include but not necessarily be limited to the following:

1. Connection to utilities at five (5) feet from the building. Coordinate with the Civil Engineering Plans and/or Division 02 work.

2. Connection of all waste, vent, and water piping to all plumbing fixtures, drinking fountains, sinks, electric water coolers, drains and mechanical equipment.

3. Provide for future expansion as indicated.

4. Connect to new mechanical equipment including chiller, cooling tower expansion tanks, domestic hot water heaters, and boilers, etc.

5. Connect hot and/or cold water to hose bibbs and wall hydrants. Provide individual shut-off valves at each location.

6. Provide double check valve assembly on incoming water service provided under Division 02. Provide reduced pressure type backflow preventor assembly on connection to chillers expansion tanks, and cooling towers as indicated.

7. Provide traps on all floor drains with trap primer where specified. Pipe to trap shall be ½" minimum.

8. 160°F hot water shall be provided to laundry, 140°F and 120°F to kitchen areas. Mixing valves shall be provided to reduce to desired temperatures within each service area.

9. 100°F hot water shall be mixed at point of use for service to public fixtures including lavatories.

10. Domestic water heating plant shall be gas <dual gas/oil fuel> supply.

11. Provide domestic hot water recirculation system. Each branch line to be set at one (1) gpm. Provide individual shut-off valve, check valve and << Circuit Setter >> ball valve with memory stop at each location.

12. Provide floor drainage in core toilets, mechanical rooms and equipment rooms.

13. Provide connections for all area drains, catch basins, downspouts, roof drains and overflow drains to storm sewer system.

14. Gas service and meter assembly for HVAC equipment (and) domestic water heaters shall be by "Northwest Natural Gas". Location of new meter to be approved by Owner, Facility Engineer, Architect, and Engineer before installation.

15. Contractor to start gas system at discharge flange of meter setting assembly. Provide regulator assembly to reduce pressure to 2.0 psi maximum entering building.

16. Provide gas shut-off and regulator assembly at each connection, as detailed on drawings. Supply to any piece of equipment shall not exceed 0.5 psi.

17. Temporary Water Service: As directed by the General Contractor, the plumber shall provide a temporary metered water service and temporary water risers with four (4) hose bibbs installed at each level as the building proceeds upwards to the roof.

1.04 SUBMITTALS

A. Prior to construction submit for approval all materials and equipment in accordance with Division 01. Submit manufacturer's data, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:

1. Emergency showers and eye wash.

2. Plumbing specialties.

3. Trap primers.

4. Cleanouts.

5. Drains

6. Roof flashing

7. Wall hydrants and hose bibbs

8. Mixing valves

9. Backwater valve

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.06 WARRANTY

A. Provide one-year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials and equipment under this Division of the Specifications shall be new, of best grade and as listed in printed catalogs of the manufacturer.

B. All manufactured materials shall be delivered and stored in their original containers. Equipment shall be clearly marked or stamped with the manufacturer's name and rating.

C. <All items shall be furnished Vandal Proofed. One type of vandal proof screw is to be used through out this facility. Coordinate with general contractor for type.>

D. The following products to be included as part of this work but specified under Section 220500 Basic Materials and Methods and Section 222113 Plumbing Piping, Valves and Specialties:

1. Piping.
2. Valves.
3. Hangers and supports.
4. Escutcheon plates, flashings, and sleeves.
5. Identification markers and signs.
6. Anchors and alignment guides to comply with seismic requirements as indicated on structural plans.
7. Excavation and backfill.
8. Pressure and temperature gauges.
9. Access Panels.

E. Plumbing Fixtures: Refer to Section 224000.

F. Plumbing Equipment: Refer to Section 221123.

G. Emergency Eyewash and Showers:

1. Acceptable manufacturers: Encon, Haws, Speakman and Guardian.

H. Products made of, or containing, lead, asbestos, mercury, or other known toxic or hazardous materials are not acceptable for installation under this Section. Any such products installed as part of the work of this

Section shall be removed and replaced and all costs for removal and replacement shall be borne solely by the Contractor(s).

2.02 VALVES: DOMESTIC WATER AND NATURAL GAS (SEE SECTION 222113)

2.03 CLEANOUTS

A. Cleanout Plugs: Bronze, taper thread countersunk head.

B. Floor Cleanouts: Service weight cast-iron body and frame, flange with flashing clamp, adjustable cast-iron collar, caulk inside, Ty-seal or No-hub joints, neoprene plug gasket seal.

1. Carpeted Areas: Zurn ZN-1400-KC-VP-BP-CM or J. R. Smith 4028 C - F- C - Y - U

2. Tiled Areas: Zurn ZN-1400-X-KC-VP-BP or J.R. Smith 4148 - F - C - U

3. Unfinished Areas: Zurn ZN-1400-HD-KC-VP-BP or J.R. Smith 4108 C - F - C - U

4. Yard Areas: Zurn Z 1474-IN-VP or J.R. Smith 4258 - C - U

C. Cleanout Tee: Cast iron cleanout tee with countersunk brass plug, neoprene plug gasket seal and smooth stainless steel cover.

1. Manufacturer: Zurn Z-1446-BP or J. R. Smith 4532 S (Y)

2.04 ROOF FLASHING

A. Flashing: Unless indicated otherwise on the drawings flashings for pipes through the roof shall be galvanized sheet metal, 24 gauge minimum << or sheet copper, 8 oz. per sq. ft. minimum >> with seams and joints lapped and soldered watertight. Coordinate with Architectural Sections for flashings and roofing.

B. Vent Pipes: Provide caulk type, vandalproof hood with Allen head vandal proof screws for all vent pipes through roof or preformed vinyl/galvanized steel assembly.

2.05 WATER HAMMER ARRESTORS

A. Piston Type: Hard drawn copper construction, mirror finished internal surfaces; machine finished brass piston, air charged, 250 psi rated, tested and certified per PDI WH-201 and ASSE 1015.

1. Manufacturer: Watts Series 15, Precision Plumbing series SC, or Sioux Chief.

2.06 ANTI-CONTAMINATION WALL HYDRANTS AND HOSE BIBBS

A. Anti-contamination Hose Bibbs, HB-1: Bronze body construction, polished chrome plated finish, renewable composition disc, wheel handle, ½" NPT inlet, 3/4" threaded hose end, vacuum breaker/backflow preventor, solder joint, ANSI 1011.

1. Manufacturer: Woodford series 24P or Zurn Z1341.

B. Anti-contamination Hose Bibbs: Toilet Rooms, HB-2: Stainless steel recessed hose box with door and lock, cast bronze valves with integral stops, 3/4"H & CW outlet with vacuum breakers.

1. Manufacturer: Acorn 8000 or Willoughby HB-2.

C. Anti-Contamination Wall Hydrant, WH-1: Exterior, box-type, freezeproof, cast-bronze construction, chrome plated finish, loose key, bronze casing, length to suit wall thickness, vacuum breaker/backflow preventor, 3/4" inlet, 3/4" threaded hose end, solder joint.

1. Manufacturer: Woodford series B 67C, or Zurn Z-1320-C.

D. Anti-Contamination wall hydrant, WH-2: Exterior, freezeproof, cast bronze construction, chrome plated finish/loose-key, bronze casing, length to suit wall thickness, vacuum breaker/backflow preventor, 3/4" inlet, 3/4" outlet with threaded end, solder joint.

1. Manufacturer: Woodford Series 65C.

E. Hose Reel HR-1: 10 gauge steel. Construction, 35 feet ½" red synthetic hose, thread end. Provide Chicago 80 spray unit.

1. Hose Reel shall be mounted in 24" wide x 36" high x 12" depth, 20 gauge steel construction, solid door panel with piano hinge and cylinder lock.

2. Manufacturer: Cox Reel Series SH-435, Hannay, T & S or Chicago.

F. Ice Maker Hook-up, IM-1: 10 3/4" x 9" x 3 5/8" steel wall box, ½" sweat connection with ½" x ¼" angle valve with compression fitting.

1. Manufacturer: Guy Gray BIM875

2.07 DRAINS

A. General: Provide drains of type and size as indicated on drawings, including features, as specified herein.

1. Acceptable Manufacturers: J.R. Smith, Zurn, Wade, Sioux Chief, Josam and Watts.

B. Area Drain AD-1: Enamel coated cast iron body with flange, clamping collar, seepage openings, adjustable 8" square top, sediment bucket, bottom outlet, caulk inside or Ty-seal, satin bronze finish, vandal proofed.

1. Manufacturer: Zurn Z-525-T-VP-S or J.R. Smith 2310 - U - FBS - C(Y).

C. Floor Drain, FD-1 - Finished Areas: Enamel coated cast iron body with flange, integral reversible clamping collar, seepage openings, adjustable round satin nickel bronze strainer, sediment bucket, bottom outlet, caulk inside or Ty-Seal or no-hub joint. Provide trap primer.

1. Manufacturer: Zurn ZN-415-5B-Y-P or J.R. Smith 2010 - A - C(Y).

D. Floor Drain, FD-2 - Mechanical Rooms: Enamel coated cast iron body with flange, clamping collar, seepage openings, 8-1/2" diameter adjustable cast iron bar strainer, sediment bucket, bottom outlet, caulk inside or Ty-Seal or no-hub joint. Provide trap primer.

1. Manufacturer: Zurn Z-520-Y-P or J.R. Smith 2350 C(Y).

E. Floor Drain, FD-3 Mechanical Rooms: 18" x 18" x 18" custom fabricated 10 gauge steel basin with slotted grate, 4" outlet, asphalt coated exterior. Provide trap primer tap and 4" outlet.

1. Manufacturer: Lynch Company.

F. Floor Sink, FS-1: Enamel coated cast iron body with seepage flange, acid resistant interior surfaces, aluminum dome strainer, 12" x 12" x 6", half grate, bottom outlet, caulk inside, Ty-Seal or no-hub joint. Provide trap primer.

1. Manufacturer: Commercial Enameling series 906-1 or Zurn-ZFD-2375-K-H-Y.

G. Roof Drains, RD-1: 8 ½" diameter Duco cast iron body with combined flashing clamp and gravel stop, sump receiver, underdeck clamp and low profile aluminum dome.

1. Manufacturer: J.R. Smith 1330-R-C-AD or Zurn ZA-125-DP.

H. Overflow Drains, OD-1: 8 ½" diameter Duco cast iron body with combined flashing clamp and gravel stop, sump receiver, underdeck clamp, 2" high water dam and low profile aluminum dome

1. Manufacturer: J.R. Smith 1330-R-C-WD-AD or Zurn ZA-125-C-R-E.

I. Deck Drains DD-1: Enamel coated cast iron body with adjustable frame, wide flange with polished nickel bronze top.

1. Manufacturer: J.R. Smith DX2565R or Zurn Z531 ZN.

J. Planting Area Drains PD-1: Enamel coated cast iron body with flashing ring; dome and brass screening inside caulk, Ty-seal of no-hub joint.

1. Manufacturer: Zurn Z-348 or J.R. Smith 2675 C(Y).

K. Hub Drain, HD-1: Open bell of pipe with 4" x 6" increaser with standpipe 12" above finished floor or as indicated.

L. Downspout Fitting, DSN-1: Cast bronze body construction and flange, satin bronze finish, threaded outlet. Fabricated stainless steel downspout cover with hinged perforated cover. Provide with low profile connector elbow Zurn Z-1042.

1. Manufacturer: Zurn Z-199, Watts RD-940 or J.R. Smith 1770 J.R. Smith 1775.

M. Trench Drain, Type 1, TD-1: 4" wide fiberglass channel construction, 5" wide stainless steel frame with perforated steel grate, bottom outlet & end caps. Provide with catch basin.

1. Manufacturer: ACO –NW 100-465 or Zurn 804-CG.

2.08 TRAP PRIMER

A. Cast bronze construction, vacuum breaker, ½" sweat solder connection. Install in accessible location or provide access panel.

1. Manufacturer: PPP or E&S, for use for up to 8 drains using PPP trap primer distribution units.

2. Manufacturer: PPP Prime-Pro flow activated trap primer PR01-500.

3. Option: Sloan F-72-A1 used in conjunction with water closet flush valve.

B. For Multiple Units or Kitchen Areas: PPP Prime Time electronic trap primer Series PT. Coordinate 120 V, electrical service with Division 26.

2.09 MIXING VALVES ASSEMBLY

A. Mixing Valve: 300 psi, Brass construction, thermostatic controller with check stops. Refer to drawings for schedule of each valve. Use high/low type for uses over 20 gpm.

B. Manufacturer: Holby, Lawler, Symmons or Leonard.

2.10 EMERGENCY SHOWERS AND EYEWASHES:

A. Emergency Shower; ESH-1:

1. Deluge shower 30 GPM flow control and pull handle.

2. Manufacturer: Haws 8100.

3. Mixing valve: Leonard TM-800-STSTL-REC-TOP, Lawler or Guardian.

2.11 BACKWATER VALVE (FOUNDATION DRAINAGE)

A. Drain Tile Sump: Enamel coated body with extension frame and solid cover. Zurn # Z-753 or J.R. Smith #7098.

B. Backwater Valve. Enamel coated body and cover with removable wheel handle, bronze gates and flapper valve and cast iron extension. Provide 30" diameter fiberglass or cast iron basin with access top, minimum. Zurn #Z-1088 or J.R. Smith series 7150-Y.

PART 3 - EXECUTION

3.01 GENERAL

A. This system to be installed by an experienced firm regularly engaged in the installation of plumbing systems as specified by the requirements of the Specifications.

B. Install all items specified in this section of the Specification under the full purview of local and state governing agencies.

C. Refer to Section 220500: General Plumbing Requirements for installation of piping, valves and other requirements.

3.02 PERFORMANCE OF WORK

A. Examine areas, physical conditions and phasing requirements under which materials are to be installed. Layout the system to suit the different types of construction and equipment as indicated on the drawings.

B. Work shall start immediately after authorization has been given to proceed so that the overall progress of the construction is not delayed. No foundry items to be installed until submittals have been approved.

C. Coordinate with other trades as necessary to properly interface components of the plumbing system.

D. Follow manufacturer's directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the drawings or covered in these Specifications.

E. The omission from the drawings or Specifications of any details of construction, installation, materials, or essential specialties shall not relieve the Contractor from furnishing the same in place for a complete system.

3.03 PIPING INSTALLATION

A. The word "piping" shall mean all pipes, fittings, nipples, valves and all accessories connected thereto.

B. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts flues, conduits and work of other trades and close to ceiling or other construction as practical, free of unnecessary traps or bends.

C. Run horizontal sanitary drainage at uniform pitch of not less than 1/8" per foot, unless otherwise indicated. Pitch horizontal vent piping downward from stack to fixtures.

D. Run drainage piping as straight as possible with long radius turns. Offsets shall be made at an angle of 45° or less.

E. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.

F. Piping connections to all equipment shall be made up with unions.

G. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.

H. Use reducers or increasers. Use no bushings.

I. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageway.

J. Vent pipes to terminate at least 6" above the roof. Provide vandal proof hood assembly.

K. Cover, cap or otherwise protect open ends of all piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect water supply piping as specified.

L. Exposed connections to equipment shall be installed with special care, showing no tool marks or threads at fittings and piping. No bowed or bend piping to be permitted.

M. All ferrous to non-ferrous connections shall be made by means of dielectric fittings. Submit shop drawings for approval.

N. Use extra heavy pipe for nipples, where unthreaded portion is less than 1½". Use no close nipples. Use only shoulder nipples.

O. All piping shall be inspected for defects and flaws prior to installation. Remove any damaged piping from job site. Piping shall be thoroughly cleaned of dirt, debris or rust.

P. Cleanouts to be provided at each change in direction greater than 135° or 100' maximum intervals on underground piping.

Q. Cleanouts to be same size as pipe except cleanout plugs larger than 4" shall not be required.

R. Cleanouts on concealed piping to be extended through and terminate flush with the finished wall or floor. Cover plates to be provided on all cleanout plugs in finished areas.

S. The bodies of cleanout ferrules to conform in thickness to that required for pipe and fittings of the same metal.

T. Route piping on roof on manufactured polypropylene pipe supports: Roof Top Blox RTB-#.

3.04 WATER HAMMER ARRESTERS

A. Install as per PDI Standard WH-20 and equipment manufacturer's recommendation and as shown on working drawings. Provide before each quick closing valve (flush valve, solenoid valve, etc.) or bank of fixtures.

B. Install at each plumbing fixture, bank of fixtures, equipment and as indicated.

3.05 TESTING AND DISINFECTING - PLUMBING SYSTEMS

A. General: Disinfection procedure shall comply with minimal requirements and under the supervision of UC Berkeley's Environment, Health and Safety (EH&S). The Contractor to perform all field tests and provide all labor, equipment, and incidentals required for the tests. Owner to witness all field tests and conduct all field inspections. The Contractor to give the Owner ample notice of the dates and times scheduled for tests. Any deficiencies to be completely retested at no additional cost.

1. Inspection: Inspection to continue during installation and testing. Perform a final inspection of the equipment prior to installation to determine conformity to the type, class, grade, size, capacity, and other characteristics specified herein or indicated. Correct or replace all rejected equipment prior to installation.

2. Water Distribution Piping Test: Before fixtures are set, subject the entire hot and cold piping system to a hydrostatic pressure test of 150 pounds per square inch with water for not less than 8 hours in order to permit inspection of all joints with no evidence of leakage. Where a portion of the water distribution piping is to be concealed before completion, test this portion separately as specified for the entire system.

3. Sanitary, Waste, Storm, Rainwater, and Vent Piping Test: Before the installation of any fixtures or drains, cap the ends of the system and fill all lines with water to the roof level and allow to stand for at least 30 minutes without leakage. Make tests within building with piping exposed. If the system is tested in sections, tightly lug each opening, except the highest opening of the section under test, and fill each section with water and test with at least a 10' head of water.

4. Sanitary Drainage Vent, Storm, Rainwater and Fixture System Final Test: Give sanitary, drainage vent, and fixture systems an in-service test after complete installation. After all fixtures are installed, test the entire vent and sewer system and prove gas and water tight. Final test shall be with air. Before proceeding with test, fill all traps with water. Close all stacks and line openings during test, for a minimum period of 24 hours. If test reveals leakage of air at any point, repair and retest the system.

5. Disinfection of Water Distribution System: After pressure tests have been made thoroughly flush the entire domestic water distribution system with water until all entrained dirt and mud have been removed, and sterilize by chlorinating material. The chlorinating material shall be liquid chlorine. The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the system or part thereof in an approved manner. Retain the treated water in the pipe for 24 hours, or, fill the system or part thereof with a water-chlorine solution containing at least 200 parts per million of chlorine and allow to stand for three hours. Open and close all valves in the system being disinfected three times during the contact period. Then flush the system with clean potable water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period open and close all valves and faucets three times. From at least three divergent points in the system,

take samples of water in properly sterilized containers for bacterial examination. Repeat the disinfecting until tests indicate that satisfactory bacteriological results have been obtained.

a. Taking of samples shall be witnessed by Architect or Owner's representative. Samples are to be taken and tested by an independent analytical testing laboratory. Written reports shall be supplied to Architect for approval.

3.06 OPERATING TESTING AND CERTIFICATION - PLUMBING SYSTEMS

A. Upon completion and disinfection, and prior to acceptance of the installation, the Contractor to subject the plumbing system to operating tests to demonstrate satisfactory, functional, and operating efficiency. Such operating tests to include the following information in a report with conclusions as to the adequacy of the system.

1. Time, date, and duration of tests.

2. Water pressures at most remote location.

3. Operation of all valves and hydrants.

4. Operation of all floor drains by flooding with water.

5. Quality of domestic water.

6. Read all indicating instruments at half-hour intervals unless otherwise directed. Supply four copies of the test report to the Owner.

3.07 CLEANING EQUIPMENT AND MATERIALS

A. In addition to the requirements of Section 220500, provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care to be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors, and similar equipment.

B. All piping, finished surfaces, and equipment to have all grease, adhesive labels, and foreign materials removed.

C. All piping to be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, flush valves, and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation for ten days.

D. When connections are to be made to existing systems, the Contractor is to do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.

3.08 OPERATION MANUALS, START-UP SERVICE, WARRANTIES, ACCEPTANCE AND GUARANTEES

A. General: Refer to Section 220500 for details.

END OF SECTION 22 0501

SECTION 22 0502
PLUMBING DESIGN REQUIREMENTS DESIGN-BUILD CONTRACTOR

PART 1 - GENERAL

1.01 PURPOSE

A. The purpose of this Section is to define the design approach upon which the mechanical design/build contractor is to base his bid and establish the design criteria, and design submittals, which will be required in the preparation and execution of the design.

1.02 APPLICABLE REQUIREMENTS

A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and Division 1, "General Requirements," and shall include all Plumbing Sections specified herein.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. All Division 22 Plumbing sections included herein.

1.04 MECHANICAL DESIGN NARRATIVE

A. Plumbing System:

1. Domestic Cold Water: Extend and connect main cold water from the nearby existing main system complete with isolation valves at point of connections. Distribute water-to-water heaters, fixtures, and equipment as necessary.

2. Domestic Hot Water: Provide instantaneous water heater at each sink, grouped lavatories and service sink. Water temperature provided shall be 120ºF for all areas including lavatories, sinks, kitchen sink and service sink. Lavatories shall be provided with on-site pressure balanced temperature limiting type faucets.

3. Domestic Hot Water Recirculation: Provide cartridge type circulating pump on each hot water return piping system to recirculate hot water. Provide circuit setter in each branch line for balancing flow. Provide seven-day time clock and adequate set at 5ºF below system design temperature to control pump operation.

4. Provide bladder type expansion tank on piping to water heater to allow for expansion without causing leakage at T&P relief valves.

5. Sinks in kitchen and storage area to be 20 gauge stainless steel.

6. Loose key stops to be provided on all fixtures.

7. Piping to be run in crawlspace or above ceilings. Insulate all water piping installed in crawlspace. Water piping above ceiling to be insulated or installed below roof insulation. The 120ºF hot water and recirculation piping shall be insulated. Provide value engineer credit to omit insulation on 120ºF hot water and recirculation piping concealed in interior walls. All 160ºF hot water and recirculation piping shall be insulated. All cold water piping to be insulated where subject to freezing or sweating.

8. Floor Drains: Provide floor drains in the following areas:
   a. Bath Areas.

b. Mechanical Rooms.

1.05 DESIGN CRITERIA

A. PLUMBING DESIGN CRITERIA

1. Design a fully operable plumbing system in accordance with the governing codes and the following criteria:

2. Size domestic water pipes for a maximum velocity 5 FPS and a maximum pressure drop of 2.5 PSI per 100 ft. Note that it may be necessary to use a smaller design pressure drop per 100' to satisfy point of use pressure (see below).

3. Size waste, vent, and domestic water in accordance with UPC and criteria stated in this Section.

4. Provide 0.5 PSI gas service to serve air conditioning units in accordance with "NWNG" requirements.

5. Maximum domestic water pressure at point of use: 65 psi.

6. Minimum domestic water pressure at point of use: 25 psi.

1.06 DESIGN SUBMITTALS

A. Prior to commencing work, Contractor shall submit plumbing, fire protection and HVAC calculations, in a labeled, three ring binder tabbed and organized into the following sections with the required calculations demonstrating compliance with the project criteria and design narrative:

1. HVAC:
   a. Heating and Cooling Load Calculations.
   b. Energy Code Forms for Building Envelope and HVAC forms.
   c. Supply and return ductwork pressure drop calculations for determining furnace blower unit static pressure.
   d. Furnace coil and condensing unit selection showing correlation between load calculations, required supply air temperature and flow and unit selection.
   e. Minimum Outdoor Air Calculations.
   f. Toilet, Laundry and Kitchen area exhaust air calculation.
   g. Exhaust ductwork pressure drop calculations.

2. Plumbing:
   a. Cold water service calculation.
   b. Hot water service sizing calculation.
   c. Riser sizing calculations.
   d. Natural gas sizing calculations and loads.

3. Fire Protection: See Section 21 1000.

B. Provide complete construction and permit Drawings on AutoCAD Version 12, detailing the location, size and routing of ductwork, piping, equipment and related systems plus the location and arrangement of grilles and plumbing fixtures. Provide separate drawings for plumbing and HVAC with at a minimum the following drawings:

1. Lower Level and Crawlspace HVAC Plan.

2. Plumbing Cover Sheet with Schedules.

3. Underground Plumbing Plan.

4. Lower Level and Crawlspace Plumbing Plan.

5. First Floor Plumbing Plan.

6. Toilet Room Details.

7. Riser Diagrams: Hot Water Riser, Cold Water Riser, Waste & Vent Riser.

C. Design Drawings may be submitted at ⅛" scale for floor plans or the contractor can meet both the shop drawing and design drawing requirements by consolidating both plans as ¼" scale drawings meeting shop drawing requirements.

1.07 GENERAL DESIGN COORDINATION REQUIREMENTS

A. Coordinate with the electrical contractor to ensure that the HVAC equipment electrical loads are satisfied and that electrical service is not only adequately, but appropriately sized.

B. Coordinate with the electrical contractor to provide adequate cooling for all Electrical and Telephone Rooms.

C. Coordinate with the General Contractor for provisions related to site utility piping.

D. Coordinate with the architectural plan and structure.

1.08 QUALITY ASSURANCE

A. Provide in accordance with rules and regulations of the following:

1. UC Regents

2. UC Berkeley

3. Local, City, County and State Codes and Ordinances.

4. Local Bureau of Buildings.

5. Local Health Department.

6. Local and State Fire Prevention Districts.

7. CBC 2013 – California Building Code.

8. CMC 2013 – California Mechanical Code.

9. CPC 2013 - California Plumbing Code.

10. CEC 2013 - California Electric Code.

11. State Administrative Codes.

B. Provide in accordance with appropriate referenced standards of the following:

1. AABC - Associated Air Balance Council

2. CSA - Canadian Standards Association
3. ADC - Air Diffuser Council.
4. AMCA - Air Moving and Conditioning Association.
5. ANSI - American National Standards Institute.
6. ARI - Air Conditioning and Refrigeration Institute.
7. ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers.
8. ASME - American Society of Mechanical Engineers.
9. ASTM - American Society for Testing Materials.
10. AWS - American Welding Society.
11. AWWA - American Water Works Association.
12. FM - Factory Mutual.
13. MSS - Manufacturer's Standardization Society.
14. NEMA - National Electrical Manufacturer's Association.
15. SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
16. UL - Underwriter's Laboratories.

END OF SECTION 22 0502

SECTION 220700
PLUMBING INSULATION

PART 1 - GENERAL

1.01 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.02 SCOPE

A. All work to be furnished and installed under this Section shall include, but not necessarily be limited to, providing insulation for the following:

1. Piping:
   a. Domestic hot water supply and return.
   b. Domestic cold water, unless otherwise noted on drawings.
   c. Horizontal roof and overflow drain piping.
   d. Underground water piping.
   e. Sanitary vent piping in unheated spaces.
   f. Drains from electric water coolers to first connection.
   g. Horizontal pipe runs from fixtures receiving cold condensate.
   h. Flush water.
   i. All valves, separators, strainers and fittings for systems listed above.

2. Hot and Cold Equipment:
   a. Hot water storage tanks.

3. Drains:
   a. All roof and overflow drain bodies.

B. Types of mechanical insulation specified in this Section include the following:

1. Fiberglass pipe insulation.

2. Cellular glass pipe insulation.

3. Calcium silicate pipe insulation.

4. Flexible elastomeric closed cell insulation

5. Fiberglass equipment insulation.

6. Calcium silicate equipment insulation.

7. Cellular glass equipment insulation.

8. Flexible unicellular equipment insulation.

9. Insulation jackets.

10. Insulation accessories.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods.

B. Section 220501: Plumbing.

1.04 DEFINITIONS

A. Ambient: The air temperature to be maintained in a conditioned room. Typically between 70°F and 78°F.

B. Insert: Spacer placed between the pipe support system and the piping to allow for the space required for insulation.

C. Insulation Group (IG): Definition of Insulation Materials and Operating Temperatures.

D. Insulation Shield: Buffer material placed between the pipe support system and the insulation to prevent the insulation material from crushing.

E. Jacket: Protective covering over the pipe insulation; may be factory applied such as "all service jacket" or field applied to provide additional protection; of such materials as canvas, PVC, aluminum or stainless steel.

F. Piping Insulation: Thermal insulation applied to prevent heat transmission to or from a piping system.

G. Vapor Barrier Jacket: Insulation jacket material that impedes the transmission of water vapor.

H. Freezing Climate: Where outdoor design temperature is less than 33^{o} F, as stated in ASHRAE fundamentals under 99% column for winter design conditions.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Provide products conforming to the requirements of the following:

1. American Society for Testing and Materials (ASTM): Manufacture and test insulation in accordance with the ASTM Standards, including:
   a. B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plat.
   b. C165 - Recommended Practice for Measuring Compressive Properties of Thermal Insulation.
   c. C167 - Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
   d. C177 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission.
   e. Properties by Means of the Guarded-Hot-Plate Apparatus.
   f. C195 - Specification for Mineral Fiber Thermal Insulating Cement.
   g. C196 - Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement.

h. C302 - Test Method for Density of Preformed Pipe-Covering-Type Thermal Insulation.
i. C303 - Test Method for Density of Preformed Block-Type Thermal Insulation.
j. C305 - Test for Thermal Conductivity of Pipe Insulation.
k. C356 - Test for Linear Shrinkage of Preformed High-Temperature Thermal Insulation.
l. C411 - Test for Hot-Surface Performance of High Temperature Thermal Insulation.
m. C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
n. C449 - Specification of Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
o. C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
p. C533 - Specification for Calcium Silicate Block and Pipe Thermal Insulation.
q. C534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
r. C547 - Specification for Mineral Fiber Preformed Pipe Insulation.
s. C552 - Specification for Cellular Glass Block and Pipe Thermal Insulation.
t. C553 - Specification for Mineral Fiber Blanket-Type Pipe Insulation (Industrial Type).
u. C592 - Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered).
v. C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
w. C916 - Standard Specification for Adhesives for Duct Thermal Insulation.
x. C921 - Practice for Determining Properties of Jacketing Materials for Thermal Insulation.
y. C1104 – Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
z. C1071 - Standard Specification for Thermal and Acoustical Insulation.
aa. C1338 – Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings..
bb. E84 - Test Method for Surface Burning Characteristics of Building Materials.
cc. E119 - Test for Fire Resistance.
dd. G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
ee. G22 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.

2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Provide and install pipe and duct insulation in accordance with the following ASHRAE Standard:
   a. 90 Energy Conservation in New Building Design.

3. National Fire Protection Association (NFPA): Manufacture insulation in accordance with the following NFPA standards:
   a. 255 Test Methods, Surface Burning Characteristics of Building Materials.

B. Do not provide materials with flame proofing treatments subject to deterioration due to the effects of moisture or high humidity.

C. Products Containing Prohibited Chemicals:

1. Products containing the following prohibited chemicals for use as flame retardants or for other purposes will not be acceptable:
   a. Pentabrominated diphenyl ether (CAS#32534-81-9)
   b. Octabrominated diphenyl ether (CAS#32536-52-0)
   c. Decabrominated diphenyl ether (CAS#1163-19-50

D. Flame/Smoke Rating: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing; or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.

E. Corrosiveness: Provide insulation such that when tested in accordance with the following test, the steel plate in contact with the insulation shows no greater corrosion than sterile cotton in contact with a steel plate for comparison.

1. Test Specimen: Two specimens shall be used, each measuring 1" by 4" by approximately ½" thick.

2. Apparatus: Provide a humidity test chamber in which two polished-steel test plates, 1" wide, 4" long and 0.020" thick, shall be placed. Plates shall be clear finish, cold-rolled strip steel, American quality, quarter hard, temper No. 3, weighing 0.85 lb/sq. ft.

3. Procedure: The steel test plates shall be rinsed with cp benzol until their surfaces are free from oil and grease and allowed to dry. One piece of cold-rolled steel shall be placed between the two insulation specimens and secured with tape or twine. The test specimen and uncovered plate shall be suspended vertically in an atmosphere having a relative humidity of 95% (plus or minus 3%), and a temperature of 120°F (plus or minus 3°F), for 96 hours, and then be examined for corrosion.

F. Insulation thickness shall be the greater standard of that specified here or the State energy conservation requirements.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation. Also furnish necessary test data certified by an independent testing laboratory. Submit samples.

B. Provide a statement with the submittal indicating that no product submitted contains an amount equal to or greater than 0.10% by mass of the following chemicals:

1. Pentabrominated diphenyl ether (CAS#32534-81-9)

2. Octabrominated diphenyl ether (CAS#32536-52-0)

3. Decabrominated diphenyl ether (CAS#1163-19-50

C. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product in maintenance manual.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coating to the site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.

B. Store and protect insulation against dirt, water, chemical, and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Johns Manville, Owens-Corning, Knauf, Armstrong, Pittsburgh-Corning, Certainteed, Halstead, Rubatex, 3M FireMaster, Pabco, Reflectix, or approved equal. Manufacturer and insulation types listed below indicate a minimum acceptable level of quality required for each classification.

2.02 PIPE INSULATIONS

A. Glass Fiber: Molded fibrous glass pipe insulation shall comply with the requirements of ASTM C 547 and meet ASTM C 585 for sizes required in the particular system. For all fluid distribution temperatures below 45°F the system shall be of a wicking type.

1. Manufacturers:
   a. Johns Manville Micro-Lok plain with PVC cover Meeting ASTM C547; or Micro-Flex (pipe sizes larger than 18"), Knauf einsulation.

2. Applications: Insulation of piping up to 18" in diameter and 3" thick insulation.

3. 'K' Value: 0.23 at 75°F.

4. Maximum Service Temperature: 850°F.

5. Vapor Retarder Jacket: AP-T PLUS white kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP jacket with outward clinch expanding staples or vapor barrier mastic as needed.

B. Rigid polyisocyanurate foam: HiTHERM HT-300.

1. 'K' Value: 0.165 at 75°F (24°C)

2. Maximum Continuous Service Temperature: 300°F.

3. Vapor Retarder Jacket: Saran 540/SSL or Mylar laminate.

C. Hydrous Calcium Silicate: Johns Manville Thermo-12/Gold, ASTM C533; Rigid Molded Pipe:

1. 'K' Value: 0.40 at 300°F.

2. Maximum Service Temperature: 1,200°F.

3. Compressive Strength (block): Minimum of 200 psi to produce 5% compression at 1½" thickness.

4. Tie Wire: 16 gauge stainless steel with twisted ends on maximum 12" centers.

D. Cellular Glass: Pittsburgh-Corning Foamglas Meeting ASTM C522: Cellular Glass Thermal Insulation:

1. 'K' Value: 0.35 at 75°F.

2. Density: 8.0 lbs./cu. ft.

3. Maximum Service Temperature: 900°F.

4. Provide with Pittsburg Corning Pittwrap jacketing.

E. Flexible Elastomeric Closed Cell Thermal Insulation: Armacel, Rubatex k-flex ECO, closed-cell, halogen free, elastomeric insulation. Comply with ASTM-C177, ASTM E 84 and UL 181.

1. 'K' Value: 0.27 at 75°F.

2. Density: 3.0 to 6.0 lbs./cu.ft.

3. Maximum Service Temperature: 260°F.

4. Seal all seams and joints with contact adhesive.

F. Field Applied Jackets (For Interior Applications):

1. All longitudinal seams shall be located on bottom of pipes.

2. PVC Plastic: Johns Manville Zeston 2000. One piece molded type fitting covers and jacketing material, gloss white. Connect with tacks and pressure sensitive color matching vinyl tape.

3. Canvas Jacket: UL listed fabric, 6 oz/sq. yd. plain weave cotton, treated with dilute fire retardant lagging adhesive.

4. Aluminum Jacket: 0.016" thick sheet, [smooth/embossed] finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.

5. Secure aluminum jackets with 3/8" or ½" stainless steel bands on 12" centers.

G. Field Applied Jackets (For Exterior Applications):

1. All longitudinal seams, on horizontal pipe runs, shall be installed on the bottom of pipes.

2. Aluminum Jacket: 0.016" (minimum) thick sheet, [smooth/embossed] finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.

3. Stainless Steel Jacket: Type 304 stainless steel, 0.010" minimum (smooth/corrugated) finish.

4. Secure stainless steel or aluminum jackets with ⅜" or ½" stainless steel bands on 12" centers.

5. Manufaturers: Pabco, Childers, RPR, or approved equal.

H. Removable Covers:

1. Provide removable covers on pumps, valves, air separators, vents, fittings, flanges, strainers, traps, etc., where periodic maintenance or removal of insulation may is required.

2. Use of premolded fittings with PVC covers is acceptable.

3. Use of lace-on type insulating blankets is acceptable.

2.03 EQUIPMENT INSULATIONS

A. Flexible Fiberglass Blanket: Johns Manville Microlite Type 75 Flexible Blanket:

1. 'K' Value: ASTM C518, 0.27 Btu•in./(hr•ft²•°F) at 75°F installed full thickness.

2. Maximum Service Temperature: 250°F.

3. Density: 0.75 lb/cu ft.

4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.

B. Rigid Fiberglass Board: Johns Manville Mat-Faced Micro-Aire Rigid Board:

1. 'K' Value: ASTM C518, 0.23 Btu•in./(hr•ft²•°F) at 75°F.

2. Maximum Service Temperature: 250°F.

3. Density: 3.0 lb/cu ft.

4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.

5. Facing: 1" galvanized hexagonal wire mesh stitched on one face of insulation. (Optional.)

C. Rigid Fiberglass Board: Johns Manville 1000 Spin-Glas Meeting ASTM C612; Rigid, Noncombustible:

1. 'K' Value: ASTM C518, 0.23 Btu•in./(hr•ft²•°F) at 75°F.

2. Maximum Service Temperature: 850°F.

3. Density: 3.0 lb/cu ft.

4. Facing: 1" galvanized hexagonal wire mesh stitched on one face of insulation. (Optional.)

D. Cellular Glass: Pittsburgh-Corning Foamglas Meeting ASTM C552; Cellular Glass Thermal Insulation:

1. 'K' Value: 0.35 at 75°F.

2. Density: 8.0 lb/cu. ft.

3. Maximum Service Temperature: 900°F.

E. Hydrous Calcium Silicate: Johns Manville Thermo-12/Gold Meeting ASTM C533; Rigid Molded Block; Asbestos-Free Coded Throughout Material Thickness and Maintained Throughout Temperature Range:

1. 'K' Value: 0.40 at 300°F.

2. Maximum Service Temperature: 1,200°F.

3. Compressive Strength (block): Minimum of 200 psi to produce 5% compression, based on 1½" thickness.

4. Securement: Insulation shall be securely banded in place, tightly butted, joints staggered and secured with 16 gauge galvanized or stainless steel wire or ½" x .015" galvanized steel bands on 12" maximum centers for large areas.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify that piping has been tested for leakage in accordance with specifications before applying insulation materials. All piping shall be inspected by Owner's Representative prior to installation of insulation. Any insulation applied prior to inspection shall be removed and new insulation applied at no additional cost to Owner. Notify Owner's Representative five (5) working days prior to insulation installation.

B. Verify that all surfaces are clean, dry and free of foreign material.

3.02 INSTALLATION

A. General:

1. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.

2. Remove and replace any insulation that has become wet or damaged during the construction process.

3. Continue insulation and vapor barrier at penetrations and supports, except where prohibited by code.

B. Piping Insulation:

1. Locate insulation and cover seams in least visible locations unless otherwise specified.

2. Neatly finish insulation at supports, protrusions, and interruptions.

3. Provide insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self sealing laps. Insulate complete system.

4. For insulated pipes conveying fluids above ambient temperature, secure jackets with self sealing lap or outward clinched, expanded staples. Seal ends of insulation at equipment, flanges, and unions.

5. Provide insert between support shield and piping on piping 1½" diameter or larger. Fabricate of Johns Manville Thermo-12, or other heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:
   a. 1½" to 2½" pipe size 10" long
   b. 3" to 6" pipe size 12" long
   c. 8" to 10" pipe size 16" long
   d. 12" and over 22" long

6. Use of metal saddles is acceptable as specified in Section 220500. Fill interior voids with segments of insulation matching adjoining pipe insulation.

7. Use of pipe hangers designed as an insulation coupling is acceptable in lieu of saddles and other devices. Klo-Shure coupling or equal.

8. For pipe exposed in mechanical equipment rooms or in finished spaces below 7 feet above finished floor, finish with Johns Manville Zeston 2000 PVC jacket and fitting covers, or aluminum or stainless steel jacket.

9. Where pumps, valves, strainers, etc., with insulation require periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage. Use of premolded covers or lace-on type insulation blankets is required.

10. For exterior applications:
    a. Provide weather protection jacket. Insulated pipe lengths, pumps, fittings, joints, and valves shall be covered with aluminum jacket or stainless steel jacket. Jacket seams shall be located on bottom side of horizontal piping. All lateral joints shall be caulked with a minimum 20-year silicone sealant (clear). All longitudinal joints, except those at the bottom of a horizontal pipe run, shall be caulked with a minimum 20-year silicone sealant (clear).
    b. Apply weather-resistant protective finish such as WB Armaflex to flexible elastomeric insulation. Insulation seams shall be located on the bottom side of horizontal piping.

All lateral and longitudinal joints to be sealed with low V.O.C., UV inhibitive adhesive, such as Armaflex 520 BLV adhesive.

11. For underground installations, install per manufacturer's written instructions and recommendations.

12. When maintenance or service access for equipment will result in foot traffic over floor mounted insulated piping the contractor is to fabricate a permanent removable walkway to prevent damage to the piping and insulation.

C. Equipment Insulation:

1. See Piping Insulation above for additional requirements.

2. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands, per manufacturer's recommendations.

3. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retardant cement.

4. Provide insulated dual temperature equipment or cold equipment containing fluids below ambient temperature with vapor retardant jackets.

5. For insulated equipment containing fluids above ambient temperature, provide jacket with or without vapor barrier.

6. Cover insulation with metal mesh and finish with heavy coat of insulating cement, mastic, or aluminum jacket as indicated in the drawings.

7. For equipment in mechanical equipment rooms or in finished spaces, finish with Johns Manville Zeston 2000 jacketing and fitting covers or aluminum or stainless steel jacketing.

8. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.

9. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage. Use of lace-on type insulation blankets is acceptable.

3.03 PIPING INSULATION SCHEDULE

A. All insulation thicknesses shall meet or exceed state energy code requirements as noted below. Increase thickness ½" if exposed to exterior ambient air. Minimum thermal resistance in range of 4.2 to 4.6 per inch of thickness. Insulation thicknesses are based on fiberglass insulation and may be adjusted for equivalent insulation values for materials with superior "K" factors.

B. Fiberglass Insulation

	PIPE SIZE (inches)	THICKNESS (inches)
Domestic hot water <<industrial, lab hot water>>	Up to 2 2 ½ and over	1 1 ½

	PIPE SIZE (inches)	THICKNESS (inches)
Domestic hot <<industrial hot>> water return	All Sizes	1
Domestic cold <<industrial, lab, flush, irrigation>> water	All Sizes	1
Roof and overflow drain bodies	All Sizes	1
Horizontal roof and overflow drainage	Up to 2 2 ½ and over	1 1
Piping exposed to freezing	All Sizes	1 ½
Plumbing vents within 10 feet of the exterior in freezing climates	All Sizes	1
Misc. drains from electric water coolers, ice machines, etc.	All Sizes	1

C. Elastometric Foam (Closed Cell):

	PIPE SIZE (inches)	THICKNESS (inches)
Condensate drain pipes	All Sizes	1/2

D. Cellular Glass:

	PIPE SIZE (inches)	THICKNESS (inches)
Underground hot water and cold water piping	Up to 2 2 ½ and over	2 2

3.04 EQUIPMENT INSULATION SCHEDULE

A. Flexible Fiberglass Blanket

	THICKNESS (inches)	REMARKS
Water softeners	1	

B. Rigid Fiberglass Board:

	THICKNESS (inches)	REMARKS
Domestic hot water storage tank	2	

C. Flexible Elastomeric Foam (Closed Cell):

	THICKNESS (inches)	REMARKS
Cold water storage tank	1 ½	

END OF SECTION 220700

SECTION 221123
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.02 SCOPE

A. All work to be furnished and installed under this section shall include but not necessarily be limited to the following:

1. Water heaters
2. Storage Tank
3. Expansion Tank
4. Water feature equipment
5. Water meters
6. Drop inlets
7. Curb inlets

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods

B. Section 220501: Plumbing

C. Section 224000: Plumbing Fixtures

D. Section 222123: Plumbing Pumps

1.04 SUBMITTALS

A. Prior to construction submit for approval all materials and equipment in accordance with Division 01. Submit manufacturer's data, colors, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:

1. Water heaters
2. Storage Tank
3. Expansion Tank
4. Drop inlets

5. Curb inlets

B. Electrical Work: Refer to Division 22, Section 220500 for requirements.

C. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages.

D. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between portions of wiring that are factory installed and portions that are to be field installed.

E. Maintenance Data: Submit maintenance data and parts lists for each type and size of water heater, control, and accessory, including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual, in accordance with requirements of Division 01.

F. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

G. Start-up: Provide written report on start-up in accordance with Section 220500.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver units to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.06 WARRANTY

A. Provide one year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses to repair or replace products or systems.

PART 2 - PRODUCTS

2.01 DOMESTIC HOT WATER STORAGE TANK,

A. Provide RECO or Adamson storage tank. Storage section shall be constructed and stamped for 150 psi wiring pressure under Section VIII of the ASME Code.

B. All openings shall be bronze.

C. Provide 3" fiberglass insulation with steel jacket.

D. Provide 12" x 16" manhole.

E. Warranty: Full 10 year uncompetitional replacement.

2.02 WATER HEATER - STEAM

A. Furnish and install where indicated on the drawings, the Adamson Co., Inc. Dura Pak factory packaged, steam heated, storage heater or AERCO.

B. The storage tank shall be constructed and stamped in accordance with Section VIII, Division 1, of the current edition of the ASME Code for Pressure Vessels. Three (3) copies of the manufacturer's data reports signed by a registered inspector shall be furnished.

C. All openings 3" and smaller shall be threaded couplings.

D. The recovery section shall be constructed with non-ferrous tube sheet, wrapper and baffles. All heat transfer surfaces shall be 3/4" OD, 18 gauge seamless copper tubing. A demand monitor shall be provided to proportion steam flow to the heating element during periods of small or large draws of water. Temperature shall be maintained to plus or minus 5 degrees of the desired outlet temperature. All integral piping on the water circulation system shall be copper.

E. Each vessel shall be delivered completely assembled prior to shipment to the job site, and will include the following:

1. One vertical storage tank.

2. Tank Lining: Baked-on phenolic.

3. ASME Code Working Pressure: 125 psi.

4. Heating Capacity: _____ GPH, 40° F to _____° F.

2.03 POINT-OF-USE HOT WATER HEATER

A. Furnish and install Eemax Instantaneous water or as indicated on the drawings.

B. Construction: Solid copper, storage tank, polystyrene insulated with steel jacket; Chromalox Cartridge type screw in element, 1500 watt, 120 volt, single phase; on-off switch; 42" cord with grounded plug.

C. Warranty: 1 year.

D. Manufacturer: Eemax, Chronomite, Bradford-White or Aerco.

2.04 RELIEF VALVES

A. Relief Valve: Watts vacuum relief valve, bronze body, silicone disc, threaded ends, installed on C.W. supply line only, refer to H.W. Heater Detail on contract drawings.

B. Temperature and Pressure Relief Valve: Watts, bronze body construction, thermostat and test lever, temperature relief set at 210°F, and pressure relief set at 125 psi.

C. Acceptable manufacturers: Watts, Kunkle, Keckley or Cash Acme.

2.05 EXPANSION TANK

A. Furnish and install where shown on plans for domestic hot water system.

B. ASME stamped and constructed vessel with the following:

1. Tanks rated for 125 / 150 psi maximum working pressure.

2. Black steel galvanized construction painted with “Hammertone” blue enamel.

3. Tank saddle supports / Tank ring base support.

4. Stainless connection opening.

5. Butyl diaphragm bonded to polypropylene liner.

6. Pre-charged air chamber permanently sealed.

7. Air valve.

C. Manufacturer: Amtrol AST, Adamson, RECO or Watts.

2.06 WATER METERS

A. Water meter shall comply with UC Berkeley campus requirements in order to communicate with the campus SCADA utility monitoring system and shall have a mechanical drive with hermetically sealed registers; meter shall be equal to or exceed AWWA Standards and shall have an all bronze case. Provide water meters installed complete with gate valve on each side of meter and full line size bypass around meter. Provide flanges on valves and support stands or wall brackets for meter support. Units shall be approved for use by local water district and or UC Berkeley campus requirements. Hersey Products Inc #MHD, Niagra or Rockwell. Meter shall be rated 100 gpm at 80 psi inlet pressure.

2.07 CURB INLET

A. Curb inlets shall be of the precast concrete type, as manufactured by Santa Rosa Cast Products or approved equal. The structure shall consist of a precast unit with three exterior walls, monolithically poured with a top slab. An opening shall be provided in the top slab for maintenance access and shall be 24 inch diameter minimum. The inlet side of the unit shall be provided with an integrally cast galvanized structural steel nosing. The access opening shall be trimmed with galvanized steel frame, cast integrally with the structure. A circular cover of reinforced concrete, trimmed with galvanized steel ring cast integrally with the cover, shall be constructed to fit the access opening. All steel nosings and frames shall be hot dipped galvanized after fabrication to requirements of ASTM specifications A123.

2.08 DROP INLET

A. Drop inlets shall be of the precast concrete type as manufactured by Santa Rosa Cast Products Company, Santa Rosa, California, or approved equal. Concrete shall contain no less than 6 sacks of Type 2 cement per cubic yard and shall have a minimum compressive strength of 3,000 psi at 28 days. Wall thickness and reinforcing mesh shall be in accordance with the manufacturer's recommendations. All structures and grates in traffic areas shall be designed to withstand H-20 loading. Structural design of concrete reinforcement and grates shall be performed and approved by licensed civil engineer and shall take into consideration the intended loading and use. The precast units shall be constructed to conform to the design dimensions for each specific job, and shall be provided with pipe openings as per job requirements. Deflected pipe openings may be chipped by manufacturer in green concrete.

B. Drop inlets exceeding four feet in depth may be poured in two or more units, and shall be provided with inter-locking keyed joints which shall be grouted with 1:4 mortar during installation. Two inch diameter lifting holes shall be provided to facilitate job handling. Grates and frames shall be constructed of structural steel. Steel grates and frames shall be hot dipped galvanized after fabrication to requirements of ASTM specifications A123. All frames shall be integrally cast. The top surface of the drop inlet shall be finished smooth, shall be square and clean. Wall surfaces shall be formed, shall be flat and true to dimension.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Orient so controls and devices needing service and maintenance have adequate access.

D. Connect water piping to units with shutoff valves and unions as indicated.

E. Start-Up: Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls. Start-up to be by authorized manufacturer's representative or agent.

3.02 OPERATION MANUALS, START-UP SERVICE, WARRANTIES, ACCEPTANCE AND GUARANTEES

A. General: Refer to Section 220500 for details.

END OF SECTION 22 1123

SECTION 22 1519
AIR COMPRESSOR EQUIPMENT

PART 1 - GENERAL

1.01 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.02 SCOPE

A. This Section specifies the requirements to furnish and install clean, dry, oil-free, and shop compressed air equipment.

B. Compressed Air Equipment:

1. Oil-free, two stage, rotary screw, water-cooled air compressor.
2. Heatless type regenerative desiccant compressed air dryer.
3. Coalescing compressed air filter.
4. Interceptor compressed air filter.
5. Absorber compressed air filter.
6. Sequence control panels.
7. Drip legs.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods

B. Section 222115: High Purity Piping

C. Section 222117: Process Piping

D. Division 26: Electrical

1.04 QUALITY ASSURANCE

A. Comply with codes and standards required for proper system installation.

B. The compressed air equipment manufacturer shall have established an ongoing Quality Assurance/Quality Control program, including manuals available for inspection at their plant.

1.05 WORKMANSHIP

A. Install all work pertaining to compressed air equipment as close as possible to layout shown on the drawings. Employ skilled mechanics to install all systems in a manner acceptable to the owner.

1.06 SUBMITTALS

A. Prior to construction submit for approval all materials and equipment in accordance with Division 01 requirements.

B. Provide the following in addition to the standard requirements:

1. Complete layout drawings including plan, elevations, and relevant details.

2. Complete catalog information on the compressed air equipment and accessories listed including:
   a. Motors
   b. Sequence control panel
   c. Accessories and piping

3. Control panel layout, control ladder diagram, and a written sequence of operations.

4. Factory test results and certifications

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01. Deliver products to the site in containers with manufacturer's stamp or label affixed.

B. Store/protect products under provisions of Division 01. Protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.08 WARRANTY

A. All compressed air equipment shall be guaranteed against defective design, material, and workmanship in accordance with the terms of the Purchase Order. In addition, guarantee performance of the compressed air equipment, in accordance with the process conditions of the individual pieces of equipment. Upon satisfactory proof that the compressed air equipment furnished do not meet specified operating conditions, furnish to the point of use any necessary additional equipment to meet specified conditions or make changes, as required, to the original equipment furnished.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish a complete compressed air system including air compressor(s), dryer(s), and filter(s) as specified herein.

2.02 OIL FREE TWO STAGE ROTARY SCREW WATER-COOLED AIR COMPRESSOR

A. General Requirements:

1. The manufacturer shall supply a positive displacement two-stage rotary screw air compressor capable of delivering 100% oil-free air. There shall be no lubricants in the compression chamber. The

assembly shall be fully packaged, including air compressor, main drive motor, oil cooler, intercooler and after cooler, separate motor driven lubrication system, fan, regulation and control systems, all mounted on a common base frame and fully enclosed by a steel sound dampening enclosure.

2. The compressor shall be the manufacturer's standard oil-free, two-stage rotary screw air compressor package. The compressor shall consist of two compressor stages connected to an integral speed increaser. The rotors shall have an asymmetrical profile. Each stage is to be driven from a common bull gear to ensure optimum speed and high efficiency. There shall be a water-cooled intercooler between the first and second compression stages and a water-cooled after cooler installed after the final stage.

3. The capacity shall be expressed in terms of free-air delivery of cubic feet per minute measured at the discharge pressure and related back to inlet conditions. The capacity and specific power shall be guaranteed per modified ASME PTC9. The free-air delivery and specific power quoted shall be within the following tolerances:
   a. Air Delivery: ± 4%
   b. Power Consumption: ± 5%
   c. The compressor shall be rated at _____ SCFM at _____ psig discharge pressure and be suitable for use on ____ volts, ____ phase, ____ Hz.

B. ACCEPTABLE MANUFACTURERS:

1. Quincy

2. Kobelco

3. Atlas Copco

4. Ingersoll - Rand

2.03 HEATLESS TYPE REGENERATIVE DESICCANT COMPRESSED AIR DRYER

A. General Requirements:

1. The manufacturer shall supply a heatless type regenerative desiccant compressed air dryer capable of drying ___SCFM at ___ PSIG with a maximum working pressure of ___ PSIG/100 degrees F. inlet and 100 degrees F. ambient and producing a -40 degrees F. pressure dew point over all load conditions from 0-100%.

2. The dryer shall be the manufacturer's standard heatless type regenerative desiccant compressed air dryer. The air dryer system shall be fabricated with dual desiccant chambers. Inlet switching valves shall be two 2-way no-lube, pilot air operated, normally open. Outlet valves shall be soft seated, silent check valves. The purge valves shall be air operated, normally closed, so that in case of power failure or when the unit is de-energized, both the inlet valves are open and purge and depressurizing valves are closed to avoid any air loss. The dryer unit shall be completely prepped, prewired, and test run before shipment. Dryers up to 1600 SCFM shall be shipped with a full charge of desiccant, and larger dryers shall be shipped with loose desiccant to be charged to the vessels on site by the customer. The dryer shall operate on a 10 minute cycle (5 minutes drying and 5 minutes regenerating). The dryer shall be the manufacturer's standard internally located regenerative desiccant compressed air dryer.

B. Acceptable manufacturers: Zurn, Pneumatech, or Ingersoll - Rand

2.04 COALESCING COMPRESSED AIR FILTER

A. General Requirements:

1. The entire filter assembly shall be constructed of non-corrosive materials which are approved by U.S.D.A. and U.S.F.D.A. for use in compressed air and respiratory air systems and are entirely compatible with all natural, as well as synthetic, lubricating oils. The assembly shall be capable of operating at temperature levels up to 225 degrees F., and shall induce, when operated at rated flow, a maximum pressure drop of 1 ½ psi dry, 2 ½ psi when wetted with 20wt. oil.

2. The filter housing shall be a T-type pressure vessel, 500 psi operating pressure, with a one piece element having a minimum D.O.P. efficiency of 99.97% (.3-.6 min. aerosols), tested according to MIL-STD-282 shall not pass solids larger than .3um or liquid aerosols larger than .75um, shall be a minimum of 99.98% efficient on all sizes, and a manual or automatic drain device.

B. Acceptable Manufacturers: Parker Finite, Zurn, or Ingersoll - Rand

2.05 INTERCEPTOR COMPRESSED AIR FILTER

A. General requirements

1. The entire filter assembly shall be constructed of non-corrosive materials which are approved by U.S.D.A. and U.S.F.D.A. for use in compressed air and respiratory air systems and are entirely compatible with all natural, as well as synthetic, lubricating oils. The assembly shall be capable of operating at temperature levels up to 225 degrees F., and shall induce, when operated at rated flow, a maximum pressure drop of .25 psi dry.

2. The filter housing shall be a T-type pressure vessel, 500 psi operating pressure, with a one piece element that shall not pass solids larger than .3um.

B. Acceptable manufacturers: Parker Finite, Zurn, Ingersoll - Rand

2.06 ABSORBER COMPRESSED AIR FILTER

A. General Requirements:

1. The entire filter assembly shall be constructed of non-corrosive materials which are approved by U.S.D.A. and U.S.F.D.A. for use in compressed air and respiratory air systems and are entirely compatible with all natural, as well as synthetic, lubricating oils. The assembly shall be capable of operating at temperature levels up to 225 degrees F., and shall induce, when operated at rated flow, a maximum pressure drop of 1 psi dry.

2. The filter housing shall be a T-type pressure vessel, 500 psi operating pressure, with a one piece element of activated charcoal and shall have an oil vapor efficiency of greater than 99%.

B. Acceptable Manufacturers: Parker Finite, Zurn, Ingersoll - Rand

2.07 VERTICAL COMPRESSED AIR RECEIVER

A. General Requirements:

1. Provide a vacuum receiver which is galvanized, internally and externally, epoxy coated, ASME coded for 150 psig, and fitted for vertical or horizontal installation.

2. The tank shall have sight glass, safety valve, automatic tank drain, and pressure gauge.

B. Acceptable Manufacturers: Roy E. Hanson Jr. Manufacturing.

2.08 SEQUENCE CONTROL PANELS FOR AIR COMPRESSOR

A. General Requirements:

1. The air compressor manufacturer shall provide a sequence control panel which is UL approved. The following components, as a minimum, shall be provided in a NEMA 12 enclosure.
   a. Automatic lead-lag operation of compressors
   b. Automatic lead-compressor alteration capability

2. Compressor shall have automatic shut-off switches for the following conditions:
   a. Low oil pressure
   b. High first stage discharge air temperature.
   c. High second stage discharge air temperature.
   d. High second stage inlet air temperature.
   e. High oil temperature
   f. Motor overload
   g. High cabinet temperature
   h. Reset switch

B. Panel Location

1. Provide for required electrical clearances

2.09 SEQUENCE CONTROL PANELS FOR COMPRESSED AIR DRYER

A. General requirements

1. The compressed air dryer manufacturer shall provide a sequence control panel which is UL listed the following components, as a minimum shall be provided in a NEMA 12 enclosure:
   a. Automatic lead-lag operation of dryers
   b. Automatic lead dryer alteration capability
   c. Outlet air pressure gauge
   d. Inlet air temperature
   e. Refrigerant low pressure gauge
   f. Refrigerant high pressure gauge
   g. High dewpoint indication
   h. Automatic drain float trap
   i. Automatic drain electronic timer

B. Panel Location

1. Provide for required electrical clearances

2.010 DRIP LEGS

A. General requirements

1. Provide per manufacturers recommendations.

2. See plans for locations.

a. ARMSTRONG "71-A"

2.11 MOTOR AND STARTER

A. Motor shall be in conformance with the requirements of Division 26 requirements.

B. Motor starter shall be suitable for connection to an electrical system having 25,000 amps RMS symmetrical fault current at 450 V, 3 phase, 60 Hz.

2.12 AIR COMPRESSOR ACCESSORIES AND PIPING

A. Provide all interconnecting piping, wiring, valves, and controls necessary for a complete air compressor equipment package. Accessories shall include, but not be limited to the following:

1. Isolation valves on the compressor outlet.
2. Pump outlet
3. Pressure gauge
4. Pressure switches which control the lead-lag operation of the compressor and solenoid valves.
5. Temperature gauges on the compressor discharge.
6. Sight glasses on the compressed air receiver tank and oil/air reservoir.
7. Flow switches which indicate loss of cooling water and automatically shut down the compressors.
8. Flow valves to control process cooling water and make-up water.
9. Compressor outlet and cooling water supply and return flexible connectors.
10. Cartridge type air inlet filters sized appropriately for the compressor size.
11. Pressure gauges on both sides of the inlet filter.
12. Unit to be completely assembled on structural steel skid with all internal water, oil, and air piping, and electrical wiring completed for easy installation; initial oil fill included.

B. To assist in bid evaluation, provide a list of all other accessories not normally provided with the supplier's standard air compressor equipment package not mentioned above.

2.13 COMPRESSED AIR DRYER ACCESSORIES AND PIPING

A. Provide all interconnecting piping, wiring, valves, and controls necessary for a complete compressed air dryer equipment package. Accessories shall include, but not be limited to the following:

1. Dryer
2. Isolation valves on the dryer inlets and outlets
3. Dryer check valves
4. Pressure gauge

5. Temperature gauges on the dryer.

6. Flow switches which indicate loss of cooling water and automatically shut down the dryer.

7. Flow valves to control process cooling water and make-up water.

8. Dryer inlet and outlet and cooling water supply and return flexible connectors.

9. Unit to be completely assembled on structural steel skid with all internal water, refrigerant, electrical wiring completed for easy installation.

B. To assist in bid evaluation, provide a list of all other accessories not normally provided with the supplier's standard dryer equipment package not mentioned above.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with the manufacturer's recommendations. Locate compressed air equipment and a concrete housekeeping pad and provide connection to system piping as shown on the drawings. Provide process cooling water supply and return and piping connection.

END OF SECTION 22 1519

SECTION 22 2113
PLUMBING PIPING, VALVES AND SPECIALTIES

PART 1 - GENERAL

1.01 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.02 SCOPE

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to the following:

1. Pipe and Fittings
   a. Sanitary waste and vent
   b. Storm drain and overflow
   c. Cold water
   d. Hot water
   e. Fuel gas
   f. Compressed air

2. Valves
   a. Water valves
   b. Backwater valves
   c. Natural gas valves
   d. Compressed air valves
   e. Balancing valves
   f. Backflow prevention valves
   g. Pressure reducing valves
   h. Gas pressure regulator valves
   i. Thermostatic mixing valves
   j. Solenoid valves

3. Thermometers and gauges

4. Piping specialties
   a. Pipe escutcheons
   b. Strainers
   c. Drip pans
   d. Air vent
   e. Dielectric unions
   f. Unions
   g. Flanges
   h. Pipe sleeves
   i. Sleeve seals
   j. Valve boxes
   k. Pipe coating
   l. Gas connectors

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Materials and Methods

B. Section 220501: Plumbing

C. Section 224000: Plumbing Fixtures

D. Section 221123: Plumbing Equipment

E. Division 26: Electrical

1.04 QUALITY ASSURANCE

A. Manufacturers Qualifications:

1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.

2. Replacement parts shall be readily available and stocked in the USA.

B. Codes and Standards:

1. All work shall be in full accordance with all applicable codes, ordinances and code rulings.

2. The Contractor shall furnish without any extra charge the labor and material required for compliance of codes.

3. Perform all tests required by governing authorities and as required under all Division 22 Sections. Provide written reports on all tests.

4. Electrical devices and wiring shall confirm to the latest standards of NEC; all devices shall be UL listed and so identified.

5. All plumbing work shall comply with the Americans with Disabilities Act (ADA).

6. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for all piping, valves and specialties indicating dimensions, valve CV, tolerances etc.

B. Shop Drawings: Submit shop drawings indicating underground piping installation showing all fittings with inverts. Indicate all footings and grade beams.

C. Maintenance Data: Submit maintenance instructions on accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.

1. All pipe, pipe fittings and valves shall be manufactured in North America. Alternatives may be acceptable, but must be submitted and approved by the Engineer prior to bidding.

OR

2. Upon request, the engineer shall be furnished certification by the manufacturer, stating samples representing each lot have been tested and inspected as indicated in governing ASTM specifications have been met. Certification shall be accompanied by test reports as prepared in accordance with relevant ASTM sections governing Test Methods and Inspection. Tension Tests reports shall include breaking load, machined diameter of the test bars, and calculated tensile strength. Certification shall include the legal name and address of the manufacturer.

B. Type M copper piping is not acceptable for any pressure water piping unless specifically noted otherwise.

C. For all Grade B piping specified below grade provide a mill report with production identification numbers for piping submitted to permit tracking of pipe by mill and production lot.

D. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturer's names used herein, unless specifically noted that substitutes are not allowed.

2.02 STANDARD PIPE AND FITTING

A. Natural Gas Pipe & Fitting (Above Grade)

1. Pipe: ASTM A53, Schedule 40 black steel.
   a. Fittings: 150 lb. rating. ANSI B16.3, malleable iron threaded; ANSI B16.5, flanged; ANSI B16.9, steel.
   b. Joints: 2" and smaller, threaded (except in the case of piping located in shafts / or plenums which must be welded); all piping inside the building 2-1/2" and larger, ANSI B16.25 bevelweld, ANSI B16.5 flanges, or ANSI B16.11 socket weld.

2. Flexible Pipe System: Corrugated stainless steel tubing (CSST) equal to Gastite®corrugated stainless steel tubing manufactured from ASTM A240, type 304 stainless steel with a minimum nominal wall thickness of 0.010". System shall comply with ANSI LC-1 "Standard for Fuel Gas Piping Using Corrugated Stainless Steel Tubing (CSST), and carrying listings by CSA International (Certification Number 1009875), ICC Evaluation Services (Report Number ESR-1031) and IAPMO Research & Testing (Certificate of Listing Number 3250). System to be fire rated for installation in plenum applications.
   a. Fittings and joints: Corrugated stainless steel tube fittings and joints equal to Gastite® mechanical tube fittings manufactured from ASTM B16 type 360 brass whose design incorporates a double wall flare for gas-tight seal with Jacket Lock™, mechanical capture of the jacket for enhanced tubing protection.

B. Natural Gas Piping (Below Grade)

1. Polyethylene, Grade 23, Type II, ASTM 2513, plain ends, heat fused joints, orange finish.

C. Fuel Oil Piping:

1. Pipe:
   a. Above Grade Carrier Pipe: ASTM 53 Schedule 40 black steel pipe with factory applied corrosion resistant coating. Galvanized steel pipe is not acceptable.
   b. Above Grade Containment Pipe: ASTM 53 Schedule 10 black steel pipe with factory applied corrosion resistant coating. Galvanized steel pipe is not acceptable.
   c. Below Grade Carrier Pipe: UL listed fiberglass piping conforming to ASTM D-2996 as manufactured by Smith.
   d. Below Grade Containment Pipe: UL listed fiberglass piping conforming to ASTM D-2996.

2. Fittings:
   a. Above Grade Carrier Pipe Fittings: ANSI B16.4 malleable iron threaded, ANSI B16.5, flanged; ANSI B16.9, steel bevelweld.
   b. Above Grade Containment Pipe Fittings: Victaulic grooved fittings.
   c. Below Grade Carrier Pipe Fittings: UL listed fiberglass fittings as manufactured by Smith.
   d. Below Grade Containment Fittings: UL listed "Clamshell" fiberglass fittings as manufactured by Smith.

3. Joints:
   a. Above Grade Carrier Pipe: 2" and smaller, threaded (except piping in shafts or plenums which must be welded); 2 ½" and larger, ANSI B16.25 bevelweld, ANSI B16.5 flanges or ANSI B16.11 socket weld.
   b. Above Grade Containment Pipe: Victaulic type grooved pipe couplings or equivalent by Gruvlok.
   c. Below Grade Carrier Pipe: Threaded and bonded (T.A.B.) system as manufactured by Smith.
   d. Below Grade Containment Pipe: UL listed "Clamshell" fiberglass fittings as manufactured by Smith.

D. Trap Primer Piping:

1. Pipe: Domestic Only, ASTM B88, Type K, soft drawn copper water tube.

2. Fittings: No joints below ground. For pipes below grade double wrap with Scotch Wrap #51 or PASCO Wrap, with 50% overlap.

E. Condensate and indirect drains:

1. Pipe: ASTM B88, Type M, hard drawn copper water tube.

2. Fittings: ANSI B16.22, wrought copper.

3. Joints: Lead-free solder joints. Solder shall be lead-free nickel/silver bearing solder meeting ASTM B-32, ASTM B-828. Flux shall be water soluble and shall meet CDA standard test method 1.0 and ASTM B813-91.

4. Insulate condensate drain pipes with minimum ½" insulation to prevent moisture dripping from pipe.

F. Domestic Hot and Cold Water Pipe & Fittings (Above Grade):

1. Pipe: ASTM B88, Type L, hard drawn copper water tube.

2. Fittings: ANSI B16.22, wrought copper, 95%-5% tin-antimony solder joints. Alternative Domestic Water Pipe Fitting (See Section 3.8F): Copper press fittings shall conform to the material and sizing

requirements of ASME B16.22. O-rings for copper press fittings shall be EPDM. Viega/Ridgid or approved equal.

G. Domestic Hot and Cold Water Pipe & Fittings-Alternative (Above Grade):

1. Pipe: ASTM F876 and F877, ViegaPEX cross linked high density polyethylene.

2. Fittings: ASTM F876, F877 and ASTM/NSF-61, Bronze PEX Press Fittings, Viega Pureflow bronze PEX Press Fittings and stainless steel press sleeves.

H. Domestic Cold and Hot Water Pipe & Fittings Above and Below Grade (2-1/2" and Larger):

1. Pipe: ASTM D1784, Corzan® IPS (iron pipe size) Rigid CPVC (chlorinated polyvinyl chloride) Schedule 80, Cell Class of 24448, NSF certified. Pipe shall meet ASTM F441.

2. Fittings: Fitting shall meet Cell Class 23447 and carry a pressure rating listed by the Plastics Pipe Institute (PPI) of PPI TR-3 and in accordance with ASTM D-2837. ASTM F439 socket, ASTM F437 for threaded CPVC Schedule 80 fittings. Threaded fittings shall have taper pipe threads in accordance with ASTM F1498. Unions and flanges shall meet the requirements of ASTM F1970. Two step-low VOC, ASTM F493 & ASTM F656 primer and solvent cement application per manufacturer's instructions and in accordance with ASTM D-2855 and ASTM F402.

3. Compound manufacturer shall conduct a program that lists those ancillary building products (including, but not limited to: fire stops/caulks, thread sealents, leak detectors/snoop, etc…) that are chemically compatible with the CPVC compounds (pipe and fittings). This compatibility program shall be administered by an independent third party testing agency.

4. 4. Contractor shall have received training from a manufacturer trained representative, and shall have received and be able to show proof of training via the use of "Proof of Training" card or other completion training certificate for the system he is installing.

I. Domestic Cold and Hot Water Pipe & Fittings Above and Below Grade (2" and Smaller):

1. Pipe: ASTM D1784, FlowGuard Gold® CTS (copper tube size) Rigid CPVC (chlorinated polyvinyl chloride) pipe with a minimum Cell Class of 24448, NSF certified. Pipe shall meet ASTM D2846.

2. Fittings: Fitting shall meet ASTM D1784 with a Cell Class of 23447. One step-low VOC, ASTM F493 solvent cement, application per manufacturer's instructions and in accordance with ASTM D-2855 and ASTM F402.

3. Compound manufacturer shall conduct a program that lists those ancillary building products (including, but not limited to: fire stops/caulks, thread sealents, leak detectors/snoop, etc…) that are chemically compatible with the CPVC compounds (pipe and fittings). This compatibility program shall be administered by an independent third party testing agency.

4. 4. Contractor shall have received training from a manufacturer trained representative, and shall have received and be able to show proof of training via the use of "Proof of Training" card or other completion training certificate for the system he is installing.

J. Sanitary Sewer, Vent, Rainwater Pipe & Fittings:

1. Pipe: Tyler or AB&I or Charlotte Pipe and Foundry, ASTM A-74, ASTM A-888 cast iron, bituminous coated, "No-Hub". Pipe and fittings shall be marked with the collective trademark of the

Cast Iron Soil Pipe Institute and manufactured by AB &I, Charlotte or Tyler. Pipe showing rust or cracks in coating shall be removed and replaced.

2. Fittings: No-hub, ASTM A-888.

3. Couplings Below Grade: Heavy Duty Type 304 stainless steel couplings conforming to FM 1680 with neoprene sealing sleeve conforming to ASTM C-1540 having minimum shield thickness of 28 gauge. Husky SD-4000 or Clamp All 125 only.

4. Couplings Above Grade: Type 304 stainless steel couplings conforming to ASTM C-1540 and neoprene sealing sleeve, having minimum shield thickness of 34 gauge. Anaco or Ideal.

5. Vent: ABS with solvent cement joints.

6. Couplings Above Grade: Band type stainless steel couplings conforming to ASTM C-1540 having a minimum thickness of 31 gauge with neoprene sealing sleeve conforming to ASTM C-564. MissionHeavyWeight, Husky 2000 or Clamp All 80 only.

K. Sanitary Sewer, Vent, Rainwater Pipe & Fittings-Alternative:

1. Pipe: Charlotte Pipe and Foundry, ASTM F 628, ASTM D 3965, NSF Standard 14, ABS (acrylonitrile-butadiene-styrene) compound with Cell Class 42222. Use in non-pressure applications where operating temperature will not exceed 160ºF.

2. Fittings: ASTM D 2661, ASTM D 2235, ABS DWV Fittings shall be by a single manufacturer and to be installed in accordance with manufacturer's recommendations. Solvent cement joints.

L. Sanitary Sewer, Vent, Rainwater Pipe & Fittings-Alternative:

1. Pipe: Charlotte Pipe and Foundry, ASTM D 1785, ASTM D 1784, NSF Standard 14, PVC Schedule 40 (polyvinyl chloride) compound with Cell Class 12454. Use in non-pressure applications where operating temperature will not exceed 140ºF

2. Fittings: ASTM D 2665, ASTM D 2564, PVC DWV Fittings shall be by a single manufacturer and to be installed in accordance with manufacturer's recommendations. Solvent cement joints.

M. Rainwater Leader Pipe and Fittings (Exposed, Above Grade):

1. Pipe: ASTM B306, DWV class, copper tube.

2. Fittings: ANSI B16.23 cast bronze or ANSI B16.29 wrought copper. Drainage pattern fittings.

3. Joints: Lead free solder. Lead solder shall not be present at the job site.

N. Vent Piping (Above Grade) (Contractor's Option):

1. Pipe: ASTM B306, DWV class, copper tube.

2. Fittings: Elkhart, ANSI B16.23 cast bronze or ANSI B16.29 wrought copper, sweat solder no lead joint. Submit sample of solder for Engineer's review and approval.

O. Water Service to Building:

1. Pipe: Class 52 ductile iron, ANSI A21.51, AWWA C1510-70, 150 psi cement lined; factory encased with 8 mil polyethylene tube or sheet.

2. Fittings: ANSI A21.10 mechanical joint, AWWA C110-1971, 250 psi. fittings to be double field wrapped with 2", 20 mil vinyl tape, 50% overlap.

3. All fittings shall be restrained with 2000 psi thrust blocks in accordance with NFPA

4. Fire Protection: Refer to Specification Section 211000.

2.03 VALVES: GENERAL

A. General: Valve ratings shall exceed respective system operating pressures by 50% (minimum). All valves shall be line size unless otherwise noted.

B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.

C. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

D. Acceptable manufacturers (manufacturer and model number listed for individual valves indicates minimum acceptable by all manufacturers):

1. Gate, Ball, Check or Butterfly: Apollo, Hammond, Nibco (commercial grade, US manufacturer only), Milwaukee, Victaulic or Watts.

2. Lubricated Plug Valves: Homestead, Resun, or Rockwell.

3. Backflow Preventors: Apollo, Ames, Febco, Cla-Val, Watts or Wilkins.

4. Pressure Reducing Valves: Apollo, Cash-Acme, Cla-Val, Watts, or Wilkins.

5. Solenoid Valves: ASCO, Automatic or Magnatrol.

6. Circuit Setters: Griswold (Venturi with characterized ball valve only), Wheatley (Y-globe type only), Armstrong, or Tour & Anderson.

E. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on the valve body.

F. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, other than plug valves. Provide one wrench for every 10 plug valves, and one in each size. Provide extended levers/stems for valves on insulated lines. For manual valves 2 ½" and larger located 8 feet above the floor in mechanical rooms provide chain operator to permit operating the valve from 4'-0" above floor.

G. Valve Features:

1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.

2. Drain: Comply with MSS SP-45, and provide threaded pipe plugs.

3. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

4. Threaded: Valve ends complying with ANSI B2.1.

5. Solder-Joint: Valve ends complying with ANSI B16.18.

6. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

2.04 DOMESTIC PLUMBING SERVICE VALVES

A. Gate Valves:

1. 2" and Smaller: Class 125, MSS SP-80, ASTM B62 cast bronze body, soldered ends, bronze bonnet, bronze wedge, rising stem, brass packing gland, non-asbestos packing and aluminum hand-wheel.

2. 2-1/2" and Larger: Class 125, MSS SP-70, ASTM A126 Grade B cast iron body, flanged ends, cast iron bonnet, cast iron wedge, bronze trim, rising stem, brass packing gland, non-asbestos packing and cast iron hand-wheel.

B. Butterfly Valves:

1. 3” and Larger: MSS SP-67, lug wafer, ductile iron body, stainless steel disc, stainless steel stem, EPDM seat, memory stop control, lever handle thru 5" size and worm gear operator for 6" and larger. Mount stem in horizontal position. Hammond 6100 series.

C. Ball Valves:

1. 2 1/2" and Smaller: 600 psi, 2 piece, bronze body, soldered ends for copper pipe and threaded ends for iron pipe, chrome plated brass ball, Teflon seat, brass stem, steel handle, full port. Apollo 70-200 series.

D. Check Valves:

1. 2" and Smaller: Class 125, MSS SP-80, ASTM B62 and ASTM B16, cast bronze body, soldered ends for copper pipe, screwed cap, swing type, Teflon bronze disc.

2. 2-1/2" and Larger: Class 125, MSS SP-71, ASTM A126 class B cast iron body, bolted bonnet flanged ends, bolted cap, swing type, cast iron disc with bronze face rings.

3. Vertical or High Flow: Class 125, cast bronze, high-flow body, TFE seat, brass check, stainless steel guide and spring. Watt #6015.

2.05 NATURAL GAS, LP GAS AND OIL SERVICE VALVES

A. Ball Valves:

1. ½" and ¾": Brass body, U.L. listed, CSA approved for pressure of system, bronze ball valve, 175 WOG, with integral lever handle. Apollo 64 series or Watts #FBV-1.

2. 1" thru 1-1/2": 175 psi working pressure, CSA and UL approved, bronze body, welded ends, stainless steel ball, stainless steel stem, steel handle with memory stop tab, conventional port.

3. Lubricated Plug Valve, 2" and Larger: Class 125, MSS SP-78, 200 PSI, UL listed, CSA approved for pressure of system, lubricated plug type, semi-steel body, loose wrench operated, straight way pattern round port, combination button head fitting and lubricant screw, Teflon seal and discs.

B. Seismic Gas Shutoff Valves:

1. ¾" thru 2" (low and medium pressure, screwed body): U.L. Listed valve meeting ASCE 25-97, positive closure, soft seal seating, visual open-close indicator, manual reset, and closure time interval within 5 seconds when subjected to a sinusoidal oscillation with peak acceleration of 0.3G and a period of 0.4 seconds. Koso/California Valve Series EV, or approved equal, sized for 0.5 PSI or 20 PSI max operating pressure, respectively.

2. 2", 3" and 4" (High pressure, screwed body): U.L. Listed valve meeting ASCE 25-97,manual reset, soft seat construction for positive sealing, visual open-close indicator, tripping mechanism with non-creeping rolling latch, and closure time interval within 5 seconds when subjected to sinusoidal oscillation with peak acceleration of 0.3G and a period of 0.4 seconds. Koso/California Valve Series EV315, or approved equal, sized for 20 PSI max. operating pressure.

3. 6" (high Pressure, Flanged body): U.L. Listed valve meeting ASCE 25-97,manual reset, soft seat construction for positive sealing, visual open-close indicator, tripping mechanism with non-creeping rolling latch, and closure time interval within 5 seconds when subjected to sinusoidal oscillation with peak acceleration of 0.3G and a period of 0.4 seconds. Koso/California Valve Series EV317, or approved equal, sized for 60 PSI max. operating pressure.

2.06 COMPRESSED AIR AND VACUUM SERVICE VALVES

A. Ball Valves:

1. 2" and Smaller: 175 psi working pressure, 3 piece bronze body, threaded ends, stainless steel ball, stainless steel stem, steel handle with memory stop tab, conventional port. Apollo 82-100 series.

B. Butterfly Valves:

1. 2-1/2" and Larger: MSS SP-67, lug wafer ductile iron body, stainless steel disc, stainless steel stem, EPDM seat, memory stop control, lever handle. Mount stem in horizontal position.

C. Air Vent Needle Valves:

1. ¾" and Smaller: 200 psi working pressure, needle globe valve, bronze body, threaded ends, bronze stem, steel wheel handle. Milwaukee #600.

2.07 BALANCING VALVES: MAXIMUM 125 PSIG SYSTEM WORKING WATER PRESSURE

A. Pressure Dependent Water Flow:

1. ½" and Larger: Construction and attachment style as required by piping system. Ball or globe valve design with memory stop. Valves shall be field adjustable. Install in pipe with minimum length of unrestricted straight pipe equivalent to five pipe diameters upstream and two pipe diameters downstream. Presso Venturi B-Plus series, Armstrong, or Tour & Anderson.

2.08 BACKFLOW PREVENTION VALVES

A. General: All backflow prevention valves shall be State approved and listed.

B. Reduced Pressure Zone Backflow Preventer for High Hazard Applications:

1. 2" and Smaller: Assembly shall consist of shutoff ball valves in inlet and outlet, and strainer on inlet. Assemblies shall include test cocks and pressure-differential relief valve located between two positive seating check valves and shall comply with requirements of ASSE Standard 1013 and AWWA C506. Bronze construction, threaded ends, stainless steel internal parts, and air gap fitting. Route pipe from air gap fitting to approved waste receptor. Watts #909-QT-S-HW valve with #909AG air gap fitting.

2. 2-1/2" and Larger: Assembly shall consist of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies shall include test cocks and pressure-differential relief valve located between two positive seating check valves and shall comply with requirements of ASSE Standard 1015 and AWWA C506. Epoxy coated cast iron body construction, flanged ends, stainless steel internal parts, bronze seats, and air gap fitting. Route pipe from air gap fitting to approved waste receptor. Watts #909-S-OSY valve with #909AG air gap fitting.

C. Double Check Valve for Low Hazard Applications:

1. 2" and Smaller: Assembly shall consist of shutoff ball valves in inlet and outlet, and strainer on inlet. Assemblies shall include test cocks and two positive seating check valves and shall comply with requirements of ASSE Standard 1015 and AWWA C510. Bronze construction, threaded ends, and stainless steel internal parts. Watts #007-QT-S.

2. 2-1/2" and Larger: Assembly shall consist of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies shall include test cocks and two positive seating check valves and shall comply with requirements of ASSE Standard 1015 and AWWA C506. Epoxy coated cast iron body construction, flanged ends, and stainless steel internal parts. Watts #709-S-OSY.

D. Atmospheric Vacuum Breaker: Assembly shall consist of a bronze vacuum breaker body with silicone disc, and full size orifice. Device shall be IAPMO listed, meet ASSE std. 1001, and ANSI std. A113.1.1 Chrome plated in finish areas.

E. Pressure Vacuum Breaker: Assembly shall consist of a one piece bronze or stainless steel body, with stainless steel spring loaded check, rubber diaphragm, and atmospheric vent, breakaway set screw. Provide chrome plated in finish areas.

2.09 PRESSURE REDUCING VALVES

A. Single seated, direct operated type; high capacity, having bronze body with strainer, by-pass feature, pressure gauge tappings and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and fail-off at inlet and outlet pressure indicated. Watts #U5 series or equal.

B. Single seated, pilot operated globe valve type having ductile iron body with FDA approved epoxy coating inside and out, with Y strainer, stainless steel seat, FDA approved diaphragm, copper control tubing, pressure gauge tappings and complying with requirements of ANSI Standard A112.26.2. Select proper size for maximum flow rate and fall-off at inlet and outlet pressure indicated. Watts 115 series or equal.

2.10 PRESSURE RELIEF VALVES

A. Pressure Relief Valves: Constructed in accordance with ASME, 125-pound setting, and so stamped. Size as required. Watts #740 series or equal.

B. Temperature and Pressure Relief Valve: Constructed in accordance with ASME, 125-pound setting, and so stamped. Size as required. Watts #100XL, 40XL, 140, N240, or 340 series or equal.

2.11 GAS PRESSURE REGULATOR VALVES

A. Diaphragm operated, steel construction of size and capacity as indicated on drawings. Regulators shall be approved serving gas supplier, CSA and UL listed. Fisher, Sherwood, or approved equal.

2.12 THERMOSTATIC MIXING VALVES

A. General: Thermostatic valve constructed of brass and stainless steel, with screwdriver locking temp. regulator and adjustable check stops. Provide access door with cylinder lock. Finish as selected by Architect. Powers E480 or Leonard #210 SB.

B. Master: High-low master thermostatic assembly of size and capacity as indicated on drawings. Bi-metal motor, adjustable checkstops, inlet and outlet pressure gauges, thermometer with full port outlet ball valves shutoffs, locking temperature regulator and surface mount stainless steel cabinet as specified. Powers 1432-RC-E-Q or Leonard type TM186-PRV-RF-LTR-STSTL.

2.13 SOLENOID VALVES

A. UL listed, globe pattern bronze valve with threaded ends, stainless steel pilot, bronze piston, malleable iron solenoid assembly with ½" tapped conduit connections and Class "A" coil, 120 Volt, 60 Hertz. Solenoid valve shall be wired to the Fire Alarm System. The valve shall close instantly on application of current and open when de-energized. Provide solenoid valve on gas line into boiler and water heating rooms where the aggregate gas input is over 400,000 Btuh. Wire to “mushroom” button(s) outside of each door to room.

2.14 THERMOMETERS AND GAUGES

A. General:

1. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.

2. No mercury shall be used in thermometers due to hazardous material classification.

3. Acceptable Manufacturers: Weksler, Winters, Trerice, Marshalltown or US Gauge.

B. Thermometers:

1. Bi-Metal Type: Provide bi-metal glass thermometers of materials, capacities, and ranges indicated, designed and constructed in service indicated. Accuracy shall be 1% +/- full scale with adjustable recalibration.
   a. Case: Type 300 series stainless steel, hermetically sealed, glass window and shall be minimum 4-1/2" diameter dial, with adjustable angle.
   b. Adjustable Joint: Die cast aluminum, finished to match case, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.
   c. Scale: Satin faced, non-reflective aluminum, permanently etched markings.
   d. Stem: Stainless steel, adjustable angle socket, length to suit installation.

2. Glass Thermometer: Provide adjustable angle 9” thermometer of materials, capacities and ranges as appropriate to medium being measured and designed and constructed for service indicated. Accuracy to be 1% +/- of full scale.
   a. Case: Aluminum or Valox

b. Temperature Sensitive Gage Liquid: Organic non-toxic. No mercury permitted.
c. Scale: Aluminum painted white with black markings.
d. Connection: ½" NPT with thermowell, 1 ¼" UNF swivel nut without thermowell.

3. Photovoltaic Cell Powered LCD Thermometer
a. Case: ABS Plastic
b. Accuracy: 1% of full scale.
c. Display: 16 LUX rating LCD display. Switchable Fahrenheit and Celcius.
d. Connection: 3/4" NPT with thermowell 1 ¼" UNF swivel nut without thermowell.

4. Range: Conform to the following:
1) Hot Water: 20°F - 240°F with 2°F scale divisions.
2) Cold Water: -40°F - 160°F with 2°F scale divisions.

C. Thermometer Test Wells:

1. Provide thermometer test wells as indicated, constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

D. Temperature Gauge Connector Plugs:

1. Provide temperature gauge connector plugs pressure rated for 500 psi and 200°F (93°C). Construct of brass and finish in nickel-plate, equip with ½" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting $^1/_8$" O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

E. Pressure Gauges:

1. General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2. Type: General use, 1% accuracy ANSI B40.1 grade A, phosphor bronze bourbon type, bottom connection.

3. Case: Drawn steel or brass, glass lens, 4-1/2" diameter.

4. Connector: Brass with ¼" male NPT.

5. Scale: White coated aluminum, with permanently etched markings.

6. Pressure differential range shall be 100 psig minimum for the appropriate application with maximum 1 psig divisions.

F. Pressure Gauge Cocks:

1. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Gauge cock constructed of brass with ¼" female NPT on each end, and "T" handle brass plug.

2. Syphon: ¼" straight coil constructed of brass tubing with ¼" male NPT on each end.

3. Snubber: ¼" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

G. Pressure Gauge Connector Test Plugs:

1. Provide pressure gauge connector plugs pressure rated for 500 psi and 200°F (93°C). Constructed of brass and finish in nickel-plate, equip with ½" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap an chain. Provide extension, length equal to insulation thickness, for insulated piping.

2.15 PIPING SPECIALTIES

A. General:

1. Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or provide proper selection to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is installer's option.

B. Pipe Escutcheons:

1. Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.

2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.

3. Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.

C. Low Pressure Y-Type Pipeline Strainers:

1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125% of the working pressure of piping system, with Type 304 stainless steel screens, with 3/64" perforations at 233 0.045" perforations per square inch.

2. Threaded ends, 2" and smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with hose bibb. Sarco, Wheatley or Mueller.

3. Flanged ends, 2-1/2" and larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with hose bibb. Sarco, Wheatley or Mueller.

4. <<Grooved ends 2 ½ and larger: Ductile iron body, bolted screen retainer with off center blowdown fitted with hose bibb. Victaulic or Gustin-Bacon.>>

D. Drip Pans:

1. Provide drip pans fabricated from 16-gauge galvanized sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top by structural angles. Provide hole, gasket, and flange at low point for watertight joint and 1" copper drain line connection. Extend 1" drain to nearest approved receptor.

E. Air Vent with Valves:

1. Install in all closed and open loop water systems at high points of systems and at any other point necessary to free system of air. A shut-off valve shall be provided in riser to each automatic vent valve to facilitate servicing. A 3/8" type "L" copper tubing drain line shall be run to drain receptor to carry away water that valve discharges. Manual type vent may be used in lieu of automatic type, where specifically shown on the Drawings. Hoffman #79 or Dole.

F. Dielectric Unions:

1. Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

G. Dielectric Flanges: Provide dielectric flanges for flanged transitions between dissimilar metal piping. Watts Series 3100 or approved equal.

H. Unions:

1. Unions shall be of type specified in following schedule:
   a. Black Steel, 2" and smaller: 250 lb. screwed malleable iron, ground joint, brass to iron seat.
   b. Black Steel, 2-1/2" and larger: 150 lb. cast iron screwed flanged, flat faced, full faced gasket.
   c. Soldered Copper or Brass Pipe, 2" and smaller: 150 lb. cast bronze or copper, ground joint, non-ferrous seat with soldered ends.
   d. Screwed Copper or Brass Pipe, 2" and smaller: 150 lb. cast brass, ground joint, brass to brass seat, with threaded ends.
   e. Flanged Copper or Brass Pipe, 2-1/2" and larger: two (2) 150 lb. cast bronze flanges.
   f. Manufacturer: EPCO, Mueller, Stanley G. Flagg or Watts.

I. Flanges:

1. Provide flanges at flanged connections to equipment, tanks and valves. Faces of flanges being connected shall be alike in all cases. Connection of raised-face flange to flat-faced flange not permitted.

2. Use ASTM A307, Grade B, bolts and nuts for cast iron flanges and ASTM A193 for steel flanges. Regular square head unfinished bolts with heavy semi-finished hex nuts ASTM A194. Cadmium plated where exposed to weather. Rating: 150 lb. or 300 lb. in high pressure portions.

3. Type of pipe and corresponding flanges as follows:
   a. Screwed Black Steel Pipelines: 125 lb. black cast iron screwed flange, flat faces.
   b. Welded Steel Pipe, 150 lb. black forges steel welding flanges, 1/16" raised fact ASTM A181 Grade I. Use flat face when connected to flat faced companion flange.

J. Pipe Sleeves:

1. Provide fire proof sleeve assemblies utilizing UL rated sealant systems at all fire rated penetrations. For non-rated sleeve penetrations pack the annular space between the pipe and sleeve with fiberglass and/or mastic.

2. Sleeves shall provide a minimum ½" annular clearance around pipe.

3. Sheet metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gauge; 4" to 6", 16 gauge; over 6", 14 gauge.

4. Steel pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

5. Iron pipe: Fabricate from cast iron or ductile-iron pipe; remove burrs.

6. Plastic and copper pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.

7. Sleeves through interior concrete walls and floors: Telescopic, submerged, adjustable sleeves by Adjust-to-Crete, AMI or Shamrock. Floor sleeves to extend a minimum of 1" above finished floor.

8. Through exterior walls and floor on grade: 150-pound class cast-iron pipe sleeve. Where waterproof membranes are used, provide membrane clamps. For insulated piping, sleeve diameter shall not be less than diameter of insulated pipe.

K. Sleeve Seals:

1. All sleeves shall be sealed to prevent intrusion of moisture, dust or insects.

2. Underground: For sleeves passing through exterior or foundation walls, provide mechanical link seal assembly.

3. Aboveground: For sleeves passing through walls or floors provide a non-toxic 3-hour rated fire resistant silicone foam sealant with a Flame Spread Rating of 20. Sealant to be tested and approved under UL 263, ASTM E119, and NFPA 251 Standards. All fire rated penetrations shall be sealed with approved UL System.

4. Local Approvals: All seals to be provided shall be in accordance with the regulations of all governing agencies of the city, county, and State Fire Marshal's Office.

L. Valve Boxes: Concrete body, cast iron cover with vandal resistant screws, extensions as required to extend full depth to valve. Valve box cover lettering shall correspond to the valve service, "Water", "Gas", "Fire", "Sewer", etc. Christy #G8 or equal.

2.16 PIPE COATING

A. All underground steel and copper pipe fittings, and all above ground steel and copper pipe and fittings in corrosive air environments shall be covered with one of the following methods:

1. Twice Wrap 20 Mil. Scotch Wrap PVC No. 51, 50% overlap.

2. Prefabricated extruded plastic cover with joints sealed with two coats of 20 Mil. Scotch Wrap No. 51 or Pasco Wrap 20 mil weight.

B. Furnish corrugated stainless steel tubing (CSST) with factory-applied corrosion –resistant polyethylene jacket for use in corrosive atmosphere. Coating properties include the following:

1. Gastite corrugated stainless steel tube jacket shall be UV-Resistant polyethylene meeting the requirements of ASTM E84 for flame spread and smoke density.

2.17 GAS CONNECTORS

A. General Areas: CSA rated, UL listed, braided stainless steel gas hose of size and capacity to meet appliance input requirements.

B. Food Service Equipment: CSA rated, UL listed, plastic coated braided stainless steel gas hose with quick disconnect, swivel fitting and coiled restraining device. Dormont #1675BPQS or approved equal.

C. Gas connectors for outdoor applications shall be listed for exterior use.

2.18 EXPANSION COMPENSATORS

A. General: Pipe expansion, in general, is to be absorbed in bends, swing joints, expansion loops, and offsets. All piping mains, branches and runouts shall be installed to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Stresses shall be within allowable limits of ASME B31.1 for pressure piping. Vertical piping for domestic hot water, chilled water, heating water, steam and steam condensate shall be provided with expansion joints at each floor. Expansion products to conform to the standards of the Expansion Joint Manufacturer's Association. Expansion joints shall not required packing. Installer shall select materials and pressure/temperature ratings to suit intended service. Select packless expansion joints to provide 150% absorption capacity of calculated maximum piping expansion between anchors. All connections shall have ends to match piping system application.

B. Expansion Compensators (Pipe Compression and Extension): Multiple stainless steel bellows and stainless steel liner with shroud and end fittings. Keflex #311 series or approved equal.

C. Flexible Expansion Joint/Seismic Connector for Steel Pipe: Stainless steel hose and braid, 180° return, CSA approved, and end fittings. Metraflex #Metraloop or approved equal.

D. Flexible Connection for Steel Pipe (Piping and Equipment Located Outside the Building): Stainless steel hose and braid, with threaded or flanged ends. Metraflex #SST or approved equal.

E. Flexible Connection for Copper Pipe: Bronze hose and braid, copper tube ends. Metraflex #BBS or approved equal.

1. For non-critical pump connections. Furnish with fluorelastomer tube and cover to ASTM D2000 Grade 1HK710. The body shall be reinforced with rectangular body rings and six bias plies of fiberglass/kevlar fabric rated 190#/26" vacuum at 250°F. Provide galvanized flat (not L shaped) back up rings and control rods to limit maximum axial extension. Garlock #206 EZ-FLO or approved equal.

2. Flexible Ball Pipe Joints: Provide flexible ball pipe joints where indicated for piping systems, with materials and pressure/temperature ratings selected by installer to suit intended service. Design joints for 360° rotation, and with minimum of 50° angular flexing movement for sizes ¼" to 4". Provide two composition gaskets for each joint. Barco or approved equal.

F. Pipe Alignment Guides: Provide pipe alignment guides on both sides of expansion joints, and elsewhere as indicated on drawings. Guide shall be of carbon steel construction with split guiding cylinder and integral anchor base and internal four finger two-piece spider. Cylinder wall thickness shall be equal to schedule 40 wall thickness of pipe being guided. Spider shall be capable of clamping directly to pipe and moving only in an axial direction while inside cylinder. Anchoring directly to building substrate. Metraflex #Style IV or equal.

G. Expansion Loops: Provide field fabricated pipe expansion loops as detailed on the drawings or in place of mechanical expansion joints.

PART 3 - EXECUTION

3.01 GENERAL

A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.

B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by Architect.

3.02 MANUFACTURER'S DIRECTIONS

A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

3.03 INSTALLATION

A. Coordinate the work between the various Plumbing Sections and with the work specified under other Divisions of the work or contracts toward rapid completion of the entire project. If any cooperative work must be altered due to lack of proper supervision or failure to make proper provisions in time, then the work hereunder shall include all expenses of such changes as are necessary in the work under other contracts, and such changes shall be directly supervised by and made to the satisfaction of the Engineer.

B. The cooperative work not included in the Plumbing Division related to the general construction work is as follows:

1. All formed concrete work.

2. Framed openings in masonry and other Architectural and Structural elements.

3. Wood grounds and nailing strips in masonry and concrete.

4. Sloping of floors to drains and floor sinks.

5. Sloping of roof-to-roof drains and overflow drains.

C. Inspect all material, equipment, and apparatus upon delivery and do not install any that may be subject to rejection as a result of damage or other defects. Provide tarps and visqueen cover to protect equipment and piping delivered to and stored at the site.

3.04 WORKING PRESSURES

A. All fittings, valves, pipe, specialties equipment shall be rated for the working pressure subjected in the installed locations.

B. Drawings indicate working pressure in each system. The rating of the equipment and material shall not be less than that of the system pressures.

C. Low pressure, 0.5 psig (14 inch Water Column) or less, Natural Gas Systems: Use 1/2 to 2-inch NPS: Gastite corrugated stainless steel tube and brass fittings.

D. Medium pressure, over 0.5 psig (14 inch Water Column) up to 5 psig, Natural Gas Systems: Use 1/2 to 2-inch NPS: Gastite corrugated stainless steel tube and brass fittings.

3.05 PIPES SIZES TO EQUIPMENT

A. General: Pipe sizes indicated shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within one foot of equipment.

B. At temperature control valves with sizes smaller than connected lines, reduction shall be made immediately adjacent to valve.

3.06 PIPING INSTALLATION

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints or couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Comply with ASME B31 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.

C. Elevator Machine Rooms, Switchgear, Generator, Telecommunications, Telephone Rooms, and Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces. Route drip pan drain piping to floor drain, floor sink or other approved receptor.

D. CSST tubing, fitting, and strike-protection are to be Gastite® and shall be installed per the current version of the Gastite® Design & Installation Guide and per **[Local Code]**. Gastite® supplied training shall be obtained by all installers prior to installation. The gas-piping system shall be pressure tested in accordance with all requirements of **[Local Code]**, ANSI LC-1 and the most current edition of the Gastite® Design and Installation Guide.

3.07 WELDING

A. Qualifications of Welders: Welders performing work under this Contract shall be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators". Installation shall conform to ANSI 31.1 "Power Piping".

1. Submit for approval the names, identification, and welder's assigned number, letter or symbol of welders assigned to this project.

2. The assigned identification symbol shall be used to identify the work of each welder and shall be indelibly stamped immediately upon completion of each weld.

3. Welders shall be tested and certified for all positions.

4. Submit identifying stenciled test coupons made by each operator.

5. Any or all welders may be required to retake welding certification tests without additional expense.

6. When so requested, a welder shall not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.

7. Recertification of the welder shall be made after the welder has taken and passed the required tests.

8. Where piping 1-1/2 inches and smaller is butt or socket welded, submit 3 samples of test welds for approval.

3.08 PIPING SYSTEM JOINTS

A. All piping shall be cut squarely, free of rough edges and reamed to full bore. Piping shall be mechanically cleaned prior to make-up of joints and fully inserted into fittings.

B. Provide joints of type indicated in each piping system.

C. Thread pipe in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

D. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM. B-32, in accordance with IAPMO IS 3-93, ASTM B-828 and Copper Development Association recommended procedures. Joints shall be cleaned by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes shall be applied liberally to the outside of the pipe and the solder cup of the fitting. Fluxes shall be water soluble for copper and brass potable water applications, and shall meet CDA standard test method 1.0 and ASTM B813-91. Solder shall be applied until a full fillet is present around the joint. Solder and flux shall not be applied in such excessive quantities as to run down interior of pipe. Lead solder or corrosive flux shall not be present at the jobsite.

1. Manufacturers:
   a. Solder: JW Harris "Bridgit" or Englehard "Silvabrite 100".
   b. Flux: Laco "Flux-Rite 90", MW Dunton "Nokorode CDA Flux", Hercules "Fluid Action Solder Flux".

E. Braze copper tube and fitting socket. Listed brazing flux shall be used for joining of copper tube to brass or bronze fittings and shall meet AWS FB3A or FB3C. "Shock" cooling is prohibited. A continuous fillet shall be visible around the completed joint. After cooling, flux residue shall be thoroughly removed with warm water and a brush prior to testing. Do not use BCUP filler on copper alloys containing over 10% nickel.

F. Corrugated stainless steel tube (CSST) fittings joints: Gastite® mechanical tube fittings manufactured from ASTM B16 type 360 brass whose design incorporates a double wall flare for gas-tight seal with Jacket Lock™, mechanical capture of the jacket for enhanced tubing protection.

G. Alternative domestic water piping mechanical press type connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. Copper press fittings shall conform to the material and sizing requirements of ASME B16.22. O-rings for copper press fittings shall be EPDM. Viega/Ridgid or approved equal.

H. Piping shall be capped during construction to prevent entry of foreign material.

I. Weld pipe joints in accordance with recognized industry practice and as follows:

1. Weld pipe joints only when ambient temperature is above 0°F.

2. Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.

3. Use pipe clamps or tack-weld joints with 1" long welds, 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".

4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and at edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.

5. Do not weld out piping system imperfections by tack-welding procedures. Refabricate to comply with requirements.

6. At Installer's option, install forged branch-connection fittings whenever branch pipe is indicated, or install regular T-fitting.

J. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

K. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

3.09 VALVES

A. General: Except as otherwise indicated, comply with the following requirements:

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided as necessary. <<Install valves on all services connected to kitchen equipment. >>

2. Install valves, except butterfly valves, with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane without prior written approval. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

3. Install butterfly valves with stems mounted horizontally.

4. All valves mounted higher than 7' above floor in mechanical rooms and where indicated shall be installed with stem horizontal and equipped with chain wheels and chains extending to 6' above floor.

5. <<Provide Seismic shut off valve on gas main downstream of meter.>>

B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends of types of pipe/tube connections:

1. Copper Pipe, 2-1/2" and Smaller: Soldered-joint valves.

2. Steel Pipe, 2" and Smaller: Threaded joint valves.

3. Larger Pipe Sizes: One of the following, at installer's option:
   a. Flanged valves.
   b. Lug valves.

D. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

E. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

F. Fluid Control: Except as otherwise indicated, install gate, ball, plug, circuit setter, globe, and butterfly valves to comply with ASME B31.9.

G. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

H. Wafer Check: Install between 2 flanges in horizontal or vertical position.

I. Ball Valve: Ball valve used on gas systems shall be UL listed, CSA approved for pressure of system, no exception.

J. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

K. Valve Identification: Tag each valve in accordance with "Mechanical Identification" section.

L. Cleaning: Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.

3.10 TEMPERATURE GAUGES

A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor without supplemental illumination. All gages to be installed with snubbers to absorb system shock.

B. Install in the following locations, and elsewhere as indicated:

1. At outlet of hot water heaters.

2. At inlet and outlet of boilers.

3.11 MECHANICAL SLEEVE SEALS

A. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form a watertight seal.

B. Fire Barrier Penetration Seals: Fill entire opening with sealing compound in compliance approved and listed UL system number. Adhere to manufacturer's installation instructions.

3.12 SUPPORTS AND HANGERS (SEE 15050)

3.13 EQUIPMENT RAILS AND PIPE PORTALS

A. Install per manufacturer's instructions.

B. Coordinate with other trades so units are installed when roofing is being installed.

C. Verify roof insulation thickness and adjust raise of cant to match.

3.14 VIBRATION CONTROL ISOLATORS

A. Comply with minimum static deflections recommended by ASHRAE, for selection and application of vibration isolation materials and units as indicated.

B. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

C. Except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration control materials and units. Adjust to ensure that units have equal deflection, do not bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices intended for temporary support during installation.

D. Install units between substrate and equipment as required for secure operation and to prevent displacement by normal forces, and as indicated.

E. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where substrate is not level.

F. Flexible Pipe Connectors: Install on equipment side of shutoff valves.

G. Upon completion of vibration control work, prepare report showing measured equipment deflections for each major item of equipment as indicated.

H. Clean each vibration control unit, and verify that each is working freely, and that there is no dirt or debris in immediate vicinity of unit that could possibly short-circuit unit isolation.

3.15 EXPANSION LOOPS

A. Expansion Loops: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as determined by installer for adequate expansion of installed piping system. Subject loop to cold spring which will absorb 50% of total expansion between hot and cold conditions. Provide pipe anchors and pipe alignment guides as indicated, and elsewhere as determined by installer to properly anchor piping in relationship to expansion loops.

B. Expansion Compensation for Risers and Terminals: Install connection between piping mains and risers with at least five pipe fittings including tee in main. Install connections between piping risers and terminal units with at least four pipe fittings including tee in riser.

3.16 EXPANSION COMPENSATORS

A. Install as noted on plans. Where plans do not indicate spacing of guides or other pertinent information, install per manufacturer's recommendations.

3.17 EXCAVATION AND BACKFILL

A. Underground piping shall be installed in stable, open trench work. Trench excavations shall be a minimum of 16" wide, true to line and grade. Contractor shall exercise all due shoring and safety procedures. No stones larger than 1" may be present in the trench to a minimum depth of 4" below the trench bottom. The trench shall be free of job site debris, and free of corrosive media. Pipe crown shall be not less than 24" below the finished ground surface for metallic pipe, and 30" for non-metallic pipe, unless otherwise indicated on the drawings or directed by the Architect. Trenches shall be kept free of excess moisture, and shall be kept open for only a short a time as necessary for installation, testing and inspection. Dispose of surplus excavation and seepage water as directed by the Architect.

B. Piping shall be properly bedded and backfilled over stable trench bottom to a level of at least 12" above the pipe crown with thin layers of unwashed sand, dampened but not puddle, and free of organic or corrosive materials and excessive moisture. Backfill shall be placed in thin layers not to exceed 6" and tamped by mechanical tampers to a minimum 90% Modified Proctor Density, in accordance with ASTM D-1557-58T. trenches shall be backfilled to a minimum depth of 36" prior to being wheel loaded. Replace to their original condition all turf, plants, concrete, asphalt, or other improvements which constitute landscaping, traffic areas or other improved areas which become disturbed by excavation. In graded and undeveloped areas, in addition to procedures specified above, backfill trenches with crown 8" above the surrounding surface.

C. Excavated and backfill in soils of unstable nature shall be provided as directed by Architect.

3.18 PIPE INSPECTIONS

A. It is the intent of the Contract Documents that systems be inspected at completion of each phase while under tests required for administrative authorities, and prior to concealment, i.e. "Rough-in" "top-out" and final.

B. Inspection – Below Grade: Inspections shall be performed by UC Berkeley's Inspection services representative. All piping installed below grade shall be inspected prior to burial by UC Berkeley Inspection services, the Architect, the Owner's Representative or the Engineer. Contractor must notify Architect no less than 24 working hours prior to inspection time. Should the piping be buried prior to inspection the contractor may be requested to uncover the piping at no delay to the project and at no additional cost to the Owner.

C. Inspection – Above Grade: Inspections shall be performed by UC Berkeley's Inspection services representative. All piping installed above grade shall be made available for inspection upon completion and prior to finish of walls and ceilings. Notify UC Berkeley's Inspection services, the Architect, the Owner's Representative or the Engineer. Contractor must notify Architect no less than 24 working hours prior to the desired inspection time. Should the piping be hidden within the structure prior to inspection the contractor may be requested to uncover the piping at no delay to the project and at no additional cost to the Owner.

3.19 CLEANING, FLUSHING, DISINFECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any).

B. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports, and accessory items.

C. Inspect pressure piping in accordance with procedures of ASME B31.

D. Disinfect water mains and water service piping in accordance with Section 220501.

3.20 TESTING

A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.

B. Piping: Remove from the system, during testing, all equipment which would be damaged by test pressure. Replace removed equipment when testing has been accomplished. The system may be tested in sections as the work progresses; however, any previously tested portion shall become a part of any latter test of a composite system. Correct leaks by remaking joints with new material.

C. Test time will be accrued only while full test pressure is on the system, unless indicated otherwise. "Tolerance" shall be no pressure drop, except that due to temperature change in a 24-hour period. Inspect and test all work prior to burying or concealing. Test pressure shall be one and one-half times the system operating pressure or the listed test pressure below, whichever is greater:

System	Test Medium	Test Pressure	Tolerance-Test Period
Domestic Water	Water	150 psig	None – 8 hours
Soil and Waste	Water	10 ft head, 5 psi	No leaks – 8 hours
Vent	Water	Top of Vent Terminal	No leaks – 8 hours
Storm	Water	Top of Roof Drain	No leaks – 8 hours
Automatic Fire	Water	200 psig	None – 8 hours
Natural Gas/Propane	Air or Nitrogen	100 psig	None – 24 hours
Compressed Air	Air	200 psig	None – 8 hours
Medical Gases/Vacuum	Nitrogen	1.5 times operating pressure	No leaks – per NFPA – 24 hours min.
Fuel Oil	Air	300 psig	None – 8 hours

D. Valves: Test all valve bonnets for tightness. Test operate all valves at least once from closed-to-open-to-closed position while valve is under test pressure. Test all automatic valves, including solenoid valves, and temperature and pressure relief valves, safety valves, and temperature and pressure relief valves not less than three (3) times.

E. Piping Specialties: Test all thermometers, pressure gauges, and water meters for accurate indication; automatic water feeders, air vents, trap primers, and vacuum breakers for proper performance. Test all air vent points to ensure that all air has been vented.

F. Backflow Preventers: Each testable backflow prevention device shall be tested and approved by certified testers after installation. Submit test results.

END OF SECTION 22 2113

SECTION 22 4000
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 220500 - Basic Materials and Methods, and other Sections in Division 22 specified herein.

1.02 SCOPE

A. All work to be furnished and installed under this section shall include, but not necessarily be limited to, the installation of plumbing fixtures and trim.

1.03 RELATED WORK IN OTHER SECTIONS

A. Section 220500: Basic Materials and Methods

B. Section 220501: Plumbing

1.04 SUBMITTALS

A. Prior to construction submit for approval all materials and equipment in accordance with Division 01. Submit manufacturer's data, colors, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:

1. Plumbing fixtures.
2. Piping specialties.
3. Toilets.
4. Urinals.
5. Lavatories.
6. Sinks.
7. Showers or tubs.
8. Drinking fountains.

B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in Division 06 for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.

C. Samples: Submit samples of any piece of equipment requested by Architect for review and approval.

D. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.

1.05 CODES AND STANDARDS

A. Uniform Plumbing Code (UPC) with State Amendments.

B. California Plumbing Code (CPC)

C. All fixtures and faucets must meet all requirements of the California Energy Code.

D. All fixtures and accessories must be approved for use by the State of California.

E. All fixtures and faucets must meet all requirements of Americans with Disabilities Act (ADA).

F. California Energy Code

G. ARI Standard 1010: "Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver units to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products. Remove damaged products from project site.

1.07 MAINTENANCE

A. Extra Stock:

1. Furnish special wrenches and other devices necessary for servicing plumbing fixtures, flush valves, and trim to Owner with receipt in a quantity of one device for each 10 fixtures.

2. Furnish faucet repair kits complete with all necessary washers, springs, pins, retainers, packings, o-rings, sleeves, and seats in a quantity of 1 kit for each 10 faucets.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide fixtures as specified. Fixtures in any secure or public areas shall be vandal proofed.

B. Architect/Engineer shall review and approve any substitution requested by Contractor prior to bid submittal.

C. Provide fixture as specified, acceptable manufacturers:

1. Vitreous China or Cast Iron Fixtures: American Standard, Eljer, Zurn or Kohler.

2. Stainless Steel Sinks: Elkay or Just
   a. All stainless steel is 18 gauge, type 304 unless otherwise specified.

3. Drinking Fountains: Elkay or Haws.

4. Terrazzo Service Sinks: Florestone or Stern Williams.

D. Provide faucet as specified. Acceptable manufacturers: Chicago Faucets, Zurn, Symmons, T and S or as indicated.

E. Provide a thermostatic mixing valve conforming to ASSE 1070 for all public lavatories and tub only fillers.

F. Provide flush valve as specified. Acceptable manufacturers: Sloan, Hydrotek or Zurn.

G. Provide commercial grade toilet seat as specified. Acceptable manufacturers: Beneke, Kohler, Church or Olsonite.

H. Provide heavy-duty cast iron commercial grade carrier as specified. Provide compact carriers where space is limited. Acceptable manufacturers: Ancon, Jay R. Smith, Wade or Zurn. No plastic parts on foundry items.

1. Wall hung water closet: J.R. Smith figs: 0210L/RY-M12 / - M40, 0210DY-M12, 0240L/RY-M12, 0240DY-M12, 0410R/LY-M12 and 0410DY-M12.

2. Wall hung urinal: J.R. Smith fig: 0634-M12 or Zurn Z-1221-58.

3. Wall hung lavatory: J.R. Smith fig: 0700(D) –M31 concealed arm carrier.

I. Provide heavy duty commercial grade 17-gauge P-Trap and supplies with stops as specified. Provide heavy duty commercial grade lavatory supplies. Provide supplies meeting AB1953 no lead requirements. Supplies shall be ½"x 3/8" x 12" ground joint flexible riser with loose key angle stop with chrome plates I.P.S. brass nipple. Sink supplies shall be ½" x 12" ground joint flexible riser with loose-key angle stop with chrome plated I.P.S. brass nipple. Provide bell type escutcheons for both P-trap and supplies. Acceptable manufacturers: Zurn, Brasscraft, Chicago, or McGuire.

1. P-trap - Lav: McGuire C8902-DF or Zurn Z-8701.

2. P-trap - Sink: McGuire C8912-DF or ZurnZ-8702.

3. Supply for Lavatory: McGuire LFH2165LK or Zurn ZH88-XL-LK.

4. Offset supply for barrier free lavatory: McGuire 158 WC.

5. Supply for Sink: McGuire LFH2167LK or Zurn ZH8803-XL-LR.

6. Supply for Water Closet: McGuire H2169noteK or Zurn ZH-8807-CR.

7. Escutcheons: McGuire WE00D Series, wrought brass, bell type.

8. Lavatory grid strainer: McGuire 155A or Zurn Z-8743.

9. Barrier-free lavatory offset grid strainer: McGuire 155WC or Zurn 8746.

10. Sink Strainer: Elkay LK-18B.

J. Provide standard grade P-Traps and supplies with stops as specified in residences. Provide supplies meeting AB1953 no lead requirements. Lavatory supplies shall be 1/2” x 3/8” x 12” ground joint flexible riser with round wheel handles and chrome plated I.P.S. brass nipple. Sink supplies shall be 1/2” x 12” ground joint flexible riser with round wheel handle angle stop with chrome plated I.P.S. brass nipple. Provide bell type chrome plated escutcheon for traps and supplies. Acceptable manufacturers: McGuire, Zurn, Chicago or Brass Craft.

1. P-Trap Lavatory: McGuire 8901-C or Zurn 8706.

2. P-Trap Sink: McGuire 8892-C or Zurn 8708.

3. Supply Lavatory: McGuire LF2165 or Zurn ZH8801-XL-LR.

4. Supply Sink: McGuire LF2167 or Zurn ZH8803-XL-LR.

5. Supply Water Closet: McGuire 2169 or Zurn Z8807CR.

6. Offset Supply for ADA Lavatory: McGuire 158W or Zurn Z-8855-WL.

7. Offset Trap Arm for ADA Lavatory: McGuire 155WC or Zurn Z-8746.

8. Offset Trap Arm for ADA Sink: McGuire 1151AWC or Zurn Z-8749.

9. Escutcheons: McGuire chrome plated WE125TR, WE150, WE125D and WE150D or Zurn.

K. Insulation: provide white molded closed cell vinyl pre-fab insulation on P-Trap and on both hot and cold water supply for barrier free lavatories and sinks. Acceptable manufacturers: Plumberex, True-Bro, and Zurn. Bag type insulators are not acceptable.

2.02 FIXTURE LISTING

A. WC-1 Water Closet:

1. Fixture: Kohler K-4330 “Kingston” or American Standard 2257.103 “Afwall EL1.28” wall mounted vitreous china siphon jet toilet 1-1/2" top spud, bolt caps, 1.28 gallon water flush.

2. Seat: Kohler or Bemis 1655-SSC solid white plastic elongated open front seat less cover, self-sustaining stainless steel check hinges.

3. Flush Valve: Kohler or Zurn Z-600AV-WS1

4. Mounting Height: 18" floor to bowl rim.

B. WC-2 Water Closet – Barrier Free: Same as WC-1 except mounted at accessible height. Refer to architectural plans.

C. UR-1 Urinal:

1. Fixture: Kohler K-5016-ET "Dexter" or American Standard 6541.132 “Allbrook” wall mounted vitreous china siphon jet urinal, 3/4" top spud, 2" outlet, wall hanger, 0.125 gallon per flush.

2. Flush Valve: Kohler or equal; refer to fixture schedule.

3. Mounting Height: 24" floor to lip.

D. UR-2 Urinal - Barrier Free: Same as UR-1 except mounted at accessible height. Refer to architectural plans.

E. L-1 Lavatory - Barrier Free:

1. Fixture: Kohler K-2905-4 “Farmington,” or American Standard 3420.403 “Affinity”, 19" x 16" cast iron countertop oval lavatory.

2. Faucet: Kohler or Chicago – battery-powered sensor operated; laminar flow Outlet set for 0.35 G.P.M.; refer to fixture schedule.

3. Mounting Height: Refer to architectural elevations for details.

4. Provide with point-of-use tempering valve.

F. L-2 Lavatory - Barrier Free: Same as L-1 except mounted at accessible height. Refer to architectural plans.

G. S-1 Sink:

1. Fixture: Elkay #DLR-2222-10, 22" x 22"x10" / #LRAD-2222-6 ½, 22"x22"x6 ½", A.D.A. compliant 18 gauge stainless steel countertop single bowl sink.

2. Faucet: Chicago Faucet 786, spread fitting with blade handles, rigid gooseneck spout, and Omni A-400-2.00 VR laminar flow set at 2.0 gpm.

3. Supplies: ½" flexible supplies with stops and escutcheon plate. Provide 1/4" flexible supply with stop for coffee maker.

4. Mounting Height: Refer to architectural details.

H. S-2 Sink:

1. Fixture: Elkay DLR-3322-10 "Lustertone" 33" x 22" x 10" / LRAD-3322-6 ½."Lustertone" 33"x22"x6-1/2",A.D.A. compliant self-rimming countertop 18 gauge stainless steel double bowl sink.

2. Faucet: Chicago Faucet 2300-8 Single lever faucet with Omni A-400-2.00 VR laminar flow set @ 2.0 G.P.M.

3. Hot Water Machine: Elkay #LKH-180 or ISE H-778, 750 Watts, 120 Volts, three prong plug and cord.

4. Drain: Elkay, standard duo strainers with 4" tailpiece, 2 required.

5. Garbage Disposer: ISE Badger 5XP, 3/4 HP, 120 Volts, three prong plug and cord.

6. Continuous Waste Arm: Brass combination drain outlet for double compartment sinks.

7. Supplies: ½" flexible supplies with stops and escutcheon plate. Provide 1/4" flexible supply with stop for coffee maker.

8. Mounting Height: Refer to architectural elevation details.

I. MS-1 Sink - Mop:

1. Fixture: Florestone 81, terrazzo floor set receptor; cast brass drain with stainless steel strainer and tailpiece; 20 gauge stainless steel rim guard, splash guard.

2. Faucet: Chicago Faucet 897-RCF; wall mounted combination fitting with vacuum breaker, wall brace, threaded hose outlet and integral stops, rough chrome finish, flow control set to 2 gpm (Omni A-810-2.0VR).

3. Sealant: Caulk edges of basin with silicone sealant.

J. DF-1 Drinking Fountain, Barrier Free Bi-Level Unit with Bottle-filler

1. Fixture: Elkay EZH2O, stainless steel construction, oval bowls.

2. Electrical: 1/5 hp; 120 volt. Coordinate hardware electrical connection with Division 26.

3. Finish: Stainless steel.

4. Mounting Height: 36" floor to top of bubbler, maximum.

PART 3 - EXECUTION

3.01 GENERAL

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.

D. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

E. Comply with the installation requirements of ADA with respect to plumbing fixtures for the physically handicapped.

F. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

G. Install a stop valve in an accessible location in the water connection to each fixture.

H. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

I. Seal fixtures to walls and floors using silicone sealant as specified in Division 07. Match sealant color to fixture color.

J. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

K. Inspect each installed unit for damage. Replace damaged fixtures.

L. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream.

M. Replace washers or cartridges of leaking or dripping faucets and stops.

N. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

O. During construction cover all installed fixtures, sinks, and water coolers with cardboard boxes and wrap with Visqueen.

P. Provide flush valve and faucet support behind wall.

END OF SECTION 22 4000

SECTION 230500
BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and Division 01 - General Requirements, and shall include all Mechanical Sections specified herein.

1.2 SCOPE OF THIS SECTION

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
1. Compliance with all codes and standards applicable to this jurisdiction
2. Shop Drawings for Equipment
3. Coordination Documents
4. Record Drawings
5. Start-up Service and Building Commissioning
6. Instruction, Maintenance, and O & M Manuals
7. Work associated with Delivery, Storage, and Handling of products
8. Work associated with provision of Temporary Facilities
9. Preparation of Posted Operating Instructions
10. Meeting Project Safety and Indemnity requirements
11. Proper Cleaning and Closing
12. Supplying proper Warranty information
13. Supply specified Guarantee documentation
14. Design and provision of Supports and Anchors
15. Pipe Portals
16. Equipment Rails
17. Access Panels and Doors
18. Identification Markers
19. Coordination of Electrical requirements for equipment provided

1.3 DESCRIPTION OF WORK

A. The Contract Documents, including Specifications and Construction Drawings, are intended to provide all material and labor to install complete heating, ventilating, air conditioning systems for the building and shall interface with all existing building systems affected by new construction.

B. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the fixtures, equipment, and pipe lines and are not to be scaled; all dimensions and existing conditions shall be checked at the building.

C. The Contractor shall comply with the project closeout requirements as detailed in General

Requirements of Division 01.

D. Where project involves interface with existing building and site systems, every effort has been made to note existing utilities and services. However, the Contractor should thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available as to concealed conditions, which exist in portions of the existing building affected by this work.

1.4 DESCRIPTION OF BID DOCUMENTS

A. Specifications:
   1. Specifications, in general, describe quality and character of materials and equipment.
   2. Specifications are of simplified form and include incomplete sentences.

B. Drawings:
   1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
   2. Before proceeding with work check and verify all dimensions.
   3. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
   4. Make adjustments that may be necessary or requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
   5. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts. Verify exact location and elevation of existing piping prior to any construction.
   6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible, including during bidding period.

1.5 DEFINITIONS

A. “Above Grade”: Not buried in the ground and not embedded in concrete slab on ground.

B. “Accessible”: Ability to perform recommended maintenance without removal of services or equipment and requiring no special platforms.

C. “Actuating” or “Control” Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

D. “Below Grade”: Buried in the ground or embedded in concrete slab on ground.

E. “Concealed”: Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.

F. “Connect”: Complete hook-up of item with required service.

G. “Exposed”: Not installed underground or “concealed.”

H. “Furnish”: To supply equipment and products as specified.

I. "Indicated," "Shown" or "Noted": As indicated, shown or noted on Drawings or Specifications.

J. "Install": To erect, mount and connect complete with related accessories.

K. "Motor Controllers": Manual or magnetic starters (with or without switches), individual push buttons or hand-off-automatic (HOA) switches controlling the operation of motors.

L. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

M. "Provide": To supply, install and connect as specified for a complete, safe and operationally ready system.

N. "Reviewed," "Satisfactory" or "Directed": As reviewed, satisfactory, or directed by or to Architect/Engineer/University California Berkeley

O. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.

P. "Shall": An exhortation or command to complete the specified task.

Q. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified products.

R. "Supply": To purchase, procure, acquire and deliver complete with related accessories.

S. "Typical" or "Typ": Exhibiting the qualities, traits, or characteristics that identify a kind, class, number, group or category. Of or relating to a representative specimen. Application shall apply to all other similarly identified on plan or detail.

T. "Will": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall".

U. "Wiring": Raceway, fittings, wire, boxes and related items.

V. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

1.6 RELATED WORK SPECIFIED ELSEWHERE

A. All Division 23 Mechanical sections included herein.

B. Division 33: Utility Site Work.
   1. Coordination of excavation of trenches and the installation of mechanical systems and piping on site.

C. Division 03: Concrete.
   1. All concrete work for Mechanical Division shall be included in Division 23 under the appropriate Sections and shall include:
      a. Concrete curbs and housekeeping pads for the mechanical equipment.
      b. Thrust blocks, pads, and boxes for mechanical equipment.
      c. Coordination of floor drain and floor sink installations in sloped floors.

D. Division 07: Thermal and Moisture Protection.
   1. Flashing and sheet metal
   2. Sealants and caulking
   3. Firestopping

E. Division 09: Painting:
   1. Division 23 installers shall perform all painting, except where specifically stated otherwise in Division 09.
   2. Painting of all exposed steel, piping, ductwork, insulation, equipment and materials
   3. Paint all exposed gas piping, interior and exterior to the building, yellow.

F. Division 10: Miscellaneous Metals.
   1. Exterior louvers and grilles shall be included in this Section.

G. Division 26: Electrical is related to work of:
   1. Power connections to all mechanical equipment

H. Division 28: Electronic Safety and Security is related to work of:
   1. Fire protection alarms and relays
   2. Smoke detector and monitoring
   3. Life Safety Systems

1.7 CODES AND STANDARDS

A. The Contractor is cautioned that code requirements not explicitly detailed in these specifications or drawings, but which may be reasonably inferred or implied from the nature of the project, must be provided as part of the contract.

B. Perform all tests required by governing authorities and required under all Division 23 Sections. Provide written reports on all tests.

C. Electrical devices and wiring shall conform to the latest standards of NEC; all devices shall be UL listed and labeled.

D. All mechanical work shall comply with the Americans with Disabilities Act (ADA).

E. All excavation work must comply with all provisions of state laws including notification to all University California Berkeley of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

F. Provide in accordance with rules and regulations of the following:
   1. Building Codes enforced by the Authority Having Jurisdiction in California:
      a. 2013 California Building Code (CBC) Title 24, Part 2 CCR
      b. 2013 California Electrical Code (CEC) Title 24, Part 3 CCR
      c. 2013 California Mechanical Code (CMC) Title 24, Part 4 CCR
      d. 2013 California Plumbing Code (CPC) Title 24, Part 5 CCR
      e. 2013 California Fire Code (CFC) Title 24, Part 9 CCR.

f. 2010 Title 24, Part 6 California Energy Efficiency Standards for Residential and Nonresidential Buildings
2. State codes and ordinances
3. Local Bureau of Buildings
4. Local Health Department
5. State Fire Prevention Districts
6. California Administrative Codes

G. Provide in accordance with appropriate referenced standards of the following:
1. NFPA - National Fire Protection Association
2. AABC - Associated Air Balance Council
3. CSA - Canadian Standards Association
4. ADC - Air Diffuser Council
5. AMCA - Air Moving and Conditioning Association
6. ANSI - American National Standards Institute
7. ARI - Air Conditioning and Refrigeration Institute
8. ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers
9. ASME - American Society of Mechanical Engineers
10. ASTM - American Society for Testing Materials
11. AWS - American Welding Society
12. FM - Factory Mutual
13. MSS - Manufacturer's Standardization Society
14. NEMA - National Electrical Manufacturer's Association
15. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
16. UL - Underwriter's Laboratories
17. ADA - Americans with Disabilities Act
18. ETL - Electrical Testing Laboratories

1.8 QUALITY ASSURANCE

A. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or Type 304 stainless steel sheet, not less than 20 USG (0.0375"), riveted or bolted to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.

B. Current Models: All work shall be as follows:
1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
2. Replacement parts shall be readily available and stocked in the USA.

C. Experience: Unless more stringent requirements are specified in other sections of Division 23, manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than one year prior to the date of bidding for this project.

1.9 GENERAL REQUIREMENTS

A. Examine all existing conditions at building site.

B. Review contract documents and technical specifications for extent of new work to be provided.

C. Provide and pay for all permits, licenses, fees and inspections.

D. Prepare a Construction IAQ Management Plan meeting the SMACNA IAQ guidelines. See Section 233113 Air Distribution for a summary of requirements.

E. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. This work shall include furnishing and installing all access doors required for mechanical access.

F. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to Equipment Specifications in Divisions 02 through 48 for rough-in requirements.

G. Coordinate mechanical equipment and materials installation with other building components.

H. Verify all dimensions by field measurements.

I. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

J. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

K. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

L. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Contractor to provide for all cutting and patching required for installation of his work unless otherwise noted.

M. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

N. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, without interference with other installations.

O. Coordinate the installation of mechanical materials and equipment above ceilings with ductwork, piping, conduits, suspension system, light fixtures, cable trays, sprinkler piping and heads, and other installations.

P. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

Q. Coordinate with University California Berkeley in advance to schedule shutdown of existing systems to make new connections. Provide valves in new piping to allow existing system to be put back in service with minimum down time.

R. All materials (such as insulation, ductwork, piping, wiring, controls, etc.) located within air plenum spaces, air shafts, and occupied spaces shall have a flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In

addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing, or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.

S. Coordinate installation of floor drains and floor sinks with work of other trades, such that finished floor slopes to drains and floor sinks are flush with surrounding floor.

T. Products made of or containing lead, asbestos, mercury or other known toxic or hazardous materials are not acceptable for installation under this Division. Any such products installed as part of the work of the Division shall be removed and replaced and all costs for removal and replacement shall be borne solely by the installing Contractor.

1.10 MINOR DEVIATIONS

A. The Drawings are diagrammatic and show the general arrangements of all mechanical work and requirements to be performed. It is not intended to show or indicate all offsets, fittings, and accessories which will be required as a part of the work of this Section.

B. The Contractor shall review the structural and architectural conditions affecting his work. It is the specific intention of this section that the contractor's scope of work shall include
   1. Proper code complying support systems for all equipment whether or not scheduled or detailed on drawings or in these specifications
   2. Minor deviations from the mechanical plans required by architectural and structural coordination.

C. The Contractor shall study the operational requirements of each system, and shall arrange his work accordingly, and shall furnish such fittings, offsets, supports, accessories, as are required for the proper and efficient installation of all systems from the physical space available for use by this section. This requirement extends to the Contractor's coordination of this section's work with the “Electrical Work”. Should conflicts occur due to lack of coordination, the time delay, cost of rectification, demolition, labor and materials, shall be borne by the Contractor and shall not be at a cost to the University California Berkeley

D. Minor deviations in order to avoid conflict shall be permitted where the design intent is not altered.

E. Advise the Architect, in writing, in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

1.11 PRODUCT SUBSTITUTIONS

A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:
   1. The proposed substitution does not affect dimensions shown on drawings.
   2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
   3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.

4. Maintenance and service parts available locally are readily obtainable for the proposed substitute.

B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.

C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to this proposed substitution.

1.12 SHOP DRAWINGS AND EQUIPMENT SUBMITTALS

A. Prior to construction submit for review all materials and equipment in accordance with Division 01 requirements.

B. After approval of preliminary list of materials, the Contractor shall submit Shop Drawings and manufacturer's Certified Drawings to the Architect for approval.

C. The Contractor shall submit approved Shop Drawings and manufacturer's equipment cuts, of all equipment requiring connection by Division 26, to the Electrical Contractor for final coordination of electrical requirements. Contractor shall bear all additional costs for failure to coordinate with Division 26.

D. Submittals and Shop Drawings shall be submitted as a complete package bound in a 3-ring binder with tabs for each specification section. The approved submittals shall be converted into Operations & Maintenance Manuals at the completion of the project. Submit six (6) typed copies of submittals. Refer to Division 01 for additional requirements.

1.13 COORDINATION DOCUMENTS

A. The Contractors shall prepare coordinated Shop Drawings to coordinate the installation and location of all HVAC equipment, ductwork, grilles, diffusers, piping, fire sprinklers, lights, audio/video systems, electrical services and all system appurtenances. The Drawings shall include all mechanical rooms and floor plans. The Drawings shall be Overlay Drawings showing each discipline on a single sheet. The Drawings shall be keyed to the structural column identification system, and shall be progressively numbered. Prior to completion of the Drawings, the Contractor shall coordinate the proposed installation with the Architect and the structural requirements, and all other trades (including HVAC, Plumbing, Fire Protection, Electrical, Ceiling Suspension, and Tile Systems), and provide reasonable maintenance access requirements. When conflicts are identified, modify system layout as necessary to resolve. Do not fabricate, order or install any equipment or materials until coordination documents are approved by the General Contractor, Architect, and University California Berkeley. Within thirty (30) days after award of Contract, submit proposed coordination document Shop Drawing schedule, allowing adequate time for review and approval by parties mentioned above. Drawings should be prepared and submitted for approval on a floor-by-floor basis to phase with building construction.

B. The Drawings shall be prepared as follows:
1. The Sheet Metal (Mechanical) Contractor shall prepare Drawings to an accurate scale of 1/4" = 1'-0" or larger, on reproducible media sheets (vellum) or AutoCAD disks. Obtain reproducibles or AutoCAD files of the HVAC design from the Architect, or Engineer, at cost plus. Drawings are to be same size as Contract Drawings and shall indicate location, size and elevation above finished floor, of all HVAC equipment, ductwork, and piping.

Plans shall also indicate proposed ceiling grid and lighting layout, as shown on electrical plans and reflected ceiling plans.

2. The Plumbing Contractor shall obtain reproducible plans or AutoCAD disks from the Mechanical Contractor, and indicate all plumbing lines including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
3. The Fire Protection Contractor shall obtain reproducible plans or AutoCAD disks with the detailed mechanical and plumbing work shown. The Sprinkler Contractor shall indicate location of all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.
4. Plans are to incorporate all addenda items and change orders.
5. Distribute plans to all trades and provide additional coordination as needed.

C. Advise the Architect in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

D. Provide means of access to all valves, dampers, controllers, operable devices, and other apparatus that may require adjustment or servicing.

E. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Architect of any discrepancies between those indicated on the Drawings and those existing in the field prior to any installation related thereto.

F. Final Coordination Drawings with all appropriate information added are to be submitted as Record Drawings at completion of project.

G. Provide copy of Record Drawings to Testing and Balancing Contractor for their use when doing their work.

1.14 RECORD DRAWINGS

A. Before commencing installation, obtain an extra set of prints from Architect, marked “Record”. Keep this set of Drawings at the job site at all times, and use it for no other purpose but to mark on it all the changes and revisions to the Contract Drawings resulting from coordination with other trades. At the completion of the project,

1. Obtain a clean set of reproducibles from the Architect or Engineer, at cost plus, and transfer the revisions to these reproducibles in a neat and orderly fashion.

OR

2. Edit project AutoCAD files to incorporate all site markups, changes, and revisions to the Contract Drawings. Submit plots of Record Drawings and six copies CD Roms labeled with all record AutoCAD drawing files.

B. Provide copy of Record Drawings to Testing and Balancing Contractor for use when doing his work.

C. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance

located (i.e. – valves, traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

D. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

E. Refer also to Special Conditions in Division 01 for full scope of requirements.

1.15 START-UP SERVICE AND BUILDING COMMISSIONING

A. Prior to start-up, be assured that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrication, venting, controls, and installed and properly set relief and safety valves.

B. Provide services of factory-trained technicians for start-up of air conditioning units, temperature controls, pumps, and other major pieces of equipment. Certify in writing compliance with this Paragraph, stating names of personnel involved and the date work was performed.

C. Provide certificates of calibration for all sensors required for control and monitoring including temperature and pressure.

D. Refer to other Division 23 Sections for additional requirements.

1.16 INSTRUCTION, MAINTENANCE, AND O&M MANUALS

A. O&M Manuals: Upon completion of the work, and prior to training of University California Berkeley 's personnel, the Contractor shall submit to the Architect complete set of operating instructions, maintenance instructions, part lists, and all other bulletins and brochures pertinent to the operation and maintenance for equipment furnished and installed as specified in this section, bound in a durable binder. Refer to Division 01.

B. Contractor shall be responsible for providing proper instruction of the of University California Berkeley 's personnel for operation and maintenance of equipment, and apparatus installed as specified in Division 23 to be no less than two hours for each piece of equipment. The Contractor shall develop and submit training materials prior to this training. These materials shall include qualifications of the trainer, training agenda, learning objectives, and a written test to be administered at the end of the training session. Operation and Maintenance manuals must present, incorporated and referenced in the training sessions.

1.17 DELIVERY, STORAGE AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials in an environmentally controlled area at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage. Piping shall be stored in bundles covered with visqueen. Piping showing signs of rust shall be removed from site and replaced.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.18 TEMPORARY FACILITIES

A. Refer to Division 01 for the requirements of temporary water and sewer for construction and safety. Provide temporary heating, air conditioning, ventilation, water, and sewer, etc. services as necessary during the construction period and as required to maintain operation of existing systems.

B. Temporary Heating for Commissioning Tests:
   1. Provide temporary heating where needed to provide false load for commissioning tests.
   2. Temporary heating may be from the permanent heating system of the project or from a dedicated temporary heating system. If temporary system is necessary, select facilities known to be safe and without deleterious effect upon what work in place or being installed.

C. Temporary Cooling for Commissioning Tests:
   1. Provide temporary cooling where needed to provide false load for commissioning tests.
   2. Temporary cooling may be from the permanent cooling system of the project or from a dedicated temporary cooling system. If temporary system is necessary, select facilities known to be safe and without deleterious effect upon the work in place or being installed.

1.19 POSTED OPERATING INSTRUCTIONS

A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. Attach or post operating instructions adjacent to each principal system and equipment including start-up, operating, shutdown, safety precautions and procedure in the event of equipment failure. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal.

1.20 SAFETY AND INDEMNITY

A. The Contractor shall be solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal hours of work.

B. No act, service, Drawing, review, or Construction Review by the University California Berkeley, Architect, the Engineers or their consultants, is intended to include the review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify and defend the University California Berkeley, the Architect, the Engineers and their consultants, and each of their officers, employees and agents from any and all liability claim,

losses or damage arising, or alleged to arise from bodily injury, sickness, or death of a person or persons, and for all damages arising out of injury to or destruction of property arising directly or indirectly out of, or in connection with, the performance of the work under the Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the Construction Contract Documents; but not including the sole negligence of the University California Berkeley, the Architect, the Engineers, and their consultants or their officers, employees and agents.

1.21 CLEANING AND CLOSING

A. All work shall be inspected, tested, and approved before being concealed or placed in operation.

B. Upon completion of the work, all equipment installed as specified in this section, and all areas where work was performed, shall be cleaned to provide operating conditions satisfactory to the Architect.

1.22 WARRANTIES

A. All equipment shall be provided with a minimum one-year warranty to include parts and labor. Refer to individual Equipment Specifications for extended or longer-term warranty requirements.

B. Provide complete warranty information for each item, to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.

C. Service during warranty period: Contractor shall provide maintenance as specified elsewhere during the 12-month warranty period.

1.23 GUARANTEE

A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him and shall repair or replace, at no additional cost to the University California Berkeley, any part thereof which may become defective within the period of one (1) year after the Date of Final Acceptance, ordinary wear and tear excepted.

B. Contractor shall be responsible for and pay for any damages caused by or resulting from defects in his work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.

B. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words “or approved equal” shall be considered to be subsequent to all manufacturers’

names used herein, unless specifically noted that substitutes are not allowed.

2.2 SUPPORTS AND ANCHORS

A. General: Comply with applicable codes pertaining to product materials and installation of supports and anchors, including, but not limited to, the following:
   1. UL and FM Compliance: Provide products, which are UL listed and FM approved.
   2. ASCE 7-05: “American Society of Civil Engineers.”
   3. 2009 International Building Code (IBC)
   4. MSS Standard Compliance: Manufacturer's Standardization Society (MSS).
   5. SMACNA: “Seismic Restraint Manual: Guidelines for Mechanical Systems.”
   6. NFPA: NFPA 13 2010 and NFPA 14 2007 for fire protection systems.
   7. Provide copper plated or plastic coated supports and attachment for copper piping systems. Field applied coatings or tape is unacceptable.
   8. Manufacturer: B-Line, Grinnell, Michigan, Tolco, Kin-Line, Simpson, or Superstrut.

B. Horizontal Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated hangers and supports of one of the following MSS types listed.
   1. Adjustable Steel Clevis Hangers: MSS Type 1.
   2. Adjustable Steel Swivel Band Hangers: MSS Type 10.
   3. U-Bolts: MSS Type 24.
   4. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
      a. Plate: Unguided type.
      b. Plate: Guided type.
      c. Plate: Hold-down clamp type.
   5. Pipe Saddle Supports: MSS Type 36, including steel pipe base support and cast iron floor flange.
   6. Pipe Saddle Supports with U-Bolt: MSS Type 37, including steel pipe base support and cast iron floor flange.
   7. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast iron floor flange.
   8. Single Pipe Roller with Malleable Sockets: MSS Type 41.
   9. Adjustable Roller Hangers: MSS Type 43.
   10. Pipe Roll Stands: MSS Type 44.
   11. Pipe Guides: Provide factory-fabricated guides of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

C. Horizontal Cushioned Pipe Clamp: Where pipe hangers are called out to absorb vibration or shock install a piping clamp with thermoplastic elastomer insert. Cush-A-Clamp or equal.

D. Vertical Piping Clamps: Provide factory-fabricated two-bolt vertical piping riser clamps, MSS Type 8.

E. Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments of one of the following MSS types listed.
   1. Steel Turnbuckles: MSS Type 13.
   2. Steel Clevises: MSS Type 14.
   3. Swivel Turnbuckles: MSS Type 15.
   4. Malleable Iron Eye Sockets: MSS Type 16.
   5. Steel Weldless Eye Nuts: MSS Type 17.

F. Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments of one of the following types listed.
   1. Concrete Inserts: MSS Type 18 or Blue Banger Hanger by Simpson
   2. Steel Brackets: One of the following for indicated loading:
      a. Light Duty: MSS Type 31.
      b. Medium Duty: MSS Type 32.
      c. Heavy Duty: MSS Type 33.
   3. Horizontal Travelers: MSS Type 58.
   4. Internally Threaded Expansion Shell Anchors: By Simpson or approved equal.
   5. Concrete Screw Anchors: Titen HD by Simpson or approved equal.

G. Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
   1. Pipe Covering Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
   2. Insulation Protection Shields: MSS Type 40, 18" minimum, or of the length recommended by manufacturer to prevent crushing of insulation. High-density insulation insert lengths shall match or exceed shield length.
   3. Thermal Hanger Shields: Constructed of 360° insert of waterproofed calcium silicate (60 psi flexural strength minimum) encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation. Shield length shall match or exceed length of calcium silicate insert.
   4. Thermal Hanger Couplings: Constructed of high strength plastic coupling to retain tubing and join insulation at clevis hangers and strut-mounted clamps. Klo-Shure Insulation Coupling or equal.

H. Miscellaneous Materials:
   1. Metal Framing: Provide products complying with NEMA STD ML1.
   2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A36.
   3. Cement Grout: Portland Cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand by volume, with minimum amount of water required for placement and hydration.
   4. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required. Weld steel in accordance with AWS standards.
   5. Pipe Brackets: “HoldRite” copper plated brackets. Insulate brackets attached to metal studs with felt.

2.3 PIPE PORTALS

A. Where pipe portals are not provided by other sections of Specification, provide prefabricated insulated pipe portals as required for piping penetrating through the roof where shown on plans. Field built pipe portals are acceptable alternatives - provide detail of construction for review.

B. Standard pipe portals, unless otherwise noted, shall be constructed as follows:
   1. Curb shall be constructed of heavy gauge galvanized steel with continuous welds on shell seams.
   2. Insulation to be 1-½" thick, 3 lb density rigid fiberglass.
   3. Curb to have a raised 3" (minimum), 45° cant.
   4. Curb to have 1-1/2" x 1-1/2" wood nailer (minimum).
   5. Curb height to be 8" (minimum) above roof deck.
   6. Cant shall be raised to match roof insulation thickness.

7. Cover or flashing to be constructed of galvanized steel or other suitable material to provide sturdy weather tight closure. Provide collars and rubber nipples with draw bands of sizes required by piping. Size curb, cover and nipples per manufacturer's recommendations.
8. Manufacturer: Roof Products Systems or Pate.

2.4 EQUIPMENT/PIPING RAILS

A. Where equipment/pipe rails are not provided by other sections of Specification, provide prefabricated reinforced equipment rails as required for support of equipment and piping. Field built curbs are acceptable alternatives - provide detail of construction for review.

B. Standard equipment rail, unless otherwise noted, shall be constructed as follows:
1. Construct of heavy gauge galvanized steel with continuous welds on shell seams.
2. Provide internal reinforcing supports welded as required to meet application requirements.
3. Equipment rails to have raised 3" (minimum), 45° cant.
4. Equipment rails to have 1 1/2" x 1 1/2" wood nailer (minimum) and counterflashing.
5. Equipment rail height to be 6" (minimum) above roof deck.
6. Cant shall be raised to match roof insulation thickness.

C. Equipment rails to be constructed to meet equipment size and weight requirements. Provide tapered rails to match roof pitch where required.

D. Manufacturer: Pate, Vent Products, Thy Curb or Roof Products Systems.

2.5 ACCESS PANELS AND ACCESS DOORS

A. Provide all access doors and panels to serve equipment under this work, including those which must be installed, in finished architectural surfaces. Frame of 16-gauge steel, door of 20 gauge steel. 1" flange width, continuous piano hinge, key operated, prime coated. Refer to Architectural Specifications for the required product Specification for each surface. Contractor is to submit schedule of access panels for approval. Exact size, number and location of access panels is not shown on Plans. Access doors shall be of a size to permit removal of equipment for servicing. Access door shall have same rating as the wall or ceiling in which it is mounted. Provide access panel for each trap primer or concealed valve, for fire and combination fire/smoke dampers, and for volume dampers. Use no panel smaller than 12" x 12" for simple manual access, or smaller than 24" x 24" where personnel must pass through. Provide cylinder lock for access door serving mixing or critical valves in public areas.

B. Included under this work is the responsibility for verifying the exact location and type of each access panel or door required to serve equipment under this work and in the proper sequence to keep in tune with construction and with prior approval of the Architect. Access doors in fire rated partitions and ceilings shall carry all label ratings as required to maintain the rating of the rated assembly.

C. Acceptable Manufacturers: Milcor, Karp, Nystrom, or Elmdor/Stoneman.

D. Submit markup of architectural plans showing size and location of access panels required for equipment access for approval by Architect.

2.6 IDENTIFICATION MARKERS

A. Mechanical Identification Materials: Provide products of categories and types required for each application as referenced in other Division 23 Sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category. Stencils are not acceptable.

B. Plastic Pipe Markers:
   1. Snap-On Type: Provide pre-printed, semi-rigid snap-on, color coded pipe markers, complying with ANSI A13.1.
   2. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers, complying with ANSI A13.1. Secure both ends of markers with color coded adhesive vinyl tape.
   3. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
   4. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

C. Plastic Duct Markers:
   1. Provide 4 1/2" x 6" laminated plastic, ANSI A13.1 color coded duct markers with white core lettering.
   2. Nomenclature: Include the following:
      a. Direction of air flow
   3. Duct service (supply, return, exhaust, etc.).
      a. Duct origin (from)
      b. Duct destination (to)
      c. Design cfm
   4. Provide a minimum of every 20 feet on all ducts with a diameter or width greater than 12".

D. Underground-Type Plastic Line Markers: Provide 6" wide x 4 mils thick multi-ply tape, consisting of solid metallic foil core between 2 layers of plastic tape. Markers to be permanent, bright colored, continuous printed, intended for direct burial service.

E. Valve Tags:
   1. Brass Valve Tags: Provide 1 1/2" diameter 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Fill tag engraving with black enamel.
   2. Plastic Laminate Valve Tags: Provide 3/32" thick engraved plastic laminate valve tags, with piping system abbreviations in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32" hole for fasteners.
   3. Valve Tag Fasteners: Provide solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
   4. Access Panel Markers: Provide 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.
   5. Non-potable Water Tags: 1/16" thick, engraved, plastic tags as indicated on Drawings.

F. Plastic Equipment Signs:
   1. Provide 4-1/2" x 6" plastic laminate sign, ANSI A.13 color coded with engraved white core lettering.

2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
3. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters, such as pressure drop, entering and leaving conditions, rpm, etc.

G. Acceptable Manufacturers: Craftmark, Seton, Brady, Marking Services, Inc., or Brimar.

2.7 ELECTRICAL

A. General:
1. All electrical material, equipment, and apparatus specified herein shall conform to the requirements of Division 26.
2. Provide all motors for equipment specified herein. Provide motor starters, controllers, and other electrical apparatus and wiring which are required for the operation of the equipment specified herein.
3. Set and align all motors and drives in equipment specified herein.
4. Provide expanded metal or solid sheet metal guards on all V-belt drives to totally enclose the drive on all sides. Provide holes for tachometer readings. Support guards separately from rotating equipment.
5. Provide for all rotating shafts, couplings, etc., a solid sheet metal, inverted “U” cover over the entire length of the exposed shaft and support separately from rotating equipment. Cover shall extend to below the bottom of the shaft and coupling, and shall meet the requirements of the State Industrial Safety Regulations.
6. Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

B. Quality Assurance:
1. Electrical components and materials shall be UL or ETL listed/labeled as suitable for location and use - no exceptions.

C. Motors:
1. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment Specifications.
2. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
3. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Unless otherwise noted on plans, all motors ½ HP or larger shall be rated for 208 or 460 volt, 3-phase, operation. Unless otherwise noted on plans, all motors less than 1/2 HP shall be rated for 120 volt, single phase operation.
4. Temperature Rating: Motor meets class B rise with class F insulation.
5. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
6. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design “B”, except “C” where required for high starting torque.
   a. Frames: NEMA Standard No. 48 or 56; use driven equipment manufacturer's standards to suit specific application.
   b. VFD driven motors to be provided rated for inverter duty (NEMA Standard MG-1, Part 31) and equipped with a shaft grounding device or as an insulated bearing motor.

c. Bearings:
1) Ball or roller bearings with inner and outer shaft seals.
2) Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
3) Designed to resist thrust loading where belt drives or other drives product lateral or axial thrust in motor.
4) For fractional horsepower, light duty motors, sleeve type bearings are permitted.
5) Enclosure Type:
a) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
b) Guarded drip-proof motors where exposed to contact by employees or building occupants.
c) Weather protected Type I for outdoor use, Type II where not housed.

d. Overload Protection: Built-in thermal overload protection where external overload protection is not provided and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.

e. Noise Rating: "Quiet."

f. Efficiency:
1) Motors shall meet the NEMA premium efficiency standard

g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

D. Starters and Electrical Devices:
1. Motor Starter Characteristics:
a. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs.
b. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
2. Manual switches shall have pilot lights and all required switch positions for multi-speed motors. Overload Protection: Melting alloy or bi-metallic type thermal overload relays, sized according to actual operating current (field measured).
3. Magnetic Starters:
a. Heavy duty, oil resistant, hand-off-auto (HOA), or as indicated, and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
b. Trip-free thermal overload relays, each phase, sized according to actual operating current (field measured).
c. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division 23 Controls sections.
d. Built-in primary and secondary fused control circuit transformer, supplied from load side of equipment disconnect.
e. Externally operated manual reset.
f. Under-voltage release or protection for all motors over 20 hp.
4. Motor Connections: Liquid tight, flexible conduit, except where plug-in electrical cords are specifically indicated.

E. Low Voltage Control Wiring:
1. General: 14 gauge, Type THHN, color coded, installed in conduit.
2. Manufacturer: General Cable Corp., Alcan Cable, American Insulated Wire Corp., Senator Wire and Cable Co., or Southwire Co.

F. Disconnect Switches:
1. Fusible Switches: For equipment 1/2 HP or larger, provide fused, each phase; heavy duty; horsepower rated; spring loaded quick-make, quick-break mechanism; dead front

line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the “OPEN” position; arc quenchers; capacity and characteristics as indicated.

2. Non-Fusible Switches: For equipment less than 1/2 horsepower, switch shall be horsepower rated; toggle switch type with thermal overload quantity of poles and voltage rating as required.

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.

B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

1. If the contractor must deviate from the manufacturer’s recommendations provide a letter from the manufacturer indicating the clearance to be provided is acceptable for scheduled performance and maintenance.

3.3 INSTALLATION

A. Coordinate the work between the various Mechanical Sections and with the work specified under other Divisions. If any cooperative work must be altered due to lack of proper supervision or failure to make proper and timely provisions, the alternations shall be made to the satisfaction of the Engineer and at the Contractor’s cost. Coordinate wall and ceiling work with the General Contractor, and his subcontractors in locating ceiling air outlets, wall registers, etc.

B. Inspect all material, equipment, and apparatus upon delivery and do not install any damaged or defected materials.

3.4 SUPPORTS AND HANGERS

A. Seismic bracing calculations and drawings shall be provided and stamped by a licensed CA structural engineer.

B. Prior to installation of hangers, supports, anchors, and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives, (if any), installers of other work with requirements specified.

C. Installation of Building Attachments: Install building attachments at required locations within concrete or on structural steel for proper piping support. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed. Fasten insert securely to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through opening at top of inserts.

D. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors, and other building structural attachments.

E. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

F. Install hangers within 12 inches of every change in piping direction, end of pipe run or concentrated load, and within 36 inches of every major piece of equipment. Hangers shall be installed on both sides of flexible connections. Where flexible connection connects directly to a piece of equipment only one hanger is required.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

H. Support sprinkler piping and gas independently of other piping.

I. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

J. Hanger Spacing in accordance with following minimum schedules (other spacings and rod sizes may be used in accordance with the SMACNA Seismic Restraint Manual using a safety factor of five):

1. Steel Pipe (Water Filled):

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 1 1/4"	5 feet	3/8"
1 ½" to 2"	7 feet	3/8"
2 ½" to 3"	10 feet	1/2"
4" and larger	12 feet	5/8"

2. Steel Pipe (Gas/Air Filled):

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 1 1/4"	6 feet	3/8"
1 ½" and larger	10 feet	1/2"

3. Copper Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	6 feet	3/8"
2 ½" and larger	8 feet	1/2"

4. Glass Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	6 feet	3/8"
2 ½" and larger	8 feet	1/2"

5. Plastic/Fiberglass Pipe:

Pipe Size	Max. Hanger Spacing	Rod Size
1/2" to 2"	4 feet	3/8"
2 ½" and larger	6 feet	1/2"

6. Caulked Bell and Spigot and Glass Pipe: Provide hanger for each section of pipe, located at shoulder of bell. Where an excessive number of fittings are installed between hangers, provide additional reinforcing.

K. Sloping, Air Venting, and Draining:

1. Slope all piping as specified and as indicated, true to line and grade, and free of traps and air pockets. Unless indicated otherwise, slope piping in the direction of flow as follows:

Service	Inclination	Slope
Heating Water	Up	1" per 40'
Chilled Water	Up	1" per 40'
Condensing Water	Up	1" per 40'

2. Provide eccentric reducers in horizontal piping for all sizing changes:
   a. Heating and chilled water piping-top side flat.
3. Connect all heating and chilled water branch piping to the bottom of their respective mains.
4. Provide drain valves and hose adapters at all low points in piping.
5. Provide vents at all high points in water piping.

L. Provisions for Movement:
1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connecting equipment.
3. Insulated Piping: Comply with the following installation requirements:
   a. Clamps: Attach clamps, including spacers, (if any), to piping with clamps projecting through insulation.
   b. Shields: Where low compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install shields or inserts.
   c. Saddles: Where insulation without vapor barrier is indicated install protection saddles.

M. Installation of Anchors:
1. Install anchors at proper locations to prevent excessive stresses and to prevent transfer of loading and stresses to connected equipment.

2. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure.
3. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
4. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends.

N. Equipment Supports:
1. Provide all concrete bases, unless otherwise furnished as work of Division 03. Furnish to Division 03 Contractor scaled layouts of all required bases, with dimensions of bases, and location to column centerlines. Furnish templates, anchor bolts, and accessories necessary for base construction.
2. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks.

O. Adjusting:
1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
3. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 ROOF CURBS, EQUIPMENT RAILS, PIPE PORTALS

A. Install per manufacturer's instructions.

B. Coordinate with other trades so units are installed when roofing is being installed.

C. Verify roof insulation thickness and adjust raise of cant to match.

3.6 ELECTRICAL REQUIREMENTS

A. Mechanical Contractor shall coordinate with Division 26 work to provide complete systems as required to operate all mechanical devices installed under this Division of work.

B. Installation of Electrical Connections: Furnish, install, and wire (except as may be otherwise indicated) all heating, ventilating, air conditioning, etc., motors and controls in accordance with the following schedule and in accordance with equipment manufacturer’s written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC, and NECA’s “Standard of Installation” to ensure that products fulfill requirements. Carefully coordinate with work performed under the Mechanical Division of these Specifications.

C. Division 23 has responsibilities for electrically powered or controlled mechanical equipment which is specified in Division 23 Specifications or scheduled on Division 23 Drawings. The specific division of responsibilities between Division 23 and 26 for furnishing or wiring this equipment is as follows:
1. Division 23 Mechanical Responsibilities:
a. MOTORS: Furnish and install all motors necessary for mechanical equipment.

b. MAGNETIC STARTERS: Furnish all magnetic starters whether manually or automatically controlled which are necessary for mechanical equipment. Furnish these starters with all control relays or transformers necessary to interface with mechanical controls. If the starter is factory installed on a piece of Division 23 equipment, also furnish and install the power wiring between starter and motor.
c. VARIABLE FREQUENCY DRIVES: Provide all VFD's associated with mechanical equipment. If the drive is installed on a piece of factory assembled equipment the wiring between motor and drive is to be provided as part of the factory equipment.
d. DISCONNECTS: Provide the disconnects which are part of factory wired Division 23 equipment. Factory wiring to include wiring between motor and disconnect or combination starter/disconnect.
e. CONTROLS: Division 23 Contractor (including the temperature controls subcontractor) is responsible for the following equipment in its entirety. This equipment includes but is not limited to the following:
    1) Control relays necessary for controlling Division 23 equipment.
    2) Control transformers necessary for providing power to controls for Division 23 equipment.
    3) Line voltage thermostats.
    4) Low or non-load voltage control components.
    5) Remote bulb thermostats.
    6) Non-life safety related valve or damper actuators.
    7) Float switches.
    8) Solenoid valves, EP and PE switches.
    9) Refrigeration controls. (Division 26 provides power to refrigeration panels.)
f. FIRE AND LIFE SAFETY EQUIPMENT:
    1) Fire/Smoke Dampers: Division 23 is responsible for providing and physically installing the damper and for installing any required control interface wiring to Division 23 controls. Fire Alarm Contractor shall provide the duct smoke detectors and connect to the Fire Alarm Control Panel
    2) Fire Sprinkler System: Division 23 is responsible for providing necessary controls including flow switches and alarm bells.
    3) Specialized fire suppression systems: Division 23 is responsible for providing necessary system controls and any required control interface wiring to these controls. Division 26 is responsible for bringing power to point of connection with the system.

D. Division 26 has responsibilities for electrically powered or controlled mechanical equipment, which is specified in Division 23 Specifications or scheduled on Division 23 Drawings. The specific division of responsibilities between Division 23 and 26 for furnishing or wiring this equipment is as follows:
1. Division 26 Electrical Responsibilities:
    a. MOTORS: Provide the power wiring for the motors.
    b. MAGNETIC STARTERS: Except where magnetic starters are factory installed on Division 23 factory assembled equipment, Division 26 is to install magnetic starters furnished by Division 23 and install the necessary power wiring to the starter and from the starter to the motor. In the case of factory installed starters, Division 26 is to install the necessary power wiring to the starter.
    c. VARIABLE FREQUENCY DRIVES: Physically mount all VFD's, which are not specified to be installed on Division 23 factory assembled equipment. Provide the necessary power wiring to the VFD and from the VFD to the motor except in the case of factory installed VFD's where wiring between the motor and VFD is to be by Division 23. Where disconnects are installed between a VFD and a motor provide the interlocking wiring between the disconnect and VFD to insure that the drive is shutdown simultaneously with motor.

d. DISCONNECTS: Provide all disconnects necessary for Division 23 mechanical equipment which are not provided as part of factory wired Division 23 equipment. Provide power wiring to all disconnects. In addition provide power wiring between motor and disconnect when the disconnect is not factory installed. See also Variable Frequency Drive above for special wiring requirements.
e. CONTROLS: Division 26 Contractor is responsible for providing power to control panels and control circuit outlets.
f. FIRE AND LIFE SAFETY EQUIPMENT:
    1) Fire/Smoke Dampers: Division 26 is responsible for power wiring to the damper and as follows:
        a) Where these dampers are part of an integrated smoke control system Division 26 is responsible for providing the detectors and for all fire detection system wiring necessary to integrate dampers and related end switches into the system.
        b) Where these dampers are not part of an integrated area wide smoke detection system, Division 23 is responsible for providing each fire/smoke damper with a dedicated duct detector installed per the requirements of the building code. (See Section 233113). If not integral with the damper assembly, the detector is to be installed by Div. 23 but wired for damper control by Div. 26.
    2) Fire Sprinkler System: Division 26 is responsible for providing power wiring to fire protection controls including flow switches and alarm bells.
    3) Specialized fire suppression systems: Division 26 is responsible for providing power wiring to suppression system and its controls.

2. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
3. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
4. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by University California Berkeley, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
5. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
6. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

E. Motors and Motor Control Equipment: Conform to the standards of the NEMA. Equip motors with magnetic or manual line starters with overload protection. Motor starters and line voltage controls shall be installed under Electrical Section but located and coordinated as required under this Section of the work. Starters shall be combination type with non-fusible disconnect switches. All single phase fractional horsepower motors shall have built-in overload protection.

3.7 PAINTING

A. All painting shall be provided under this Division work, unless otherwise specified under Section

099113 & 099123: Painting. Painting schemes shall comply with ANSI A13.1. Paint all exposed materials such as piping, ductwork, equipment, insulation, steel, etc. Exposed gas piping inside and outside the building shall be painted with two coats of “Rust-O-Leum” Yellow. The inside surface of visible ductwork above diffusers/grilles shall be painted flat black. Exposed copper indirect waste piping serving food service equipment shall be painted metallic chrome.

B. All exposed work under Division 23 shall receive either a factory finish or a field prime coat finish, except:
   1. Exposed copper piping.
   2. Aluminum jacketed outdoor insulated piping.

3.8 IDENTIFICATION MARKERS

A. General: Where identification is to be applied to surfaces which require insulation, painting, or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Piping System Identification:
   1. Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
   2. Locate pipe markers as follows:
      a. Near each valve and control device.
      b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
      c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
      d. At access doors, manholes, and similar access points which permit view of concealed piping.
      e. Near major equipment items and other points of origination and termination.
      f. Spaced horizontally at maximum spacing of 20' along each piping run, with minimum of one in each room. Vertically spaced at each story transversed.

C. Underground Piping Identification: During backfilling/topsoiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

D. Ductwork Identification: A minimum of every 20' for all ductwork 12" or more in diameter or width.

E. Mechanical Equipment Identification: Locate engraved plastic laminate signs on or near each major item of mechanical equipment and each operational device. Provide signs for the following:
   1. Main control and operating valves, including safety devices.
   2. Meters, gauges, thermometers, and similar units.
   3. Pumps, compressors, and similar motor-driven units.
   4. Hot water system mixing valves and similar equipment.
   5. Fans, blowers, primary balancing dampers, and mixing boxes.
   6. Packaged HVAC central-station and zone-type units.
   7. Tanks and pressure vessels.
   8. Strainers, filters, treatment systems and similar equipment.
   9. Sprinkler and standpipe equipment.

F. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations. Equipment signs shall include an identification of the area or other equipment served by the equipment being labeled.

3.9 VIBRATION AND DYNAMIC BALANCING

A. Vibration tolerances shall be as specified by the “International Research and Development Corporation”, Worthington, Ohio, measured by the displacement, peak to peak, as follows:
1. All Fans: Below severity chart labeled “FAIR”, maximum velocity of 0.0785 in/sec, peak.
2. Pump and Electric Motors: Below severity chart labeled “SLIGHTLY ROUGH”, maximum vibration velocity of 0.157 in/sec, peak.
3. Compressors: Same as pumps.

B. Correction shall be made to all equipment, which exceeds vibration tolerances specified above. Final vibration levels shall be reported as described above.

3.10 TESTING

A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.

B. Ductwork: Test all air quantities as specified in Section 230593 - Testing, Adjusting and Balancing. Pressure tests per SMACNA.

C. Registers and Diffusers: Test for proper operation of manually operated control feature. Test all air quantities as specified in Section 230593 – Testing, Adjusting and Balancing.

D. Ductwork Specialties: Test all operable ductwork specialties for proper operation. Check all fire, smoke and fire/smoke dampers to ensure that they are 100% open.

E. Temperature Control: Test all control functions to assure that all systems are controlling as specified or as otherwise necessary and that all controls are adjusted to maintain proper room temperatures. The manufacturer's representative shall perform all tests.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 230500 - Basic Materials and Methods, and other Sections in Division 23 specified herein.

1.2 WORK RELATED IN OTHER SECTIONS

A. Section 230500: Basic Materials and Methods

B. Section 230900: Controls and Instrumentation

C. Section 233113: Air Distribution

1.3 SUMMARY

A. Scope: Extent of testing, adjusting and balancing work required by this Section is indicated on the drawings, in schedules, and by the requirements of this Section, and Section 230500 -Basic Mechanical Requirements.

B. Systems: Testing, adjusting and balancing specified in this Section shall include, but not be limited to, the following systems:
   1. Air handling systems including supply, return and exhaust.
   2. Hydronic system including heating and chilled water
   3. Air distribution ductwork including supply, return and exhaust.
   4. General exhaust systems.

C. Reference Standards
   1. ASHRAE-Standard 111--1988 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air Conditioning, and Refrigeration Systems.
   2. ASHRAE —2003 HVAC Applications Handbook: Chapter 37--Testing, Adjusting and Balancing.
   3. AABC--National Standards for Total System Balance.
   4. SMACNA--HVAC Systems--Testing, Adjusting and Balancing.
   5. Sheet Metal Industry--Testing, Adjusting, Balancing Bureau (TABB) Certified Technician Standards, Procedures and Specifications.
   6. American National Standards Institute (ANSI): Comply with the following:
      a. S1.4Specification For Sound Level Meters.
      b. S1.11Specification For Octave-Band and Fractional-Octave-Band Analog and Digital Filters.

1.4 QUALITY ASSURANCE

A. Contractors Qualifications: A specialist certified by the or Associated Air Balance Council (AABC) with at least 5 years of experience in those testing, adjusting and balancing requirements similar to those required for this project, who is not the installer of the system to be tested and is otherwise independent of the project.

B. Testing, adjusting, and balancing shall be performed by a certified AABC technician under direct field supervision of a Certified AABC Supervisor.

C. Penalty: The Contractor shall submit the name of the organization he proposes to employ for approval within 30 days after contract award. If the Contractor fails to submit the name of an acceptable agency within the specified time, a firm may be selected to accomplish the work, and this selection shall be binding upon the Contractor at no additional cost.

D. Retainages: In addition to any other sums retained or withheld pursuant to the provisions of this Contract, the amount of dollars will be withheld from payments to the contractor until such time as the work has been completed and accepted. In no event will this amount be paid to the Contractor prior to 60 days following acceptance of the project; during such time, the Contractor shall investigate and correct any reported deficiencies unless such deficiencies are a result of unauthorized tampering by building occupants.

E. Calibration of Testing Instruments: All measurement instruments used for testing, adjusting, balancing, and commissioning shall be calibrated. The time between the most recent calibration data and the final test report date shall not be over 6 months

F. Testing and balancing agency, as part of its contract, shall act as authorized inspection agency responsible to University of California Berkeley and shall list all items that are installed incorrectly, require correction, or have not been installed in accordance with contract Drawings and Specifications, pertaining to air distribution, cooling and heating systems. The testing and balancing agency is required to provide written reports of all deficiencies and proposed recommendations to the University of California Berkeley, Contractor, Architect and Engineer.

G. The testing and balancing agency shall provide with his bid a performance guarantee covering all phases of the work as herein specified.

H. The General and mechanical contractors shall cooperate with the selected testing and balancing agency in the following manner:
   1. Provide sufficient time before final completion dates so that tests and balancing can be accomplished.
   2. The various system installers, suppliers and contractors shall provide all required materials, labor and tools to make corrections when required without undue delay. Install balancing dampers as required by testing and balancing agency.
   3. The contractor shall put all heating, ventilating and air conditioning systems and equipment into full operation and shall continue the operation of the same during each working day of testing and balancing.
   4. Testing and balancing agency shall be kept informed of any major changes made to the system during construction, and shall be provided with a complete set of Record Drawings.
   5. The General Contractor shall make space and other facilities available to the testing and balancing agency to enable their work to progress. The General Contractor shall schedule the work of other trades to avoid conflicts with this work.

1.5 SUBMITTALS

A. Conform to the Submittals requirements of Division 01.

B. Forms: The Contractor shall deliver a complete copy of either AABC standard forms for testing and balancing work associated with the project. These forms shall serve as specific guidelines for producing final test report. Hybrid or non-standards forms are not acceptable. Data shall include, but not be limited to, a title page with building information, instrument lists, air flows, water flows, temperatures, sound levels, capacities, nameplate data.

C. Test Reports: Provide six (6) certified test reports, signed by the test and balance supervisor who performed the work. The final reports shall include identification and types of instruments used, and their most recent calibration date, and key plans identifying all inlets and outlets. Final test reports shall be typed. Hand written reports are not acceptable.

D. Maintenance Data: Include, in maintenance manuals, copies of certified test reports and identification of instruments.

E. Qualifications: The Contractor shall submit the certified individual qualifications of all persons responsible for supervising and performing the actual work and the name of the certifying engineer. Provide a reference list of five (5) similar size projects with contact person and telephone number.

1.6 AGENDA

A. Agenda: A preliminary report and agenda shall be submitted and approved prior to the start of testing and balancing work.
   1. Review plans and specifications prior to installation of any of the affected systems, and submit a report indicating any deficiencies in the systems that would preclude the proper adjusting, balancing, and testing of the systems.
   2. The agenda shall include a general description of each air and water system with its associated equipment and operation cycles for heating and cooling.
   3. The agenda shall include a list of all air and water flows to be performed at all mechanical equipment.
   4. The agenda shall incorporate the proposed selection points for sound measurements, including typical spaces as well as sound sensitive areas such as conference rooms.
   5. The agenda shall also include specific test procedures and parameters for determining specified quantities (e.g. flow, drafts, sound levels) from the actual field measurements to establish compliance with contract requirements. Samples of forms showing application of procedures and calculations to typical systems shall be submitted.
   6. Specific test procedures for measuring air quantities at terminals shall specify type of instrument to be used, method of instrument application (by sketch) and factors for:
      a. Air terminal configuration.
      b. Flow direction (supply or exhaust).
      c. Velocity corrections.
      d. Effective area applicable to each size and type of air terminal.
      e. Density corrections.
   7. The agenda shall include identification and types of measurement instruments to be used, and their most recent calibration date.

1.7 JOB CONDITIONS

A. General: Do not proceed with testing, adjusting and balancing work until the following conditions have been met.
   1. Work has been completed and is operable. Ensure that there is no latent residual work yet to be completed on the tested equipment.
   2. Work scheduled for testing, adjusting and balancing is clean and free from debris, dirt and discarded building materials.
   3. All architectural openings (doors, windows, and other openings) which may affect the operation of the system to be tested, adjusted, and balanced shall be at their normal states.
   4. All related mechanical systems which may affect the operation of the system to be tested, adjusted, and balanced shall be at their normal operating conditions.

PART 2 - PRODUCTS

2.1 TEST HOLES

A. Test holes shall be provided in ducts, housings and pipes as necessary for the proper air and water measurements and to balance systems. At each location where ducts or plenums are insulated, test holes shall be provided with an approved extension with plug fitting.

2.2 PATCHING MATERIALS

A. Material: Seal, patch and repair ductwork, piping and equipment drilled or cut for testing purposes.
   1. Plastic plugs with retainers may be used to patch drilled holes in ductwork and housings.
   2. Piping shall be capped with materials the same as the piping system.
   3. Insulation shall be neatly hemmed with metal or plastic edging, leaving test points visible for future testing.

2.3 TEST INSTRUMENTS

A. Standards: Utilize instruments and equipment of type, precision, and capacity as recommended in the AABC manual MN-1.

B. Test Instruments: All instruments used for measurements shall be accurate and calibration histories for each instrument shall be available for examination. Each test instrument shall be calibrated by an approved laboratory or by the manufacturer. A representative has the right to request instrument recalibration, or the use of other instruments and test methodology, where accuracy of readings is questionable.

C. Additional Instruments: Permanently installed measuring instruments, such as temperature and pressure gauges, shall be checked against transfer standard instruments. Any instrument which does not meet specification requirement shall be replaced or recalibrated.

D. Cone Instruments: The Contractor shall employ manufactured enclosure type cones, capable of air volume direct readings, for all diffuser/grille/register air flow measurements. The readout meters shall meet calibration requirements.

PART 3 - EXECUTION

3.1 PROCEDURES AND INSTRUMENTS, GENERAL

A. Requirements: All systems and components thereof shall be adjusted to perform as required by drawings and specifications.

B. Test Duration: Operating tests of heating and cooling coils, fans, and other equipment shall be of not less than four hours duration after stabilized operating conditions have been established. Capacities shall be based on temperatures and air and water quantities measured during such tests.

C. Instrumentation: Method of application of instrumentation shall be in accordance with the approved agenda.
   1. All instruments shall be applied in accordance with the manufacturer's certified instructions.
   2. All labor, instruments, and appliances required shall be furnished by the Contractor. Permanently installed instruments used for the tests (e.g., flow meters and Btu meters) shall not be installed until the entire system has been cleaned and ready for operation.

3.2 DUCT SMOKE DETECTORS

A. The testing and balancing agency shall direct the placement of all duct mounted smoke detectors.
   1. Obtain information from the Contractor who is to furnish the smoke detectors on the proper device placement and installation limitations and on the proper differential pressure across the sampling tubes of the duct detectors.
   2. Based on the submitted manufacturer's installation guidelines indicate the proper mounting location to the installing Contractor.

B. After the installation of all smoke detectors test them again in the final installation position and report differential pressures.

3.3 AIR SYSTEM PROCEDURES

A. Adjustments: Adjust all air handling systems to provide approximate design air quantity to or through, each component, and to maintain stable and comfortable interior temperatures, free of drafts or stagnant conditions. Adjusting and balancing of all systems shall be conducted during periods of the year approximating maximum seasonal operation.

B. Equalizers: Equalizing devices shall be adjusted to provide uniform velocity across the inlets (duct side for supply) of terminals prior to measuring flow rates.

C. Balance: Flow adjusting (volume control) devices shall be used to balance air quantities (i.e., proportion flow between various terminals comprising system) to the extent that their adjustments do not create objectionable air motion or sound (i.e., in excess of specified limits).
   1. Balancing between runs (submains, branch mains, and branches) generally shall be accomplished by flow regulating devices at, or in, the divided-flow fitting.
   2. Restriction imposed by flow regulating devices in or at terminals shall be minimal.
   3. Final measurements of air quality shall be made after the air terminal has been adjusted to provide the optimum air patterns of diffusion.

D. Fan Adjustment: Total air system quantities, generally, shall be varied by adjustment of fan speeds and Variable Frequency Drives. Damper restriction of a system's total flow may be used only for systems with direct-connected fans (without adjustable pitch blades), provided system pressure is less than 1/2-inch W.G. and sound level criteria is met.

E. Air Measurement: Where air quantity measuring devices are specified in other sections such systems shall be used as a cross-check of portable measuring equipment.
1. Except as specifically indicated herein, pitot tube traverses shall be made of each duct to measure air flow therein. Pitot tubes, associated instruments, traverses, and techniques shall conform to the ASHRAE "Handbook Fundamentals Inch Pound Edition."
2. For ducts serving modular office areas with movable partitions, which are subject to change, pitot tube traverses may be omitted provided the duct serves only a single room or space and its design volume is less than 2000 cfm. In lieu of pitot tube traverses, airflow in the duct shall be determined by totaling volume of individual terminals served, measured as described herein.
3. Where duct's design velocity and air quantity are both less than 1000 (fpm/cfm), air quantity may be determined by measurements at terminals served.

F. Test Holes: Test holes shall be in a straight duct, as far as possible downstream from elbows, bends, take-offs, and other turbulence generating devices, to optimize reliability of flow measurements. TAB contractor shall plug all duct holes made during the balancing effort with approved, leak tight, duct plugs.

G. Air Terminal Balancing: Generally, measurement of flow rates by means of velocity meters applied to individual terminals, with or without cones or other adapters, shall be used only for balancing. Measurement of air quantities at each type of air terminal (inlet and outlet) shall be determined by the method approved for the balancing agenda. Laboratory tests shall be conducted to prove of methodology when so directed. Such tests shall be conducted in conformance with applicable ASHRAE or American Society of Mechanical Engineers (ASME) codes and shall be made at no cost.

H. Air Motion: Air motion and distribution shall be as specified and indicated on drawings. The Contractor at no additional cost shall, in addition to air motion measurements, make smoke tests wherever requested to demonstrate the air distribution from air terminals.

I. Air System Test and Balance Procedure: Perform the following tests, and balance each system in accordance with the following requirements:
1. Test and adjust blower RPM to design requirements.
2. Test and record motor full load amperes.
3. Make pitot tube traverse of main supply ducts and obtain design CFM at fans.
4. Test and record system pressures, suction and discharge.
5. Test and adjust system for design recirculated air, CFM.
6. Test and adjust system for design CFM outside air.
7. Test and record entering air temperatures.
8. Test and record leaving air temperatures.
9. Adjust all supply, return and exhaust air ducts to proper design CFM.
10. Adjust all zones to proper design CFM, supply and return.
11. Test and adjust duct systems and each diffuser, grille, and/or register to within 10% of design requirements.
12. Each grille, diffuser and register shall be identified as to location and area.
13. Size, type and manufacturer of VAV boxes, diffusers, grilles, registers and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations.

14. Readings and tests of diffusers, grilles and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustment.
15. In cooperation with the control manufacturer's representative, setting adjustments of automatically operated dampers to operate as specified, indicated, and/or noted. Testing agency shall check all controls requiring adjustment by control installers. Room thermostats shall be checked for cooling and heating response.
16. All diffusers, grilles and registers shall be adjusted to minimize drafts in all areas.
17. Adjust overall system balances to allow all self-closing exterior doors to close from any open position. Maximum interior air pressure in a 100% outside air intake mode shall not exceed 0.05" static pressure relative to the outside air pressure.
18. As part of the work of this contract, the HVAC contractor shall make any changes in the pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to University of California Berkeley
19. After air balancing is completed and RPM determined, HVAC Contractor shall provide fixed pitch pulleys.
20. All mixing boxes, VAV air valves, control dampers, smoke dampers and similar devices which operate at 100% shut off shall be tested for leakage.
21. Variable Air Volume Fan Systems: The primary balancing mode is 100% outside air with all terminal boxes on a full call for cooling. Also check and record performance at minimum outside air with all terminal boxes on call for full cooling and at minimum outside air with all terminal boxes on call for full heating. Verify that the systems are operating on a stable part of the fan curves in each mode. Record final duct static controller settings.

3.4 AIR SYSTEM DATA

A. Report: The certified report shall include for each air handling system the data listed below.
   1. Equipment (Fan or Factory Fabricated Station Unit):
      a. Installation data
         1) Manufacturer and model
         2) Size
         3) Arrangement, discharge and class
         4) Motor hp, voltage, phase, cycles, and full load amps
         5) Location and local identification data
      b. Design data
         1) Data listed in schedules on drawings and specifications.
      c. Fan recorded (test) data
         1) cfm
         2) static pressure
         3) rpm
         4) motor operating amps
         5) motor operating bhp
   2. Duct Systems:
      a. Duct air quantities (maximum and minimum) - main, submains, branches, outdoor (outside) air, total air, and exhaust:
         1) duct size(s)
         2) number of pitot tube (pressure measurements)
         3) sum of velocity measurements (Note: Do not add pressure measurements)
         4) average velocity
         5) recorded (test) cfm
         6) design cfm
      b. Individual air terminals
         1) terminal identification supply or exhaust, location and number designation

2) type size, manufacturer and catalog identification applicable factor for application, velocity, area, etc., and designated area
3) design and recorded velocities - fpm (state "core," "inlet," etc., as applicable)
4) design and recorded quantities - cfm (deflector vane or diffusion cone settings)

3.5 WATER SYSTEM PROCEDURES

A. Preparation:
1. Open all valves to full open position. Close coil bypass stop valves. Set mixing valve to full coil flow.
2. Remove all strainers and clean same. Reinstall.
3. Examine water system and determine if water has been treated and cleaned.
4. Check pump rotation.
5. Check expansion tank to determine they are not air bound and the system is completely full of water.
6. Check all air vents at high points of water systems and determine that all are installed and operating freely.
7. Check operation of automatic bypass valve.
8. Check and set operating temperatures of all equipment at design requirements.
9. Complete air balance must have been accomplished before actual water balance begins.

B. Adjustment: All heating, cooling and condensing water systems shall be adjusted to provide required quantity to or through each component.

C. Metering: Water quantities and pressures shall be measured with calibrated meters.
1. Venturi tubes, orifices, or other metering fittings and pressure gauges shall be used to measure water flow rates and balance systems. Systems shall be adjusted to provide the approved pressure drops through the heat transfer equipment (coils except room units, converters, etc.) prior to the capacity testing.
2. Where flow metering fittings are not installed, in air/water type heat transfer equipment, flow balance shall be determined by measuring the air side energy differential across the heat transfer equipment. Measurement of water temperature differential shall be performed with the air system, adjusted as described herein, in operation.

D. Automatic Controls: Automatic control valves shall be positioned for full flow through the heat transfer equipment of the system during tests.

E. Flow: Flow through bypass circuits at three-way valves shall be adjusted to equal that through the supply circuit, when the valve is in the bypass position.

F. Distribution: Adjustment of distribution shall be effected by means of balancing devices (cocks, valves, and fittings) and automatic flow control valves as provided; service valves shall not be used.
1. Where automatic flow control valves are utilized in lieu of Venturi tubes, only pressure differential need be recorded, provided that the pressure is at least the minimum applicable to the tag rating.

G. Special Procedures: Where available pump capacity (as designed) is less than total flow requirements of individual heat transfer units of system served, full flow may be simulated by the temporary restriction of flow to portions of the system; specific procedures shall be delineated in the agenda.

H. Water System Test and Balance Procedure: Perform the following tests, and balance each system in accordance with the following requirements:
1. Set chilled and heating water pumps to proper gallons per minute delivery.
2. Adjust chilled water flow though 100% Outside Air Unit.
3. Adjust heating water flow through VAV boxes(s).
4. Test and record entering and leaving water temperatures through 100% outside air unit and VAV boxes.
5. Test and record water temperatures at inlet and outlet side of each terminal unit. Note rise or drop of temperatures from source.
6. Proceed to balance each terminal unit.
7. Upon completion of flow readings and adjustments at coils, mark all settings and record data.
8. After adjustments to coils are made, recheck settings at the pumps and readjust if required.
9. Record and check the following items at each coil.
   a. Inlet water temperatures.
   b. Leaving water temperatures.
   c. Water pressure drop of each coil.
10. Pump operating suction and discharge pressures and final total dynamic head.
11. List all mechanical specifications of pumps.
12. Rated and actual running amperage of pump motor.
13. Water metering device readings.

3.6 WATER SYSTEM DATA

A. Report: The certified report for reach water system shall include the data listed below.
1. Pumps:
   a. Installation data
      1) manufacturer and model
      2) size
      3) type drive
      4) motor hp, voltage, phase, and full load amps
   b. Design data
      1) gpm
      2) head
      3) rpm and amps
   c. Recorded data
      1) discharge pressures (full-flow and no-flow)
      2) suction pressures (full-flow and no-flow) operating head
      3) operating gpm (from pump curves if metering is not provided) no-load
      4) amps
      5) full-flow amps
      6) no-flow amps
2. Air Heating and Cooling Equipment:
   a. Design data
      1) load in Btu or MBh
      2) gpm
      3) entering and leaving water temperature
      4) entering and leaving air conditions (DB and WB)
      5) cfm
      6) water pressure drop
   b. Recorded data
      1) type of equipment and identification (location or number designation)

2) entering and leaving air conditions (DB and WB)
3) entering and leaving water temperatures
4) gpm (if metered)
5) temperature rise or drop

3. Water Chilling Units:
   a. Installation data
      1) manufacturer and model
      2) motor hp, voltage, cycles, phase, and full load amps
      3) part load amperes
      4) gpm – 100% outside air unit
      5) water pressure drop - 100% outside air unit
      6) entering and leaving water temperature - 100% outside air unit
   b. Recorded data (100% outside air unit)
      1) gpm
      2) water pressure drop
      3) entering and leaving water temperature
      4) amperes

3.7 SOUND TEST PROCEDURES

A. Scope: Tests of sound levels shall be made at each selection point included in the agenda.

B. Timing: Sound level measurements shall be taken at times when the building is unoccupied, or when activity in surrounding areas and background noise level in areas tested are at a minimum and relatively free from sudden changes in noise levels.
   1. Measurements shall be taken with all equipment turned off, except that being tested.
   2. The required sound levels shall be measured at any point within a room not less than 6 feet from an air terminal or room unit, and not closer than 3 feet from any floor, wall, or ceiling surface.

C. Meters: Sound levels shall be measured with a sound meter complying with ANSI S1.4. The "A" scale shall be used to measure over all sound levels. To determine the specified octave band levels, the above sound level meter, set on "C" scale, shall be supplemented by an octave band analyzer complying with ANSI S1.11.

D. Equipment Components: The "Equipment Component" of room sound equals LPt-C. The "Equipment Component" of room sound (noise) levels shall be determined for each of eight octave bands as follows:
   1. Measure room sound pressure level "LPb" with equipment to be tested shut off.
   2. Measure room sound pressure level "LPt" with equipment to be tested turned on.
   3. Calculate LPt-LPb; if this value is less than 1, applicable test must be rerun with lower background level (LPb) unless LPt is within sound pressure level specified for equipment.
   4. Determine "c" from the table below.

LPt-LPb (db)	c (db)
1	7
2	4
3	3
4 to 4- ½	2
5 to 5- ½	1 – ½
6 to 7- ½	1
8 to 12	½
over 12	0

3.8 SOUND LEVEL DATA

A. Report: certified report shall record data on sound levels, taken at each selected location, as follows:
   1. Source of sound and location.
   2. Diagram or description of relationship of sound source to measuring instrument.
   3. "A" scale readings equipment being tested turned off (ambient) equipment being tested turned on (operating conditions).
   4. Readings at each specified octave band frequency equipment being tested turned off (ambient) equipment being tested turned on (operating conditions).
   5. "Equipment Components" of sound (noise) levels with applicable calculations per "Sound Test Procedures".
   6. Graph showing relationship between pressure levels specified and recorded readings

B. Retest: Subsequent to any correctional construction work, such as acoustic corrections, measurement shall be made to verify that associated air and water quantities, as previously measured, have not been disrupted.
   1. Certified report shall record all sound data, and their locations, after final adjustments of air and water systems involves.

3.9 CERTIFIED REPORTS

A. Submittals: Six (6) copies of the reports described herein, covering air and water system performance, air motion (fpm), and sound pressure levels, shall be submitted prior to final tests and inspection.

B. Instrument Records: Types, serial numbers, and dates of calibration of all instruments shall be included.

C. Reports: Reports shall conspicuously identify items not conforming to contract requirements, or obvious malfunction and design deficiencies.

D. Certification: Certification shall include checking of adherence to agenda, of calculations, of procedures, and evaluation of final summaries.

3.10 FINAL COMMISSIONING TESTS, INSPECTIONS AND ACCEPTANCE

A. Scope: Test shall be made to demonstrate that capacities and performance of air and water systems comply with contract requirements.
   1. At the time of final inspection, the Contractor shall recheck, random selection of data (water and air quantities, air motion, and sound levels) recorded in the certified report.
   2. Points and areas for recheck shall be selected by the commissioning team.
   3. Measurement and test procedures shall be the same as approved for work forming basis of certified report.
   4. Selections for recheck (specific plus random), in general, will not exceed 25 percent of the total number tabulated in the report, except that special air systems may require a complete recheck for safety reasons.

B. Retests: If random tests elicit a measured flow deviation of 10 percent or more from, or a sound level of 2 db or more greater than, that recorded in the certified report listings, as 10 percent or more of the rechecked selections, the report shall be automatically rejected. In the event the

report is rejected, all systems shall be readjusted and tested, new data recorded, new certified reports submitted, and new inspection tests made, all at no additional cost. Retainage time shall be based on the date of the final acceptance of the certified report.

C. Marking of Settings: Following final acceptance of certified reports, the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked by the Contractor so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

END OF SECTION

SECTION 230700
HVAC INSULATION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 230500 - Basic Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this Section shall include, but not necessarily be limited to, providing insulation for the following:
   1. Ductwork
      a. All supply air ductwork
      b. All return air ductwork
      c. Acoustical duct lining, in vertical/horizontal supply and return ducts within twenty feet (20') of air handling equipment and where otherwise shown on drawings.
      d. Outside air ductwork in return plenums, mechanical rooms and in freezing climates
      e. Exhaust air ductwork in cold air plenums.
      f. Vapor/moisture ductwork.
      g. Insulation to protect fire rated exhaust systems
   2. Piping:
      a. Heating hot water supply and return piping.
      b. Chilled water supply and return piping.
      c. Valves, pumps, air separators, strainers and fittings in insulated piping systems.
      d. Refrigerant hot gas and suction piping.
   3. Hot and cold equipment.
      a. Generator exhaust systems.
   4. Plenums and equipment rooms, as noted.

B. Types of mechanical insulation specified in this Section include the following:
   1. Fiberglass pipe insulation.
   2. Calcium silicate pipe insulation.
   3. Flexible elastomeric closed cell insulation
   4. Fiberglass duct insulation.
   5. Fiberglass equipment insulation.
   6. Calcium silicate equipment insulation.
   7. Insulation jackets.
   8. Insulation accessories.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220501: Plumbing.

B. Section 230500: Basic Materials and Methods.

C. Section 232113: HVAC Piping, Valves and Specialties.

1.4 DEFINITIONS

A. Ambient: The air temperature to be maintained in a conditioned room. Typically between 70°F and 78°F.

B. Insert: Spacer placed between the pipe support system and the piping to allow for the space required for insulation.

C. Insulation Group (IG): Definition of Insulation Materials and Operating Temperatures.

D. Insulation Shield: Buffer material placed between the pipe support system and the insulation to prevent the insulation material from crushing.

E. Jacket: Protective covering over the pipe insulation; may be factory applied such as “all service jacket” or field applied to provide additional protection; of such materials as canvas, PVC, aluminum or stainless steel.

F. Piping Insulation: Thermal insulation applied to prevent heat transmission to or from a piping system.

G. Vapor Barrier Jacket: Insulation jacket material that impedes the transmission of water vapor.

H. Freezing Climate: Where outdoor design temperature is less than 33° F, as stated in ASHRAE fundamentals under 99% column for winter design conditions.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Provide products conforming to the requirements of the following:
   1. American Society for Testing and Materials (ASTM): Manufacture and test insulation in accordance with the ASTM Standards, including:
      a. B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plat.
      b. C165 - Recommended Practice for Measuring Compressive Properties of Thermal Insulation.
      c. C167 - Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
      d. C177 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission.
      e. Properties by Means of the Guarded-Hot-Plate Apparatus.
      f. C195 - Specification for Mineral Fiber Thermal Insulating Cement.
      g. C196 - Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement.
      h. C302 - Test Method for Density of Preformed Pipe-Covering-Type Thermal Insulation.
      i. C303 - Test Method for Density of Preformed Block-Type Thermal Insulation.
      j. C305 - Test for Thermal Conductivity of Pipe Insulation.
      k. C356 - Test for Linear Shrinkage of Preformed High-Temperature Thermal Insulation.
      l. C411 - Test for Hot-Surface Performance of High Temperature Thermal Insulation.

m. C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
n. C449 - Specification of Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
o. C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
p. C533 - Specification for Calcium Silicate Block and Pipe Thermal Insulation.
q. C534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
r. C547 - Specification for Mineral Fiber Preformed Pipe Insulation.
s. C552 - Specification for Cellular Glass Block and Pipe Thermal Insulation.
t. C553 - Specification for Mineral Fiber Blanket-Type Pipe Insulation (Industrial Type).
u. C592 - Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered).
v. C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
w. C916 - Standard Specification for Adhesives for Duct Thermal Insulation.
x. C921 - Practice for Determining Properties of Jacketing Materials for Thermal Insulation.
y. C1104 - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
z. C1071 - Standard Specification for Thermal and Acoustical Insulation.
aa. C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings..
bb. E84 - Test Method for Surface Burning Characteristics of Building Materials.
cc. E119 - Test for Fire Resistance.
dd. G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
ee. G22 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.

2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Provide and install pipe and duct insulation in accordance with the following ASHRAE Standard:
   a. 90 Energy Conservation in New Building Design.
3. National Fire Protection Association (NFPA): Manufacture insulation in accordance with the following NFPA standards:
   a. 255 Test Methods, Surface Burning Characteristics of Building Materials.

B. Do not provide materials with flame proofing treatments subject to deterioration due to the effects of moisture or high humidity.

C. Products Containing Prohibited Chemicals:
1. Products containing the following prohibited chemicals for use as flame retardants or for other purposes will not be acceptable when present in quanties greater than 0.1% by mass:
   a. Pentabrominated diphenyl ether (CAS#32534-81-9)
   b. Octabrominated diphenyl ether (CAS#32536-52-0)
   c. Decabrominated diphenyl ether (CAS#1163-19-50

D. Flame/Smoke Rating: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing; or satisfactory certified test report from an

approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.

E. Corrosiveness: Provide insulation such that when tested in accordance with the following test, the steel plate in contact with the insulation shows no greater corrosion than sterile cotton in contact with a steel plate for comparison.
   1. Test Specimen: Two specimens shall be used, each measuring 1" by 4" by approximately ½" thick.
   2. Apparatus: Provide a humidity test chamber in which two polished-steel test plates, 1" wide, 4" long and 0.020" thick, shall be placed. Plates shall be clear finish, cold-rolled strip steel, American quality, quarter hard, temper No. 3, weighing 0.85 lb/sq. ft.
   3. Procedure: The steel test plates shall be rinsed with cp benzol until their surfaces are free from oil and grease and allowed to dry. One piece of cold-rolled steel shall be placed between the two insulation specimens and secured with tape or twine. The test specimen and uncovered plate shall be suspended vertically in an atmosphere having a relative humidity of 95% (plus or minus 3%), and a temperature of 120°F (plus or minus 3°F), for 96 hours, and then be examined for corrosion.

F. Insulation thickness shall be the greater standard of that specified here or the State energy conservation requirements.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation. Also furnish necessary test data certified by an independent testing laboratory. Submit samples.

B. Provide a statement with the submittal indicating that no product submitted contains an amount equal to or greater than 0.10% by mass of the following chemicals:
   1. Pentabrominated diphenyl ether (CAS#32534-81-9)
   2. Octabrominated diphenyl ether (CAS#32536-52-0)
   3. Decabrominated diphenyl ether (CAS#1163-19-50

C. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product in maintenance manual.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coating to the site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.

B. Store and protect insulation against dirt, water, chemical, and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Johns Manville, Owens-Corning, Knauf, Armstrong, Pittsburgh-Corning, Certainteed, Halstead, Rubatex, 3M FireMaster, Pabco, Reflectix, or approved equal. Manufacturer and insulation types listed below indicate a minimum acceptable level of quality required for each classification.

2.2 DUCTWORK INSULATIONS

A. Flexible Fiberglass Blanket: Johns Manville Microlite XG, formaldehyde-free Type 75 Flexible Blanket, Knauf ECOSE Duct Wrap:
   1. Application: Insulation wrap for ductwork, or other HVAC systems.
   2. 'K' Value: ASTM C553-92, 0.27 Btu•in./(hr•ft²•ºF) at 75°F installed full thickness.
   3. Density: 0.75 lb/cu ft.
   4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft.
   5. Installation: See Part 3 below.

B. Fiberglass Acoustic Duct Liner: Johns Manville Duct Liner R-300 with Anti-Microbial Treatment.
   1. Application: Duct lining for acoustic or thermal purposes.
   2. 'K' Value: ASTM 1071, 0.23 Btu•in./(hr•ft²•ºF) at 75°F.
   3. Noise Reduction Coefficient: 0.65 or higher based on "Type A mounting."
   4. Maximum Velocity on Mat or Coated Air Side: 5,000 ft/min.
   5. Adhesive: UL listed waterproof type compliant with ASTM C916.
   6. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.

C. Field Applied Jackets (For Interior Applications):
   1. All longitudinal seams shall be located on bottom of ductwork
   2. PVC Plastic: Johns Manville Zeston 2000. One piece molded type fitting covers and jacketing material, gloss white. Connect with tacks and pressure sensitive color matching vinyl tape.

2.3 PIPE INSULATIONS

A. Glass Fiber: Molded fibrous glass pipe insulation shall comply with the requirements of ASTM C 547 and meet ASTM C 585 for sizes required in the particular system. For all fluid distribution temperatures below 45°F the system shall be of a wicking type.
   1. Non-Wicking:
      a. Manufacturers:
         1) Johns Manville Micro-Lok plain with PVC cover Meeting ASTM C547; or FSK faced Micro-Flex (pipe sizes larger than 18”)
         2) Knauf
      b. Applications: Insulation of piping up to 18” in diameter and 3” thick insulation.
      c. 'K' Value: 0.23 at 75°F.
      d. Maximum Service Temperature: 850°F.
      e. Vapor Retarder Jacket: AP-T PLUS white kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP jacket with outward clinch expanding staples or vapor barrier mastic as needed.

2. Wicking: Owens Corning VaporWick Meeting ASTM C547; Rigid Molded Noncombustible:
   a. 'K' Value: 0.23 at 75°F.
   b. Maximum Service Temperature: 850°F.
   c. Jacket: Polymer facing with factory-applied adhesive closure to provide positive mechanical and vapor sealing of longitudinal seams.

B. Rigid polyisocyanurate foam: HiTHERM HT-300.
1. 'K' Value: 0.165 at 75°F (24°C)
2. Maximum Continuous Service Temperature: 300°F.
3. Vapor Retarder Jacket: Saran 540/SSL or Mylar laminate.

C. Hydrous Calcium Silicate: Johns Manville Thermo-12/Gold, ASTM C533; Rigid Molded Pipe:
1. 'K' Value: 0.40 at 300°F.
2. Maximum Service Temperature: 1,200°F.
3. Compressive Strength (block): Minimum of 200 psi to produce 5% compression at 1½" thickness.
4. Tie Wire: 16 gauge stainless steel with twisted ends on maximum 12" centers.

D. Flexible Elastomeric Closed Cell Thermal Insulation: Armacel, Rubatex k-flex ECO, closed-cell, halogen free, elastomeric insulation. Comply with ASTM-C177, ASTM E 84 and UL 181.
1. 'K' Value: 0.27 at 75°F.
2. Density: 3.0 to 6.0 lbs./cu.ft.
3. Maximum Service Temperature: 260°F.
4. Seal all seams and joints with contact adhesive.

E. Field Applied Jackets (For Interior Applications):
1. All longitudinal seams shall be located on bottom of pipes.
2. PVC Plastic: Johns Manville Zeston 2000. One piece molded type fitting covers and jacketing material, gloss white. Connect with tacks and pressure sensitive color matching vinyl tape.
3. Aluminum Jacket: 0.016" thick sheet, [smooth/embossed] finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.
4. Secure aluminum jackets with 3/8" or ½" stainless steel bands on 12" centers.

F. Field Applied Jackets (For Exterior Applications):
1. All longitudinal seams, on horizontal pipe runs, shall be installed on the bottom of pipes.
2. Aluminum Jacket: 0.016" (minimum) thick sheet, [smooth/embossed] finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.
3. Aluminum jackets with ⅜" or ½" stainless steel bands on 12" centers.
4. Manufacturers: Pabco, Childers, RPR, or approved equal.

G. Removable Covers:
1. Provide removable covers on pumps, valves, air separators, vents, fittings, flanges, strainers, traps, etc., where periodic maintenance or removal of insulation may is required.
2. Use of premolded fittings with PVC covers is acceptable.
3. Use of lace-on type insulating blankets is acceptable.

2.4 EQUIPMENT INSULATIONS

A. Flexible Fiberglass Blanket: Johns Manville Microlite Type 75 Flexible Blanket:
1. 'K' Value: ASTM C518, 0.27 Btu•in./(hr•ft²•ºF) at 75°F installed full thickness.
2. Maximum Service Temperature: 250°F.

3. Density: 0.75 lb/cu ft.
4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.

B. Rigid Fiberglass Board: Johns Manville Mat-Faced Micro-Aire Rigid Board:
1. 'K' Value: ASTM C518, 0.23 Btu•in./(hr•ft²•ºF) at 75°F.
2. Maximum Service Temperature: 250°F.
3. Density: 3.0 lb/cu ft.
4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.
5. Facing: 1” galvanized hexagonal wire mesh stitched on one face of insulation. (Optional).

C. Cellular Glass: Pittsburgh-Corning Foamglas Meeting ASTM C552; Cellular Glass Thermal Insulation:
1. 'K' Value: 0.35 at 75°F.
2. Density: 8.0 lb/cu. ft.
3. Maximum Service Temperature: 900°F.

D. Hydrous Calcium Silicate: Johns Manville Thermo-12/Gold Meeting ASTM C533; Rigid Molded Block; Asbestos-Free Coded Throughout Material Thickness and Maintained Throughout Temperature Range:
1. 'K' Value: 0.40 at 300°F.
2. Maximum Service Temperature: 1,200°F.
3. Compressive Strength (block): Minimum of 200 psi to produce 5% compression, based on 1½" thickness.
4. Securement: Insulation shall be securely banded in place, tightly butted, joints staggered and secured with 16 gauge galvanized or stainless steel wire or ½" x .015" galvanized steel bands on 12” maximum centers for large areas.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that piping and ductwork has been tested for leakage in accordance with specifications before applying insulation materials. All piping and ductwork shall be inspected by University of California Berkeley Representative prior to installation of insulation. Any insulation applied prior to inspection shall be removed and new insulation applied at no additional cost to University of California Berkeley. Notify University of California Berkeley’s Representative five (5) working days prior to insulation installation.

B. Verify that all surfaces are clean, dry and free of foreign material.

3.2 INSTALLATION

A. General:
1. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
2. Remove and replace any insulation that has become wet or damaged during the construction

process.

3. Continue insulation and vapor barrier at penetrations and duct supports, except where prohibited by code. Instances where this is required include:
   a. Ductwork support angle or struts. To prevent crushing of low density insulation, provide separator or high density insulation at point of support. Vapor barrier to continue unbroken at point of support.

B. Ductwork –Insulation on the Duct Exterior:
1. Provide insulated ductwork conveying air below ambient temperature (below room temperature) with vapor retardant jacket. Seal all vapor retardant jacket seams and penetrations with UL listed tapes or vapor retardant adhesive.
2. Provide insulated ductwork conveying air above ambient temperature (above room temperature) with or without vapor retardant jacket. Where service access is required, bevel and seal ends of insulation.
3. All exposed exterior metallic ductwork exposed or covered with cladding is to be built with a crown to shed moisture.
4. Continue insulation through walls, sleeves, hangers, and other duct penetrations except where prohibited by code.
5. The insulation shall be firmly wrapped around the ducts with all joints lapped a minimum of 2". The vapor barrier shall be sealed with FSK or metallic pressure sensitive tape. Installed thickness shall not exceed 25% compression. Secure insulation with 16 gage soft annealed black or galvanized wire spaced not more than 12" on centers for straight runs of duct and 6" on centers for elbows and fittings
6. The underside of duct work 24” or greater in width shall be secured with mechanical fasteners and speed clips spaced approximately 18” on center. The protruding ends of the fasteners shall be cut off flush after the speed clips are installed, and then, when required, sealed with the same tape as specified above.
7. For ductwork exposed in mechanical equipment rooms below 7’ or in finished spaces, finish with Johns Manville Zeston 2000 PVC jacket or aluminum or stainless steel jacket.
8. For interior vapor/moisture duct applications, install fiberglass insulation unless specifically indicated otherwise on drawings. Install to meet manufacturer’s requirements and as required by local code authorities.

C. Duct Liner:
1. Adhere insulation to sheet metal with a UL listed adhesive. Adhesive shall be applied to the sheet metal with a minimum coverage of 90%.
2. Secure insulation with mechanical liner fasteners as indicated by SMACNA or manufacturer. Pin length should be as recommended by the liner manufacturer.
3. All exposed edges of the liner must be factory or field coated. Unless factory coated, all transverse edges and longitudinal joints of the duct liner shall be coated. For systems operating at 4,000 fpm or higher, a metal nosing must be installed in all liner leading edges.
4. Repair liner surface penetrations with UL listed adhesive.
5. Duct dimensions indicated on plans are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

D. Piping Insulation:
1. Locate insulation and cover seams in least visible locations unless otherwise specified.
2. Neatly finish insulation at supports, protrusions, and interruptions.
3. Provide insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self sealing laps. Insulate complete system.
4. For insulated pipes conveying fluids above ambient temperature, secure jackets with self sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions.
5. Provide insert between support shield and piping on piping 1½” diameter or larger. Fabricate

of Johns Manville Thermo-12, or other heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:

a. 1½" to 2½" pipe size 10" long
b. 3" to 6" pipe size 12" long
c. 8" to 10" pipe size 16" long
d. 12" and over 22" long

6. Use of metal saddles is acceptable as specified in Section 230500. Fill interior voids with segments of insulation matching adjoining pipe insulation.
7. Use of pipe hangers designed as an insulation coupling is acceptable in lieu of saddles and other devices. Klo-Shure coupling or equal.
8. For pipe exposed in mechanical equipment rooms or in finished spaces below 7 feet above finished floor, finish with Johns Manville Zeston 2000 PVC jacket and fitting covers, or aluminum or stainless steel jacket.
9. Where pumps, valves, strainers, etc., with insulation require periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage. Use of premolded covers or lace-on type insulation blankets is required.
10. For exterior applications:
    a. Provide weather protection jacket. Insulated pipe lengths, pumps, fittings, joints, and valves shall be covered with aluminum jacket or stainless steel jacket. Jacket seams shall be located on bottom side of horizontal piping. All lateral joints shall be caulked with a minimum 20-year silicone sealant (clear). All longitudinal joints, except those at the bottom of a horizontal pipe run, shall be caulked with a minimum 20-year silicone sealant (clear).
    b. Apply weather-resistant protective finish such as WB Armaflex to flexible elastomeric insulation. Insulation seams shall be located on the bottom side of horizontal piping. All lateral and longitudinal joints to be sealed with low V.O.C., UV inhibitive adhesive, such as Armaflex 520 BLV adhesive.
11. When maintenance or service access for equipment will result in foot traffic over floor mounted insulated piping the contractor is to fabricate a permanent removable walkway to prevent damage to the piping and insulation.

E. Equipment Insulation:
1. See Piping Insulation above for additional requirements.
2. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands, per manufacturer's recommendations.
3. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retardant cement.
4. Provide insulated dual temperature equipment or cold equipment containing fluids below ambient temperature with vapor retardant jackets.
5. For insulated equipment containing fluids above ambient temperature, provide jacket with or without vapor barrier.
6. Cover insulation with metal mesh and finish with heavy coat of insulating cement, mastic, or aluminum jacket as indicated in the drawings.
7. For equipment in mechanical equipment rooms or in finished spaces, finish with Johns Manville Zeston 2000 jacketing and fitting covers or aluminum or stainless steel jacketing.
8. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.

9. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage. Use of lace-on type insulation blankets is acceptable.

3.3 DUCTWORK INSULATION SCHEDULE

A. All insulation thicknesses shall meet or exceed state energy code and mechanical code requirements as noted below. Minimum thermal resistance in range of 4.2 to 4.6 per inch of thickness. Insulation thicknesses are based on fiberglass insulation and may be adjusted for equivalent insulation values for materials with superior "K" factors.

B. All air distribution system ducts and plenums, but not limited to, building cavities, mechanical closets, air handler boxes, and support platforms uses as ducts or plenums, shall be installed, sealed , and insulated to meet the requirements of the code. Portions of supply-air and return-air ducts conveying heated or cooled air located in one or more of the following spaces shall be insulated to a minimum level of R-8.
   1. In a space between the roof and an insulated ceiling.
   2. In a space directly under a roof with fixed vents or opening to the outside or unconditioned spaces
   3. In an unconditioned crawlspace.
   4. In other unconditioned spaces.

C. Flexible Fiberglass

	THICKNESS (inches)	FINISH	REMARKS
Supply ducts within building envelope	1-1/2	FSK	
Supply or return duct installed as exposed ductwork in the occupied space.	0		Except where noted on drawings for acoustical reasons
Return ducts within building envelope	1-1/2	FSK	
Supply and return ductwork located as described in 3.3.B above.	2		

D. Thicknesses in the above table shall have insulation values as follows: 1 1/2 "= R-6, 2" = R-8.0, 3" = R-12. Greater thicknesses are permitted to achieve identical values if space constraints allow.

E. Duct Liner:

	THICKNESS (inches)	FINISH	REMARKS
Where indicated	1" unless otherwise noted on plans	Linacoustic R-300	
Within 20' of Air Handling Unit in supply and return ducts	1	Linacoustic R-300	

3.4 PIPING INSULATION SCHEDULE

A. All insulation thicknesses shall meet or exceed state energy code requirements as noted below. Increase thickness ½" if exposed to exterior ambient air. Minimum thermal resistance in range of 4.2 to 4.6 per inch of thickness. Insulation thicknesses are based on fiberglass insulation and may be adjusted for equivalent insulation values for materials with superior "K" factors.

B. Fiberglass Insulation

	PIPE SIZE (inches)	THICKNESS (inches)	REMARKS
Heating water supply and return systems and fittings	Up to 1-½ 1-½ and over	1 ½ 3	
Chilled water supply and return systems and fittings. (44°F and above)	Up to 1 ½ 1 ½ and over	1 ½ 2	
Misc. drains from electric water coolers, ice machines, etc.	All Sizes	1	

C. Elastometric Foam (Closed Cell):

	PIPE SIZE (inches)	THICKNESS (inches)	REMARKS
Condensate drain pipes	All Sizes	1/2	
Refrigerant suction and hot-gas piping	All Sizes	3/4	Provide aluminum jacket on exterior insulated piping.
Refrigerant liquid piping	All Sizes	3/4	Provide on all piping concealed in structure and close proximity to likely human contact.

3.5 EQUIPMENT INSULATION SCHEDULE

A. Flexible Fiberglass Blanket

	THICKNESS (inches)	REMARKS
Expansion/Compression tanks	1 ½	
Air separators	1 ½	
Chilled water pump bodies	1 ½	
Hot water storage tanks	1 ½	

B. Rigid Fiberglass Board:

	THICKNESS (inches)	REMARKS
Heating hot water pumps	2	

C. Flexible Elastomeric Foam (Closed Cell):

	THICKNESS (inches)	REMARKS
Chilled water pump bodies	1 ½	

D. Calcium Silicate:

	THICKNESS	REMARKS

	(inches)	
Engine exhaust mufflers and piping	4	Provide jacketing

END OF SECTION

SECTION 230900
INSTRUMENTATION AND CONTROL

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 230500 - Basic Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include but not necessarily be limited to the following:
   1. Submit shop drawings of the entire control system components fully coordinated with major equipment suppliers' requirements. Provide proposed programming logic sequences of control functions on each system.
   2. Installation of control components other than valves, dampers and sensing wells as required for a complete and workable system.
   3. This Contractor shall furnish, install and coordinate the interlock and control wiring as specified and/or required for a complete and workable control system.
   4. Controls dampers are specified and furnished in Section 233113 of these specifications. Provide damper actuators, wiring and conduit as required to operate all dampers as shown.
   5. Upon completion of the installation, data entry and programming, provide complete validation and adjustment of specified control system through period of testing and University of California Berkeley's acceptance. The control contractor shall perform a point-to-point check out of all newly installed points to verify point existence, proper end to end connection and correct SI units with the University of California Berkeley's Representative.
   6. The entire program and sequence of operation with the final points list shall be verified by the Control Contractor, the University of California Berkeley's Representative, and signed by both parties. A copy of the final program, sequence of operation, and points list shall be submitted to the Engineer for approval and inclusion with the operation and maintenance manuals.
   7. University of California Berkeley training on operation of the control system.
   8. One-year warranty on workmanship and materials.
   9. Interlocking of electrical systems and motors as shown on Drawings, except where specifically shown on electrical drawings.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Sources of 120-volt electrical power as indicated on the Electrical drawings and specifications for control system components furnished by this section. The controls contractor shall be responsible for all additional electrical distribution from these connection points to the control panels and other controls devices.

B. Provide certificates of calibration for all sensors required for control and monitoring including temperature and pressure.

1.4 QUALITY ASSURANCE

A. Manufacturers are subject to compliance with requirements contained herein and on the Drawings. Control systems shall be provided by one of the following manufacturers, no other manufacturers will be considered for this work:
   1. Automated Logic
   2.

B. Electrical Standards: Provide electrical products that have been tested, listed, and labeled by Underwriter Laboratories (UL) and comply with NEMA standards.

1.5 SUBMITTALS

A. Prior to construction submit for approval the following materials:
   1. Wiring diagrams.
   2. Sequence of operation, control logic and control points list.
   3. Controls service contract.
   4. Operations and maintenance manuals.
   5. Temperature sensors, with bypass buttons where shown.
   6. Pressure sensors.
   7. Duct smoke detectors.
   8. Actuators.
   9. Control valves (Note that service valves are specified in Section 230500 of these documents)
   10. Dampers (Note that dampers are specified in Section 233113 of these documents)
   11. Miscellaneous Devices.
   12. Airflow measuring elements.
   13. Control panels and controllers.
   14. Other components such as relays, solenoid valves, restrictors, etc., complete material submittal.
   15. Parts list for each system control.
   16. Submittal shall include name of local vendor, 24hr emergency service phone number, and name of contact person.

1.6 LAYOUT DRAWINGS

A. Prior to the start of installation, submit to the University of California Berkeley's Representative for approval layout drawings coordinated with all building systems, and lists of materials, fixtures, and equipment to be incorporated in the work. The layout drawings shall consist of plans and diagrams to show clearly the locations and size of major items of equipment and controls. The general arrangement of the systems to be installed, coordination with other work, and all requirements for installation shall be met.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged components; remove from project site.

PART 2 - PRODUCTS

2.1 GENERAL

A. All components used shall be serviceable, repairable, and replaceable by qualified temperature control technicians using non-proprietary parts, tools, and instruments.

2.2 IDENTIFICATION

A. All control devices shall have identification means attached to the front or most visible surface. Room thermostat having no special purpose other than to control local temperature shall not be identified.

B. Small Devices: Milled laminate plates secured with epoxy cement.

2.3 FIELD DEVICES

A. Provide instrumentation as required for monitoring, control or optimization functions. All devices and equipment shall be approved for installation in the City of Berkeley and University of California Berkeley.

B. Room Temperature Sensors/Thermostats

1. Room sensor with backlit display and graphical menus.

Temperature monitoring range	+20/120°F (-13° to 49°C)
Output signal	Changing resistance
Accuracy at Calibration point	±0.5°F (+/- 0.3°C)
Set Point and Display Range	55° to 95° F (13° to 35°C)

2. Liquid immersion temperature:

Temperature monitoring range	+30/250°F (-1°/121°C)
Output signal	Changing resistance
Accuracy at Calibration point	±0.5°F (+/-0.3°C)

3. Duct (single point) temperature:

Temperature monitoring range	+20/120°F (-7°/49°C)
Output signal	Changing resistance
Accuracy at Calibration point	±0.5°F (+/-0.3°C)

4. Duct Average temperature:

Temperature monitoring range	+20° +120°F (-7°/+49°C)
Output signal	4 – 20 mA DC
Accuracy at Calibration point	+0.5°F (+0.3°C)
Sensor Probe Length	25’ L (7.3m)

5. Outside air temperature:

Temperature monitoring range	-58°±122°F (-50°C to +50°C)
Output signal	4 – 20 mA DC
Accuracy at Calibration point	±0.5°F (+/-0.3°C)

6. Liquid Differential Pressure Transmitter

Ranges	0-5/30 inches H2O 0-25/150 inches H2O 0-127/750 inches H2O
Output	4 – 20 mA DC
Calibration Adjustments	Zero and span
Accuracy	+-0.2% of span
Linearity	+-0.1% of span
Hysteresis	+-0.05% of span

7. Differential pressure:
   a. Unit for fluid flow proof shall be Penn P74.

Range	8 to 70 psi
Differential	3 psi
Maximum differential pressure	200 psi
Maximum pressure	325 psi

   b. Unit for air flow shall be Siemens Building Technologies SW141.

Set point ranges:	0.5” WG to 1.0” WG 1.0” WG to 12.0” WG	(124.4 to 248.8 Pa) (248.8 to 497.6 Pa)

8. Static pressure sensor:

Range	0 to .5” WG (0 to 124.4 Pa) 0 to 1” WG (0 to 248.8 Pa) 0 to 2” WG (0 to 497.7 Pa) 0 to 5” WG (0 to 1.2 kPa) 0 to 10” WG (0 to 2.5 kPa)
Output signal	4 – 20 mA VDC
Combined static error	0.5% full range
Operating Temperature	-40° to 175°F (-40°C to 70.5°C)

9. Air Pressure Sensor:

Range	0 to 0.1 in. water (0 to 24.9 Pa) 0 to 0.25 in. water (0 to 63.2 Pa) 0 to 0.5 in. water (0 to 124.5 Pa) 0 to 1.0 in. water (0 to 249 Pa) 0 to 2.0 in. water (90 to 498 Pa) 0 to 5.0 in. water (0 to 1.25 kPa) 0 to 10.0 in. water (0 to 2.49 kPa)
Output signal	4 to 20 mA
Accuracy	+1.0% of full scale

10. Humidity Sensors:

Range	0 to 100% RH
Sensing Element	Bulk Polymer
Output Signal	4 – 20 mA DC
Accuracy	At 77°F (25°C) $\pm$ 2% RH

11. Insertion Flow Meters (Equal to Onicon Series F-1200)

Sensing Method	Impedance Sensing
Accuracy	± 2% of Actual Reading
Maximum Operating Pressure	400 PSI
Output Signal	4 – 20 mA
Bi-directional	Where required

12. Pressure to Current Transducer

Range	3 to 15 psig (21 to 103 kPa) or 3 to 30 psig (21 to 207 kPa)
Output signal	4 – 20 mA
Accuracy	± 1% of full scale (± 0.3 psig)

13. Control Valves (all control valves shall have electric actuators).

Electric Control	
Rangeability	40:1
Flow Characteristics	Modified. Equal percentage
Control Action	Normal open or closed as selected
Medium	Steam, water, glycol
Body Type	Screwed ends 2" and smaller, flanged Valves 2 ½ and larger
Body Material	Bronze for cast bodies Brass acceptable for forged valves
Body Trim	Bronze for cast bodies Brass acceptable for forged valves
Stem	Stainless steel for globe valve Brass acceptable for ball valves
Actuator	0-10 VDC, 4-20 MA or 2 position 24 VAC/120VAC

a. All automatic temperature control valves in water lines shall be provided with characterized throttling plugs or ball and shall be sized for minimum 25% of the system pressure drop or 5 psi, whichever is less.
b. Positive positioning relays shall be provided on pneumatic control when required to provide sufficient power for sequencing.
c. Two position valves shall be line size.
d. Control valves shall be two-way or three-way pattern as shown, constructed for tight shut-off and shall operate satisfactorily against system pressures and differentials. Valves shall be constructed to satisfactorily operate and close against a maximum pump head pressure plus 50%. Valves with sizes up to and including 2" shall be "screwed"; 2-½" and larger valves shall be "flanged" configuration. Control valves shall be sized for maximum pressure drop of 5.0 psig at rated flow (except as noted).
e. Valve design shall produce a true equal percentage flow characteristic. Globe valve or characterized ball valves are acceptable in the ½" to 2" range size.
f. See Section 232113 for additional valve specifications including acceptable manufacturers or packagers of valve/actuator assemblies.
g. Valve actuators shall be rated for at least 125% of the motive power necessary to operate the valves over their full range of operation against the total and differential pressures shown, including torque required to seat or unseat resilient seated butterfly valves.

14. Actuators
    a. Actuators shall be Underwriters Laboratories Listed under Standard 873 or Canadian Standards association Class 4813 02 and have NEMA type 2 housings -- water and moisture resistant. Spring return actuators mounted near outdoor air streams shall have a semi-permeable membrane to remove moisture from inside actuator.
    b. Actuators shall be applied according to the manufacturer's application instructions. See execution for additional requirements.
    c. Each actuator shall be factory tested before shipment at 110% of guaranteed minimum torque.
    d. Damper actuators shall be rated and tested for at least 125% of the maximum motive power necessary to operate against the pressure shown.
    e. Overload Protection: Actuators shall provide protection against actuator burnout using an internal current limited circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation or use of magnetic clutches are not acceptable.
    f. Actuators shall be properly sized to provide sufficient torque to position the damper or valve throughout its operating range.
    g. For power failure and safety applications a mechanical spring return mechanism shall be used. Capacitors or other non-mechanical forms of fail-safe are not acceptable except a "central emergency backup power source".
    h. Actuators shall be direct coupled (over the shaft) enabling them to be mounted directly to the damper shaft without the need for connecting linkage. The clamp holding the damper shaft shall use a V-bolt and toothed V-clamp causing a cold-weld effect for positive griping. Single bolt or setscrew type fasteners are not acceptable.
    i. Actuators shall be capable of being mechanically and electrically paralleled to increase torque where required.
    j. Spring return actuators should be capable of mounting directly onto a jackshaft up to 1.05" diameter.
    k. Provide spring return actuators for 100% Outside Air Unit economizer dampers.
    l. Provide spring return and end switches on all 100% OSA dampers.

C. Terminal box actuators
    1. When the actuator is at either the full open or full closed position, continual pulsing or actuator against end stops (end stop dithering) shall not occur. Actuator shall be constructed to de-energize or stall against the end stop.

2.4 MISCELLANEOUS DEVICES

A. Freezestats:
    1. Install freezestats as indicated on the plans and provide protection for every square foot of coil surface area with one linear foot of element per square foot of coil.
        a. Upon detection of low temperature, the freezestats shall stop the associated supply fans and return the automatic dampers to their normal position. Provide manual reset.

B. Firestats:
    1. Provide manual reset, fixed temperature line voltage type with a bi-metal actuated switch.
    2. Switch shall have adequate rating for required load.

C. Current Sensing Relay:
1. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
2. Adjust the relay switch point so that the relay responds to motor operation under load as an "on" state and so that the relay responds to an unloaded running motor as an "off" state. A motor with a broken belt is considered an unloaded motor.
3. Provide for status device for all fans and pumps.

D. Carbon Monoxide Sensors
1. General: Sensor for on-off control of exhaust systems.
2. Sensor: Digitally profiled metal oxide semiconductor (MOS). Modular replaceable sensor element with a minimum 5-year life.
3. Detection range: 0 to 200 ppm. Relay setpoint: 35 ppm
4. Relay Output: N.O. Form A (SPST) 5 A @ 120/240AC for use with normally closed fan motor contactor.
5. Analog Output: 4-20 mA.
6. Coverage: 5000 sq.ft.
7. Manufacturer: Intec Controls

E. Carbon Dioxide Sensors
1. General: Sensor for IAQ demand control.
2. Sensor: Non-dispersive infrared sensing technology. Sensor chamber shall be manufacturer with a non-corrosive material (i.e. gold plating) that does not affect sampling.
3. Detection range: 0 to 3000 ppm. +/- 5% and +/- 50 ppm. Annual drift 20 ppm nominal
4. Analog Output: 4-20 mA, 0-10 Vdc

F. Airflow Measuring Arrays
1. Fan flow measurement: Supply and return fan inlets shall be provided with airflow measuring devices. This device shall not obstruct the inlet cone to the fan, nor add any pressure losses or sound level increases to the fan performance. The unit shall be AMCA lab tested for accuracy of 3%±.
2. Outside Air Measurement: Provide a minimum outside airflow measuring station in a straight duct section upstream from the minimum outside air dampers and interfacing control for providing an electronic signal for use by the control contractor in controlling a minimum outside airflow. On outdoor mounted units, outside airflow measurement station is to be factory mounted on the intake side of the outside air intake.
3. Sensor Performance:
   a. Fan Installation:
      1) Installed airflow accuracy: +/- 3% to 10% of reading with +/- 0.25% repeatability.
      2) Sensor probe performance: +/- 2% of reading, 0-5000 fpm, 0.15°F temperature accuracy +/-.
   b. Outside Air/duct Installation:
      1) Installed airflow accuracy: +/- 2% of reading with +/- 0.25% repeatability.
      2) Sensor probe performance: +/- 2% of reading, 0-5000 fpm, 0.15°F temperature accuracy +/-.
4. Transmitter:
   a. Flow measuring array to include a transmitter for flow and temperature analog output signal for the building energy management system in either 4-20 mA or 0-10VDC. Coordinate signal output with controls installer.
   b. Transmitter to include an analog airflow gauge to provide direct analog readout in cfm. Mount on the outside of the 100% Outside Air Unit if 100% Outside Air Unit is

located in a mechanical room. Mount in a NEMA 3R control cabinet if located outside.

c. Device to provide switch selectable Modbus or Johnson N2 outputs.

5. Airflow measuring station to be by Ebtron, KURZ, Fluid Components and Sierra Instruments or equal.

2.5 PRESSURE INDEPENDENT FLOW CONTROL VALVES (100% OUTSIDE AIR UNIT CHILLED WATER COIL CONTROL VALVES)

A. Modulating control valves shall be pressure independent. The flow rate through the valve shall not vary more than + or - 5% due to system pressure fluctuations across the valve in the selected operating range. Controls contractor shall furnish the valve actuator. The actuator shall be shipped to valve manufacturer for mounting and calibration.

B. All 100% Outside Air Unit coils shall utilize proportional control electronic valves.

C. The rangeability of the valve shall be 100:1 (minimum).

D. The valve bodies shall be of cast iron and rated for 150 PSI working pressure. All internal parts shall be stainless steel, teflon, brass, or bronze. Valve flow characteristics shall be able to be changed without removing the valve from the piping system.

E. Balancing valves shall not be required where pressure independent control valves are installed. Flow performance curves shall be provided with each valve.

F. The actuator shall modulate the control valve from 0 to 100% full rated flow.

G. Three pressure/temperature ports (Pete's Plugs) shall be installed at the factory in each valve. Two ports shall be used to measure inlet and outlet pressure to the valve. The third port is used to measure internal pressure within valve.

H. Manufacturer: Delta P Valve by Flow Control Industries, Inc., Belimo PICCV. Valves and actuator shall be provided by controls contractor and installed by mechanical contractor.

2.6 PRESSURE INDEPENDENT CHARACTERIZED CONTROL VALVES PICCV (VAV BOX REHEAT COIL CONTROL VALVES)

A. Electronic valves at all variable air volume terminals reheat coils shall be spring return actuator with MFT 0-10VDC control. . The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory.

B. The valve bodies shall be of forged brass body and rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and TEFZEL characterizing disc.

C. All actuators shall be electronically programmed by use of external computer software for the adjustment of flow. Programming using actuator mounted switches or multi-turn actuators are not acceptable.

D. Balancing valves shall not be required where these control valves are installed. Flow performance curves shall be provided with each valve.

E. Pressure/temperature ports (Pete's Plugs) shall be installed at the factory in each valve larger

than 1". Two ports shall be used to measure inlet and outlet pressure to the valve.

F. Manufacturer: Delta Control Products AutoTouch, Belimo PICCV, Valves shall be provided by controls contractor and installed by mechanical contractor.

G. 3-way coils ONLY: Belimo 3-way spring return, MFT proportional control "Characterized Control Valves" combined with Griswold's Isolator R with automatic flow cartridge, integrated isolation ball valve, and two T/P test ports. Belimo 3-way valve shall be provided by controls contractor installed by mechanical contractor. Griswold valve shall be provided and installed by mechanical contractor.

2.7 WIRE AND CABLE, TRANSFORMERS AND TERMINAL BLOCKS

A. Wire and Cable General: Wire and cable jacket material shall be flame retardant PVC, or fluoraopolymer as required for the application per NFPA 70. Multiconductor cable shall have an outer jacket. Wire and cable not indicated as GFE shall be provided.

B. Control Wiring
1. Digital Functions: Control wiring for digital functions shall be 18 AWG minimum with 600-volt insulation.
2. Analog Functions: Control wiring for analog functions shall be 18 AWG minimum with 600-volt insulation, twisted and each pair shielded, 2, 3, or 4 wire to match analog function hardware.

C. Sensor Wiring: Sensor wiring shall be 20 AWG minimum twisted and shielded, 2, 3, or 4 wire to match analog function hardware.

D. Terminal Blocks: Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

E. Transformer: Step-down transformer shall be utilized where control equipment operates at lower than line circuit voltage. Transformer, other than transformers in bridge circuits, shall have primaries wound for the voltage available and secondaries wound for the correct control circuit voltage. Transformer shall be sized so that the connected load is 80 % of the rated capacity or less. Transformer shall conform to UL 508 and NEMA ST1.

F. Nonconducting Wiring Duct: UL listed nonconducting wiring duct in control panels shall have slotted sides, snap-on duct covers, fittings for connecting ducts, mounting clips for securing ducts, and wire-retaining clips. Wire shall be sequentially labeled on both ends for identification with point address.

2.8 DDC CONTROLS

A. General: This specification defines the minimum equipment and performance requirements for a Direct Digital Control (DDC) building control system

B. Scope of Work: The Control Contractor shall furnish and install all equipment, accessories, wiring and instrument piping required for a complete and functioning system.
1. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and shall not be custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use.
2. The building control system shall possess a fully modular architecture, permitting

expansion through the addition of more stand-alone control units, temperature sensors, pressure sensors, actuators, and/or operator terminals.

3. Supervision and checkout of the system shall be by local branch engineers and technicians directly employed by the Control Contractor.

C. Warranty: The building control system, including all hardware and software components shall be warranted for a period of one year following the date of beneficial use. Any manufacturing defects arising during this period shall be corrected without cost to the University of California Berkeley

D. Building Control System: The building control system specified herein shall be a Direct Digital Control system which can, without additional equipment, perform all of the automatic temperature control and energy management functions as required on the accompanying plans. Direct Digital Control shall be defined as a control technique through which the process variable is continuously monitored by a digital computer which accomplished loop control by calculating a control solution for output to a control device.

E. The system, as specified, shall independently control the building's HVAC equipment to maintain a controlled environment in an energy efficient manner. The building operator shall communicate with the system and control the sequence of operation to maintain 78 degrees Fahrenheit during the summer (user defined period) and 70 degrees Fahrenheit during the winter (user defined period).

2.9 GENERAL PRODUCT DESCRIPTION

A. The Facility Management System shall be capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection and archiving.

B. The facility management system shall consist of the following:
1. Standalone DDC panels
2. Standalone application specific controllers (ASCs)
3. Portable Operator's Terminals
4. Personal Computer Operator Workstations.

C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, standalone DDC panels, and operator devices.

D. System architectural design eliminate dependence upon any single device for alarm reporting and control execution. Each DDC panel shall operate independently by performing its own specified control, alarm management, operator I/O, and historical data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

E. Standalone DDC panels shall be able to access any data from, or send control commands and alarm reports directly to any other DDC panel or combination of panels on the network without dependence upon a central processing device. Standalone DDC panels shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

2.10 COMMUNICATIONS

A. Inherent in the system's design shall be the ability to expand or modify via an auto-dial telephone line modem connections.

B. Dial-Up Communications: Auto-dial/auto-answer communications shall be provided to allow standalone DDC panels to communicate with remote operator stations on an intermittent basis via telephone lines.
   1. Dial-Up Standalone DDC Panels: Auto-Dial panels shall automatically place calls to workstations to report critical alarms, or to upload trend and historical information for archiving.
      a. Standalone DDC Panels shall analyze and prioritize all alarms to minimize the initiation of calls. Non-critical alarms shall be buffered in memory and reported as a group of alarms, or until an operator manually requests an upload of all alarms.
      b. The auto-dial program shall include provisions for handling busy signals, "no-answers", and incomplete data transfers. Default devices shall be called when communications cannot be established with primary devices.

2.11 MODEM CHARACTERISTICS

A. dial-up communications shall make use of 52k baud modems and voice grade telephone lines. Each standalone DDC panel may have its own modem, or a group of standalone DDC panels may share a modem.

2.12 STAND-ALONE DDC PANELS

A. General: Standalone DDC panels shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each standalone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this specification and the attached point list.

B. Memory: Each DDC panel shall have sufficient memory to support its own operating system and data bases including:
   1. Control processes
   2. Energy Management Applications
   3. Alarm Management
   4. Historical/Trend Data for all points
   5. Maintenance Support Applications
   6. Custom Processes
   7. Operator I/O
   8. Dial-Up Communications
   9. Manual Override Monitoring

C. Point types: Each DDC panel shall support the following types of point inputs and outputs:
   1. Digital Inputs for status/alarm contacts
   2. Digital Outputs for on/off equipment control
   3. Analog Inputs for temperature, pressure, humidity, flow, and position measurements
   4. Analog Outputs for valve and position control, and capacity control of primary equipment
   5. Pulse Inputs for pulsed contact monitoring

D. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of software applications, workstation hardware, field controllers, sensors, and actuators.

E. The system architecture shall support 10% expansion capacity of all types of DDC panels, and all point types included in the initial installation.

F. Serial Communication Ports: Standalone DDC panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices such as industry standard printers, laptop workstations, PC workstations, and panel mounted or portable DDC panel Operator's Terminals. Standalone DDC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or network terminals.

G. Hardware Override Switches: As indicated in the point schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC panel via local, point discrete, onboard hand/off/auto operator override switches for binary control points and gradual switches for analog control type points. These override switches shall be operable whether the panel is powered or not.

H. Hardware Override Monitoring: DDC panels shall monitor the status of position of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited. DDC panels shall also collect override activity information for daily and monthly reports.

I. Local Status Indicator Lamps: The DDC panel shall provide local status indication for each binary input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

J. Integrated On-Line Diagnostics: Each DDC panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. The DDC panel shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each DDC panel, and shall not require the connection of an operator I/O device.

K. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.

L. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shut down of all standalone DDC panels to prevent the loss of database or operating system software. Non-Volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
   1. Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.
   2. Should DDC panel memory be lost for any reason, the user shall have the capability of reloading the DDC panel via the local area network, via the local RS-232C port, or via telephone line dial-in.

2.13 SYSTEM SOFTWARE FEATURES

A. General
   1. All necessary software to form a complete operating system as described in this specification shall be provided.
   2. The software programs specified in this section shall be provided as an integral part of the

DDC panel and shall not be dependent upon any higher level computer for execution.

B. Control Software Description:
   1. Pre-Tested Control Algorithms: The DDC panels shall have the ability to perform the following pre-tested control algorithms:
      a. Two Position Control
      b. Proportional Control
      c. Proportional plus Integral Control
      d. Proportional, Integral, plus Derivative Control
      e. Automatic Control Loop Tuning
   2. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.
   3. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
   4. Powerfail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

C. Energy Management Applications: DDC Panels shall have the ability to perform any or all of the following energy management routines:
   - Time of Day Scheduling
   - Calendar Based Scheduling
   - Holiday Scheduling
   - Temporary Schedule Overrides
   - Optimal Start
   - Optimal Stop
   - Night Setback Control
   - Enthalpy Switchover (Economizer)
   - Peak Demand Limiting
   - Temperature Compensated Load Rolling
   - Fan Speed/CFM Control
   - Outside Air Intake CFM Monitoring
   - Heating/Cooling Interlock
   - Cold Deck Reset
   - Hot Deck Reset
   - Hot Water Reset
   - Compressor Sequencing

   All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Execution portion of this specification.

D. Custom Process Programming Capability: DDC panels shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
   1. Process Inputs and Variables: It shall be possible to use any of the following in a custom process:
      a. Any system-measured point data or status
      b. Any calculated data
      c. Any results from other processes
      d. User-Defined Constants
      e. Arithmetic functions (+,-,*,/, square root, exp, etc.)
      f. Boolean logic operators (and, or, exclusive or, etc.)
      g. On-delay/Off-delay/One-shot timers

2. Process Triggers: Custom processes may be triggered based on any combination of the following:
   a. Time interval
   b. Time of day
   c. Date
   d. Other processes
   e. Time programming
   f. Events (e.g., point alarms)
3. Dynamic Data Access: A single process shall be able to incorporate measured or calculated data from any and all other DDC panels on the local area network.
   a. In addition, a single process shall be able to issue commands to points in any and all other DDC panels on the local are network.
4. Advisory/Message Generation: Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device, buffer the information in a follow-up file, or cause the execution to a dial-up connection to a remote device such as a printer of pager.
5. Custom Process Documentation: The custom control programming feature shall be self-documenting. All interrelationships defined by this feature shall be documented via graphic flowcharts and English language descriptors.

E. Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each DDC panel shall perform distributed, independent alarm analysis and filtering to minimize network traffic, and prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by either operator activity at a PC Workstation or local I/O device.
   1. Point Change Report Description: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.
   2. Prioritization: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Each DDC panel shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point. The user shall also be able to define under which conditions point changes need to be acknowledged by an operator, and/or sent to follow-up files for retrieval and analysis at a later date.
   3. Report Routing: Alarm reports, messages, and files will be directed to a user-defined list of operator devices, or PCs used for archiving alarm information. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.
   4. Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 65-character alarm message to more fully describe the alarm condition or direct operator response. Each standalone DDC panel shall be capable of storing a library of at least 250 Alarm Messages. Each message may be assignable to any number of points in the panel.
   5. Auto-Dial Alarm Management: In Dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.

F. Historical Data and Trend Analysis: A variety of Historical data collection utilities shall be provided to automatically sample, store, and display system date in all of the following ways.
   1. Continuous Point Histories: Standalone DDC panels shall store Point History Files for all analog and binary inputs and outputs. The Point History routine shall continuously and automatically sample the value of all analog inputs at half hour intervals. Samples for all

points shall be stored for the past 24 hours to allow the user to immediately analyze equipment performance and all problem-related events for the past day. Point History Files for binary input or output points and analog output points shall include a continuous record of the last ten status changes or commands for each point.

2. Control Loop Performance Trends: Standalone DDC panels shall also provide high resolution sampling capability with an operator-adjustable resolution of 10-300 seconds in one-second increments for verification of control loop performance.
3. Extended Sample Period Trends: Measured and calculated analog and binary date shall also be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 1 minute of 2 hours, in one-minute intervals, shall be provided. Each standalone DDC panel shall have a dedicated buffer for trend date, and shall be capable of storing a minimum of 5000 data samples.
4. Data Storage and Archiving: Trend data shall be stored at the Standalone DDC panels, and uploaded to hard disk storage when archival is desired. Uploads shall occur based upon either user-defined intervals, manual command, or when the trend buffers become full. All trend data shall be available in disk file form for use in 3rd Party personal computer applications.

G. Runtime Totalization: Standalone DDC panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the Execution portion of this specification.
1. The Totalization routine shall have a sampling resolution of one minute or less.
2. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.

H. Analog/Pulse Totalization: Standalone DDC panels shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g. KWH, gallons, KBTU, tons, etc.).
2. The Totalization routine shall have a sampling resolution of one minute or less.
3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

I. Event Totalization: Standalone DDC panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.
1. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached

2.14 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

A. Each Standalone DDC Controller shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).

B. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

C. Each ASC shall have sufficient memory to support its own operating system and date base including:

1. Control Processes
2. Energy Management Applications
3. Operator I/O (Portable Service Terminal)

D. The operator interface to any ASC point data or programs shall be through any network-resident PC workstation, or any PC or portable operator's terminal connected to any DDC panel in the network.

E. Application Specific Controllers shall directly support the temporary use of a portable service terminal. The capabilities of the portable service terminal shall include but not be limited to the following:
1. Display temperatures
2. Display status
3. Display setpoints
4. Display control parameters
5. Override binary output control
6. Override analog setpoints
7. Modification of gain and offset constants

F. Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller.

G. The differential pressure controller that operates the VFD shall be connected (wired) to the same controller that operates the respective VFD

H. Application Description:
1. VAV Terminal Unit Controllers:
   a. VAV Terminal Unit Controllers shall support, but not be limited to, the control of the following configurations of VAV boxes to address current requirements as described in the Execution portion of this specification, and for future expansion:
      1) Single Duct Only (Cooling Only, or Cooling with Reheat)
      2) Fan Powered (Parallel/Side Pocket, Series/On-Off Logic)
      3) Supply/Exhaust
   b. VAV Terminal Unit Controllers shall support the following types of point inputs and outputs:
      1) Proportional Cooling Outputs
      2) Box Heating Outputs (Proportional, or 1 to 3 Stages)
      3) Fan Control Output (On/Off Logic, or Proportional Series Fan Logic)
   c. VAV box damper or zone re-heat valves are approved for tri-state control. All other strategies shall be proportional control (2-10vdc or 4-20ma) unless approved otherwise prior to bid.
   d. The modes of operation supported by the VAV Terminal Unit Controllers shall minimally include, but not be limited to, the following:
      1) Day/Week Schedules
      2) Comfort/Occupancy Mode
      3) Economy Mode (Standby Mode, Unoccupied, etc)
      4) Temporary Override Mode
   e. Occupancy-Based Standby/Comfort Mode Control: Each VAV Terminal Unit Controller shall have a provision for occupancy sensing overrides. Based upon the contact status of either a manual wall switch or an occupancy sensing device, the VAV Terminal Unit Controller shall automatically select either Standby or Comfort mode to minimize the heating and cooling requirements while satisfying comfort conditions.

f. Occupancy-Based Zone Lighting Control: VAV Terminal Unit Controllers shall provide an auxiliary binary output to serve as the interface to an associated lighting relay. Based upon the status of either an occupancy sensing device, or manual wall switch, the VAV Terminal Unit Controller shall provide a contact output to automatically adjust the lighting level to accommodate occupant requirements while reducing electrical consumption. Standby/Comfort (described in the previous section) and Lighting overrides shall be served by the same occupancy override input.

g. Continuous Zone Temperature Histories: Each VAV Terminal Unit Controller shall automatically and continuously maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.

h. Alarm Management: Each VAV Terminal Unit Controller shall perform it own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

2. 100% Outside Air Unit Controllers:

a. 100% Outside Air Unit Controllers shall support, but no be limited to, the following configurations of systems to address current requirements as described in the Execution portion of this specification.

b. 100% Outside Air Unit Controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.

c. 100% Outside Air Unit controllers shall have a library of control routines and program logic to perform the sequence of operation as specified in the Execution portion of this specification.

d. Occupancy-Based Standby/Comfort Mode Control: Each 100% Outside Air Unit Controller shall have a provision for occupancy sensing overrides. Based upon the contact status of either a manual wall switch or an occupancy sensing device, the 100% Outside Air Unit Controller shall automatically select either Standby or Comfort mode to minimize the heating and cooling requirements while satisfying comfort conditions.

e. Continuous Zone Temperature Histories: Each 100% Outside Air Unit Controller shall automatically and continuously, maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.

f. Alarm Management: Each 100% Outside Air Unit Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

3. Central Plant (LCP) Controllers:

a. LCP controllers shall support the operation of boilers.

b. LCP controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.

c. LCP controllers shall have a built-in status and adjust panel interface to allow for the local adjustment of all setpoints, temporary override of any input or output points and status of any points in alarm.

d. Alarm Management: Each LCP controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

2.15 OPERATOR INTERFACE

A. Basic Interface Description:

1. Command Entry/Menu Selection Process: Operator Workstation interface software shall

minimize operator training through the use of English language prompting, English language point identification, and industry standard PC application software.

2. The operator interface shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device, and "point and click" approach to menu selection. Users shall be able to start and stop equipment of change setpoints from graphical displays through the use of a mouse of similar pointing device.
3. Multiple, Concurrent Displays: The Operator Interface shall provide the ability to simultaneously view several different types of system displays in overlapping windows to speed building analysis. For example, the interface shall provide the ability to simultaneously display a graphic depicting an air handling unit, while displaying the trend graph of several associated space temperatures to allow the user to analyze system performance. If the interface is unable to display several different types of displays at the same time, the EMS contractor shall provide at least two operator stations.
4. Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.
    a. Passwords shall be exactly the same for all operator devices, including portable or panel-mounted network terminals. Any additions or changes made to password definition shall automatically cause passwords at all DDC panels on a network to be updated and downloaded to minimize the task of maintaining system security. Users shall not be required to update passwords for DDC panels individually.
    b. A minimum of five levels of access shall be supported:
        1) Level 1 = Date Access and Display
        2) Level 2 = Level 1 + Operator Overrides
        3) Level 3 = Level 2 + Database Modification
        4) Level 4 = Level 3 + Database Generation
        5) Level 5 = Level 4 + Password Add/Modification
    c. A minimum of 50 passwords shall be supported at each DDC panel.
    d. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device, including portable or panel mounted devices, shall be limited to only those items defined for the access level of the password used to log-on.
    e. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices on-line.
5. Operator Commands: The operator interface shall allow the operator to perform commands including, but not limited to, the following:
    a. Start-up of shutdown selected equipment
    b. Adjust setpoints
    c. Add/Modify/Delete time programming
    d. Enable/Disable process execution
    e. Lock/Unlock alarm reporting for each point
    f. Enable/Disable Totalization for each point
    g. Enable/Disable Trending for each point
    h. Override PID Loop setpoints
    i. Enter temporary override schedules
    j. Define Holiday Schedules
    k. Change time/data
    l. Enter/Modify analog alarm limits
    m. Enter/Modify analog warning lights
    n. View limits
    o. Enable/Disable Demand Limiting for each meter
    p. Enable/Disable Duty Cycle for each load
6. Logs and Summaries: Reports shall be generated automatically or manually, and directed to either CRT displays, printers, or disk files. As a minimum, the system shall

allow the user to easily obtain the following types of reports:
a. A general listing of all points in the network
b. List all points currently in alarm
c. List of all off-line points
d. List all points currently in override status
e. List of all disabled points
f. List all points currently locked out
g. List of all items defined in a Follow-Up file
h. List all Weekly Schedules
i. List all Holiday Programming
j. List of Limits and Deadbands
k. Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration of the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

B. System Configuration and Definition: All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.
1. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:
a. Add/Delete/Modify Standalone DDC Panels
b. Add/Delete/Modify Operator Workstations
c. Add/Delete/Modify Application Specific Controllers
d. Add/Delete/Modify points of any type, and all associated point parameters, and tuning constants
e. Add/Delete/Modify alarm reporting definition for each point
f. Add/Delete/Modify control loops
g. Add/Delete/Modify energy management applications
h. Add/Delete/Modify time- and calendar-based programming
i. Add/Delete/Modify Totalization for every point
j. Add/Delete/Modify Historical Data Trending for every point
k. Add/Delete/Modify custom control processes
l. Add/Delete/Modify any and all graphic displays, symbols, and cross-references to point data
m. Add/Delete/Modify dial-up telecommunication definition
n. Add/Delete/Modify all operator passwords
o. Add/Delete/Modify Alarm Messages
2. System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hardcopy printouts of all configuration and application data. Control process and DDC control loop documentation shall be provided in logical, graphical flow diagram format to allow control sequences to be easily interpreted and modified at any time in the future.
3. Database Save/Restore/Back-Up: Back-up copies of all standalone DDC panel databases shall be stored in at least one personal computer operator workstation. Continuous supervision of the integrity of all DDC panel data bases shall be provided. In the event that any DDC panel on the network experiences a loss of its data base for any reason, the system shall automatically download a new copy of the respective data base to restore proper operation. Data base back-up/Download shall occur over the local area network without operator intervention. Users shall also have the ability to manually execute downloads of any of all portions of a DDC panels data base.

C. Personal Computer Operator Workstations shall be provided for command entry, information management, network alarm management, and database management functions. All real-time

control functions shall be resident in the Standalone DDC panels to facilitate greater fault tolerance and reliability.

1. Workstations shall be general purpose, commercially available by Compaq, NEC, HP, IBM or Dell, personal computers with sufficient memory and processor capacity to perform all functions described in this specification. Minimum system requirements are 300 MHZ, 64 MB ram, 1.4 MB floppy Drive, and mouse.
2. Sufficient bulk storage (6 GB) shall be provided to accommodate all fully configured point date bases, all application databases, all graphics data bases, all user-defined reports, and all historical data archival as described in this specification.
3. The display provided for system operation shall have a diagonal screen measurement of no less than 15", and a minimum display resolution of no less than 640 x 320 pixels. Separate controls shall be provided for color, contrast, and brightness. The screen shall be non-reflective.

D. Standalone DDC panel Local or Portable Operator's Terminals: Each DDC panel shall be capable of supporting an operator's terminal for local command entry, instantaneous and historical data display, and program additions and modifications.

1. There shall be a provision for both permanently mounting the standalone DDC panel Operator Terminal, or using it as a portable handheld unit.
2. The DDC panel Operator Terminal shall simultaneously display a minimum of 6 points with full English identification to allow an operator to view single screen dynamic displays depicting entire mechanical systems.
3. The operator functions provided by the DDC panel Operator Terminal shall include, but not limited to, the following:
    a. Start and Stop Points
    b. Modify Setpoints
    c. Modify PID Loop Setpoints
    d. Override PID Control
    e. Change Time/Date
    f. Add/Modify Start/Stop Weekly Scheduling
    g. Add/Modify Setpoint Weekly Scheduling
    h. Enter Temporary Override Schedules
    i. Define Holiday Schedules
    j. View Analog Limits
    k. Enter/Modify Analog Warning Limits
    l. Enter/Modify Analog Alarm Limits
    m. Enter/Modify Analog Differentials
    n. View Point History Files
4. The DDC panel Operator Terminal shall provide access to all real or calculated points in the controller to which it is connected, or any other controller in the network. This capability shall not be restricted to a subset of predefined "global points", but shall provide totally open exchange of data between the operator terminal and any DDC panel in the network.
5. Operator access at all DDC panel Operator Terminals shall be identical to each other, as well as identical to the PC or Laptop Operator Workstations. Any password changes shall automatically be downloaded to all controllers on the network.
6. The DDC panel operator terminal shall provide English language prompting to eliminate the need for the user to remember command formats or point names. Prompting shall be provided consistent with a user's password clearance and the types of points being displayed, to eliminated the possibility of operator error.
7. A multi-function touchpad shall be provided for point and command selection, as well as parameter entry. To minimize the possibility of operator error, the DDC panel Operator Terminal shall change and limit touch pad functions based upon an operator's password clearance, the function being performed, and types of points being displayed. Screen

displays shall clearly indicate only valid touchpad functions.

8. Context-Sensitive Help: On-line, interactive user's "Help" manuals and tutorials shall be provided. Based upon operator request, the "help" function shall provide general system operating instructions, and specific descriptions of commands available in the currently displayed menus.
9. Identification for all real or calculated points shall be consistent for all network devices. the same English language names used at PC workstations shall be used to access points at the DDC panel Operator's Terminal to eliminate cross-reference or look-up tables.
10. In addition to instantaneous summaries, the DDC panel Operator's Terminal shall allow a user to view a Point History field for system points. Pint History fields shall provide a record of value of analog points over the last 24 hours, at 30-minute intervals, or a record of the last ten status changes for binary type points.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Control component shall be installed in accordance with manufacturer's instructions. Control components shall be grouped wherever possible, and installed within local control panels. See plans for locations.

B. Controls Contractor shall supervise the installation of control valves, dampers, temperature sensors, pressure sensors, actuators and sensing wells.

C. Conduit and wiring for the temperature control system not specifically shown on the electrical prints shall be installed by electricians and mechanics employed by the Temperature Control Contractor. All wiring must be in accordance with local and national electrical codes. All electrical conduit wiring and wiring methods shall be in full compliance with requirements of the electrical section.

D. Provide and install duct smoke detectors as required. The Balancing Contractor shall direct the Controls Contractor on the proper location for installing the smoke detectors.

E. Thermostats or sensors mounted on outside walls shall be mounted on 1/4" minimum thickness cork or rigid fiberglass.

F. Identify each item mounted on the face of a control panel with an engraved phenolic label (1/4" high engraved letters minimum). Identify each item of control equipment (except room sensors and thermostats).

G. All control adjustments shall be accessible without use of a ladder.

H. All thermostats or temperature sensors in the conditioned space shall have blank locking covers.

I. Airflow measuring arrays installed in fan inlet volutes must be designed to withstand velocities encountered in this location. Mounting system is to be warranted against failure and consequent fan damage.

J. Control system shall be connected to the campus Ethernet system with capability for access remotely by the contractor during the commissioning period. Once the controls have been fully commissioned, the controls contractor shall format the program to match the campus controls server ALC program and downloaded by the controls contractor in the presence of the campus EMS manager

3.2 ELECTRIC ACTUATOR APPLICATION AND INSTALLATION

A. A weather shield shall be used if located outside. Ambient temperature rating of 122°F shall not be exceeded through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary.

B. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator. Cords or conduit shall incorporate a drip leg if condensation is possible.

C. Application Requirements:
1. Airtight dampers shall be fully closed and leakage minimized during mounting of actuators. Both drive signal and spring return shall fully close dampers.
2. Where spring return actuators are required for freeze protection, the power circuit to the actuators shall be disconnected by hard wire interlock to the freeze-stat. Use of a signal input to the program to initiate spring return is not acceptable. Use of the control signal to drive the actuators closed in not acceptable.
3. Face and bypass shall be proportional spring return closed to face position.
4. Outside air dampers shall be proportional control (2-10vdc or 4-20ma), with mechanical spring to return damper to the normally closed position on power failure.
5. Relief air dampers shall be proportional control (2-10vdc or 4-20ma), with mechanical spring to return damper to the normally closed position on power failure.
6. Return air dampers shall be proportional control (2-10vdc or 4-20ma), with mechanical spring to return damper to the normally open position on power failure.
7. Exhaust air dampers shall be On/Off control, spring return to normally closed position.
8. Combustion air intake dampers shall be On/Off control, spring return to open position.
9. Inlet vane actuators shall be floating or proportional control (2-10vdc or 4-20ma), non-spring.
10. Provide sufficient torque as velocity, static, or side seals require per damper manufacturer's recommendation. In all cases torque shall be a minimum 5-in-lb per sq ft for opposed blade dampers and 7-in-lb per sq ft for parallel blade dampers. No individual damper section may exceed 20 sq ft.

D. Terminal box actuator control:
1. Each VAV box actuator control loop shall be individually tuned using the parameters set up in Control Logic above. Where height truculence in the sensor flow control loop is causing dithering (rapid oscillation) of actuator control loop, the sensor loop shall be corrected mechanically and/or with software averaging as necessary.
2. VAV box CFM control point shall be accurate to ±25 CFM to avoid excessive actuator movements. Actuator movements shall be limited to not more than 2 per minute. CFM minimum controller set point shall be 25 CFM higher than calculated and scheduled by Engineer.

3.3 SYSTEM OPERATION

A. It shall be the Control Contractor's responsibility to coordinate requirements with equipment suppliers, and furnish and install all control devices necessary to provide the control sequence specified, where not furnished by others. This is to include control transformers, room or insertion thermostats, and other devices without limitation.

3.4 OPERATOR INSTRUCTION

A. During system commissioning and at such time acceptable performance of the control hardware and software has been established, the Control Contractor shall provide on-site operator instruction to the University of California Berkeley 's operating personnel. Operator instruction during normal working hours shall be performed by a competent representative familiar with the system hardware, software, and accessories.

B. At a time mutually agreed upon during system commissioning as stated above, the System Contractor shall give instruction to the University of California Berkeley 's designated personnel on the operation of the Control systems and describe its intended use with respect to the programmed functions specified. Operator orientation of the control system shall include, but not limited to, the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

C. The training shall be in three sessions as follows:
   1. Twelve -Four Hour Initial Training - three day training after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the University of California Berkeley 's personnel can start to familiarize themselves with the system before classroom instruction.
   2. First Four Hour Follow-up - approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.
   3. Two Day Warranty Follow-Up - 8 hours in no less than 4 hour increments, to be scheduled at the request of the University of California Berkeley during the warranty period. These sessions shall cover topics as requested by the University of California Berkeley, including how to install additional points and add local control modules.

3.5 OPERATION AND MAINTENANCE MANUAL

A. Provide the University of California Berkeley with the manual containing all instructions for operations and maintenance of all components at least 30 days prior to completion and/or at least 15 days prior to Initial Training sessions.

B. Manual will contain all copies of AS-BUILT control drawings and schematics.

C. Manual shall contain manufacturer's catalog data and shop drawings for all control components.

D. Manual shall include name of local vendor, 24hr emergency service phone number, and name of contact person.

E. Post a copy of the final sequence of operation and control drawings, under glass, in the mechanical room adjacent the main control panel.

F. Provide the list of spare parts in the manual.

END OF SECTION

SECTION 230902
VARIABLE FREQUENCY DRIVES (VFD)

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 230500 - Basic Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SCOPE

A. Furnish complete and operational VFD systems as shown on the plans. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
1. Variable frequency drives (VFDs).
2. Controls and control connections.
3. Electrical power connections.

1.3 RELATED WORK IN OTHER SECTIONS

A. Section 230500: Basic Materials and Methods

B. Section 230593: Testing, Adjusting and Balancing

C. Section 230900: Controls and Instrumentation

D. Section 237312: 100% Outside Air Unit

1.4 QUALITY ASSURANCE

A. Supplier of VFD shall be solely responsible for assuring that the VFD shall work properly with the motor(s) being controlled. VFD supplier shall provide all materials and labor required to replace motors, bearing, shafts, etc. that may be incompatible with VFD or become damaged by VFD at no additional cost to the University of California Berkeley. VFD supplier shall reimburse Architect and Engineer at their standard hourly rates for their involvement in resolving failures due to their VFDs.

B. Manufacturer shall have a minimum of 15 years experience building similar equipment for controlling the speed for induction motors and at least one hundred successful installations with a variety of VFD sizes and applications.

C. To insure quality and minimize failures the VFD(s) and connected motor(s) shall be by one manufacturer. To reduce the known problem of bearing failures by "fluting" the VFD switching rates shall be 6-8 Khz wherever possible. Manufactured VFDs at switching rates of 12-15 Khz shall be accompanied by an additional extended warranty to cover bearings and motors to a period of ten (10) years. Should it be impossible to provide matched motor and VFD's provide a shaft grounding system for the driven motor. Acceptable manufacturer is Shaft Grounding Systems in Albany, Oregon (Representative: DP&A Sales 541-997-4068) or Aegis Shaft Grounding Ring (www.est-aegis.com/cse).

D. To insure quality and minimize infantile failures at the job site, the VFD shall be burned in at the factory at an ambient of 104°F minimum for at least 8 hours. The VFD shall be operating a dynamometer and the load speed shall be cycled during the test. All optional and special features shall be functionally tested at the factory for proper operation.

E. Codes and Standards: Provide VFDs conforming to the requirements of the latest addition of the following:
1. ANSI/EIA 508Electrical Performance Standards for Television Broadcast Transmitters
2. UL508. All VFD equipment provided under this section must be labeled as UL508 approved.
3. ANSI/IEEE 518Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources.
4. ANSI/IEEE 519-1992: IEEE Recommended Practices and Requirements for Harmonic Control in Electrical power systems.

1.5 SUBMITTALS

A. Prior to construction submit for approval the following materials:
1. VFD supplier shall provide reference list showing at least ten years of prior manufacturing experience in production of VFDs and a list of at least twenty successful installations with a variety of VFD sizes and applications.
2. Manufacturer's data, installation instructions, and maintenance and operational instructions for variable frequency drives. Indicate electrical service and special requirements. Include manufacturer's descriptive literature, repair data, and parts listing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver units to the site in containers with manufacturer's stamp or label affixed.

B. Protect units against dirt, water, chemical, and mechanical damage. Do not install damaged units. Remove damaged equipment from site.

1.7 WARRANTY

A. Provide two-year (24 months) warranty under provisions of Division 01. Provide extended ten (10) year warranty on motors and bearings as described above, if applicable. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABB, or approved equal by, Yaskawa, Danfoss-Graham. Connected motors should be by the same manufacturer whenever possible.

2.2 GENERAL

A. Furnish a complete VFD as scheduled on the plans. Refer to plans for locations of variable speed controllers. Each fan or pump motor shall have a dedicated VFD unit. All standard and optional features shall be included within the VFD enclosure unless otherwise specified. The VFD enclosure shall be provided to match the environment requirements where the VFD will be mounted and operated. Provide NEMA rated enclosure as required.

B. The adjustable frequency controller shall convert three-phase, 60 Hz utility power to adjustable voltage and frequency, three-phase, AC power for stepless motor speed control from 10% to 100% of the motor's 60 Hz speed.

C. The VFD shall include a converter and an inverter section. The converter section shall convert fixed frequency and voltage AC utility power to a DC voltage. Drive shall utilize a single surface mount micro-processor.

D. The VFD shall be of the pulse width modulation (PWM) type. VFDs shall be provided with an advanced flux vector frequency control to limit noise at drive and motor.

E. Drive manufacturer or sales representative shall evaluate electrical system of the project. Any additional protective equipment such as line filters, reactors or input isolation transformers required to prevent interference from drive with other electrical equipment in the building shall be included as part of the bid. No additional expense shall be incurred by University of California Berkeley for provision or installation of these devices if required for electrical system operation after drive has been purchased. Units shall include factory mounted input line reactors.

F. The VFD maximum output current rating shall be 110% of the motor nameplate full load current. VFD shall be able to start into a rotating load in either direction without trip.

G. The differential pressure controller that operates the VFD shall be connected (wired) to the same controller that operates the respective VFD.

H. The VFD and options shall be tested to ASNI/EIA Standard 508 and listed by a nationally recognized testing agency such as UL or ETL.

I. The VFD and options shall comply with the applicable requirements of the latest standards of ANSI, IEEE, and the National Electrical Code.

J. Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in ANSI/IEEE Standard 519.

K. The drive efficiency shall be 97% (minimum) and have a fundamental power factor of 0.98 at all speeds.

2.3 BASIC FEATURES

A. The VFD shall be housed in a NEMA enclosure appropriate to the mounting location.
   1. NEMA 12 enclosure shall be used for dusty locations, plenum mechanical rooms, penthouses, or air stream mounting.
   2. NEMA 3R is required for all locations exposed to falling rain, snow or ice or to indoor locations subject to falling water.
   3. If NEMA 1 enclosure is suitable it shall be louvered, vented through cabinet using a removable louver/filter, and equipped with an integral cooling fan with thermostat control, and arranged so that units can be mounted back to back on a frame and/or side to side on a wall. Venting fans shall be supplied in enclosure if required. If a different NEMA enclosure is indicated the enclosure shall provide means of maintaining the drive at temperature acceptable to the drive manufacturer in exterior ambient temperatures. Enclosure shall be complete with no requirements for low voltage wiring. Factory mounted main circuit breaker disconnect shall be included.

B. The following operator controls shall be located on the front of the enclosure:

1. Door mounted operator digital controls consisting of auto/manual switch, start/stop switch with reset and manual speed control. In the auto position, the drive will start/stop from a remote contact closure and motor speed is determined by the follower signal. In the manual position, motor speed is determined by manual speed selection. Manual potentiometers are not acceptable.
2. Power on pilot light to indicate that the VFD is being supplied by the power line.
3. Fault digital display to indicate that the VFD has tripped on a fault condition. The drive shall retain in memory the last three (3) fault conditions that caused the drive to trip. Indication should include but not be limited to the following: Under voltage, over voltage, overcurrent, over temperature, phase loss, phase imbalance and external trip.
4. Digital display to indicate voltage, current, frequency or RPM. Selectable by the operator while the VFD is running.

C. VFD shall be provided with two (2) each form C dry contacts for indication of run and fault starters. In addition each drive shall have an analog output signal 0 to 10_{VDC} (or $4\text{-}20_{MA}$)to indicate drive speed (percent of full load).

D. While in the remote mode, the VFD will attempt at least five (5) restarts after a power outage, drive fault or external fault before requiring manual reset. After ten minutes of runtime, the restart attempts return to zero. The VFD shall display a countdown timer when auto restart is being attempted, or incorporate programming to select number of restarts, number of faults per time period, and time between restarts.

2.4 PROTECTIVE FEATURES

A. Protection against input transient voltage spikes.

B. Overload protection for the motor. If power input or output is interrupted while the control is in operation, no damage shall result. The unit shall be able to operate without any equipment connected to the inverter output. The drive must protect itself against all phase-to-phase short circuits and ground faults.

C. Protection against input power undervoltage, overvoltage and phase loss.

D. Protection against output current overload and overcurrent.

E. Protection against over-temperature within the VFD enclosure.

F. Protection against overvoltage on the DC bus.

G. Drive shall have an auxiliary contact to permit a remote trip.

H. DC bus discharge circuit and warning light for protection of service personnel or meet UL requirements for DC bus discharge.

I. Drive shall be capable of operating and insensitive to imbalance or out-of-rotation incoming power phase.

J. Lockable main fused input disconnect shall be factory mounted as specified on the drawings or as required by the application.

2.5 ADJUSTMENTS

A. Maximum speed, adjustable to 100% base speed.

B. Minimum speed, adjustable to 10% base speed.

C. Acceleration time, adjustable 1 to 360 seconds (minimum) factory set at 20 seconds.

D. Deceleration time, adjustable 1 to 360 seconds (minimum) factory set at 20 seconds.

E. Current limit, adjustable 50 to 110%.

F. Adjustable speed lock-outs for three (3) operating ranges.

G. Capable of following 0-5$_{MA}$, 4-20$_{MA}$, 10-50$_{MA}$, 0-4$_{VDC}$, 0-8$_{VDC}$, 0-10$_{VDC}$ grounded or ungrounded signal as required to interface with the building control system.

2.6 SERVICE CONDITIONS

A. The VFD shall be designed to operate within the following service conditions:
1. Ambient temperature, 32°F-104°F.
2. Relative humidity, 5-95%, non-condensing.
3. Elevation to 3,300 feet without derating.
4. AC line voltage variation, -10% to +10% of nominal.

2.7 SPECIAL FEATURES

A. All control wiring, and accessories shall be factory installed in the drive casing so that only the connection of the remote auxiliary start/stop and override contacts is required to provide override control as described above.

B. All drives shall be equipped with fail safety speed control (adjustable 20-100%), factory installed and wired, that operates as follows: If the drive is on (in either normal or override mode) and no signal is detected from the building control system, the drive shall operate at a preset adjustable speed. On resumption of the building control system signal, the drive shall operate as normal. Fail safe speed shall be adjusted through digital keyboard mounted on the outside drive cabinet.

C. Drives shall be protected with input line reactors factory mounted.

D. Provide drive with a communications board enabling it to communicate with the building management system (BMS) over a serial RS-485 interface or with a BACNET, LonWorks, Modbus, Profibus or BMS proprietary interface

E. Drive shall be equipped with hard wired connection for fire alarm system initiated fan shutdown

2.8 BYPASS

A. Provide a manual 3-contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a three position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position the motor is operated at an adjustable speed from the VFD. In the OFF position, the motor and VFD are disconnected. In the BYPASS position, the motor is operated at the full speed from the AC

power line and power is disconnected from the VFD so that service can be performed. Include motor thermal overload and fuse or circuit breaker protection while in bypass operation.

B. Service personnel shall be able to defeat the main power disconnect and open the bypass enclosure without disconnecting power using a specially designed tool and mechanism while meeting all local and national code requirements for safety.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify that mounting surface is ready to receive work. Mount the VFD(s) on the wall or at supports in locations identified on the drawings. Provide a layout drawing of VFD locations to electrical installer.

B. If the disconnect for the equipment powered by the VFD is in a location where it is probable that it will be placed in an off position prior to shutting down the VFD, the contractor is to provide electrical protection for the VFD. This may be in the form of a conduit and wire interlock between disconnect and drive or internal protection integral to the VFD.

C. Coordinate wiring and control with Control Contractor. Control installers shall install all wiring associated with control signals into the VFD and for interlock control wiring between disconnects and VFDs.

D. Electrical installer shall install all line voltage power wiring and conduit from electrical switchgear and from the VFD to the disconnect at the controlled motor. The only exception to this is when the motor and drive are factory installed on a packaged piece of equipment. In that case the wiring from drive to motor is to be installed in the factory to meet the requirements herein. Coordinate with Division 26 work.

E. Line length between VFD and driven motor shall be as short as possible. Line length shall not exceed twenty (20) feet without prior approval from Engineer.

F. Input and output power wiring shall be installed in separate grounded conduit. In addition, control wiring shall be installed in its own separate grounded conduit.

G. Use symmetric motor cable between the VFD and motor, with low inductance shield or conduit, and with all joints joined with bonding straps. MC metal clad 3 phase type cable per NEC 334-1, UL approved, 3 phase conductors and 3 ground conductors. Sheath to be continuous corrugated aluminum. Manufacturer and type to be BICC 2 kV rated Drives Cable, Anixter series 7V, or approved equal.

H. Use cable connectors with 360 degree connections to the armor conduit at both ends of motor cable. Verify electrical path from inverter cabinet entry plate to armor / conduit to motor terminal box.

I. Install an auxiliary high frequency bonding connection for potential equalization between VFD frame and building steel.

J. Unless absolutely necessary do not install disconnect between VFD and connected motor. VFD is to be furnished with a lockable disconnect.

K. Installation in “Fan Wall “ Air Handlers: When a single VFD supplies multiple fans, assemble and prewire units at the factory, installing conduit and conductors between the fan motor, VFD, and terminal strips. Wiring from the VFD output terminals to the fan motor shall be Belden VFD Cable installed in conduit (295XX Series).

3.2 MANUFACTURER'S START-UP SERVICES

A. The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, verify control wiring, verify power wiring, start-up the drive, and check for proper operation. The service technician shall provide final adjustments to meet the specified performance requirements. Harmonic test with scope shall be also performed at the job site and results submitted to the University of California Berkeley's Representative. Fully staffed parts and service personnel shall be within four hours travel from the jobsite.

B. Carrier Frequency Set up:
   1. Set initial carrier frequency at 2 kHz.
   2. Manually raise VFD speed output from 10 Hz to 60 Hz by 10 Hz increments, allowing at least 15 seconds between each adjustment. If excessive motor noise is heard at any speed, raise carrier frequency by 2 kHz increments until motor noise is no longer excessive. Do not set carrier frequency higher than 10 kHz.
   3. If excessive motor noise continues to be heard at or below 10 kHz, inform University of California Berkeley. If the motor is provided by the VFD manufacturer, either repair, replace, or provide 5 year extended warranty on the effected motor.

C. Lockout of resonant frequencies:
   1. With carrier frequency set per the above specification, manually and slowly raise VFD speed output from 10 Hz to 60 Hz by 1 Hz increments. If excessive motor, frame, or driven load noise is heard at any speed, lock out that frequency.
   2. Each frequency skip shall be programmed with as narrow a bandwidth as possible, while still avoiding the most objectionable range of resonant frequencies. Each frequency skip bandwidth shall not exceed 5 Hz without approval by Engineer.

D. Training:
   1. Provide 2 hour training session to the University of California Berkeley’s representative.
   2. Training to include
      a. Demonstration of operation of bypass switch and door-mounted disconnect switches. Explain emergency operation.
      b. Demonstrate operation of operator keypads for viewing data and setting parameters.
      c. Demonstrate operation in manual mode, including setting of specific speeds.
      d. Explain the drive parameters that might require operator adjustment.
      e. Describe troubleshooting techniques and warranty procedure.
      f. Manufacturer shall give on recorded media, settings for all VFD drives on project to allow for resetting of drives in the future to original settings determined with the commissioning agent.

END OF SECTION

SECTION 232113
HVAC PIPING

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 230500 - Basic Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this section shall include, but not necessarily be limited to, the following:
   1. Pipe and Fittings
      a. Chilled water
      b. Refrigerant piping
      c. Heating water
      d. Temperature and Pressure relief
      e. Direct buried factory prefabricated piping system for chilled water
   2. Valves
      a. HVAC Service Valves (125 psig max. working pressure)
      b. Pressure Independent Temperature Control Valves (Coil Control Valves)
      c. Hydronic Service Pressure Reducing Valves
      d. Hydronic Service Pressure Relief Valves
   3. Thermometers, gauges and accessories
   4. Piping specialties
      a. Pipe escutcheons
      b. Strainers
      c. Drip pans
      d. Air vent
      e. Dielectric unions and flanges
      f. Unions
      g. Flanges
      h. Pipe sleeves
      i. Sleeve seals
   5. Pipe coating
   6. Expansion Compensators

B. In addition, provide the following:
   1. Furnish accessories and labor for flushing and cleaning HVAC piping.
   2. Install water treatment systems provided under 232500.
   3. Furnish material, accessories and labor for antifreeze charging of HVAC piping.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Division 01: General Requirements
   1. Section 019113: General Commissioning Requirements

B. Division 23: Mechanical

1. Section 230500: Basic HVAC Materials and Methods
2. Section 230593: Testing, Adjusting and Balancing
3. Section 230700: HVAC Insulation

1.4 ASSURANCE

A. Manufacturers Qualifications:
   1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
   2. Replacement parts shall be readily available and stocked in the USA.

B. Codes and Standards:
   1. All work shall be in full accordance with all applicable codes, ordinances and code rulings.
   2. The Contractor shall furnish without any extra charge the labor and material required for compliance of codes.
   3. Perform all tests required by governing authorities and as required under all Division 23 Sections. Provide written reports on all tests.
   4. Electrical devices and wiring shall confirm to the latest standards of NEC; all devices shall be UL listed and so identified.
   5. All HVAC work shall comply with the Americans with Disabilities Act (ADA).
   6. All excavation work must comply with all provisions of state laws including notification to all University of California Berkeley's of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

1.5 FIELD QUALITY ASSURANCE (PRE-INSULATED BELOW GRADE PIPING SYSTEM)

A. Provide the services of a certified manufacturers representative to instruct the contractor on the installation procedures of the piping, and to be present on site to assist during critical stages of installation and testing. The representative must be a direct employee of the manufacturer who is certified to provide Field Technical Assistance (FTA).

B. One (1) day of FTA shall be provided for each 500 feet of trench with a minimum of Three (3) days required. These three days shall not be consecutive days and must be spread out over the duration of the installation. It is the installing contractors responsibility to schedule these days, with enough advance notice, to facilitate the manufacturer's representative. The FTA representative shall observe critical periods of the installation including the following:
   1) Initial inspection of the trench and initial pipe placement
   2) Initial field joint closure instruction and inspection
   3) Any field modification to the piping system.
   4) Initial backfill of piping in trench

C. Include a report consisting of the installation log indicating actual installed conditions and test certification signed by the manufacturer's representative above, the contractor, and the Architect's representative. Include certification by the manufacturer's representative that the installation is in conformance with the manufacturer's recommendations.

D. Pre-insulated pipe manufacturer shall provide testing on the polyurethane foam as indicated within these specifications

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for all piping, valves and specialties indicating dimensions, valve CV, flow capacity, pressure setting, tolerances etc.

B. Shop Drawings: Submit shop drawings indicating underground piping installation showing all fittings with inverts. Indicate all footings and grade beams.

C. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, valve replacement, and spare parts lists. Include this data, product data, and shop drawings in operating and maintenance manuals.

D. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable Victaulic style number.

E. Pre-insulated Below Grade Piping System:
1 Product Data.
2. Installation Manuals.
3. Complete shop drawings for piping systems including elbows, tees, flanges, and anchors.
4. Complete stress analysis indicating that the design complies with ANSI B 31.1.
5. Submittals will only be accepted from pre-approved manufactures meeting the specifications as described within this specification. No exceptions will be made.
6. All submittals shall be stamped by a California Registered Professional Engineered employed by the pre-insulated piping system manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.
1. All pipe, pipe fittings and valves shall be manufactured in North America.

B. Type M copper piping is not acceptable for any pressure water piping unless specifically noted otherwise.

C. For all Grade B piping specified below grade provide a mill report with production identification numbers for piping submitted to permit tracking of pipe by mill and production lot.

D. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturers' names used herein, unless specifically noted that substitutes are not allowed.

E. Hydronic Piping Pressure Classifications:
1. Chilled Water, Heating Water:
a. "Normal Pressure" shall be working fluid pressure up to 50 psig.
b. "Medium Pressure" shall be working fluid pressure up to 100 psig.
c. "High Pressure "shall be working fluid pressure up to 200 psig.

2.2 PIPE AND FITTINGS

A. Chilled Water Piping:
1. Pipe: Acceptable alternatives are:
a. ASTM A53 Grade B, Schedule 40 black steel up to 10" diameter. Standard weight black steel for 12" and larger.
b. ASTM B88, Type K or Type L hard drawn copper water tube for normal pressure above grade.
2. Fittings: Select appropriately to match the pipe material used.
a. Steel normal pressure application: 150 lb. rating. ANSI B16.3, malleable iron threaded; ANSI B16.5, flanged; ANSI B16.9, steel bevel welding
b. Steel grooved end system: Painted, grooved end system, for applications to 300 psi.
1) Grooved joint couplings shall be ASTM A395 and A536 ductile iron. Victaulic rigid Style 107 ("Installation Ready" stab-on design) and 07 (standard coupling), or flexible Style 177 ("Installation Ready" stab-on design and 77 (standard coupling), Tyco-Grinnell rigid Fig. 772 or flexible Fig 705 and 707, or Gruvlok FIG 7001 flexible or FIG 7401 rigid.
2) Rigid Type: Coupling housings shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style 107 or 07 or Gruvlok FIG 7401.
a) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings shall be placed in close proximity to the vibration source. Victaulic Style 177 or 77 or Gruvlok FIG 7001.
3) Gasket as recommended for the intended service by the manufacturer. Gaskets shall be pressure responsive synthetic rubber, Grade "EHP" or Grade "E" EPDM.
4) Grooved fittings shall be ASTM A395 and A536 ductile iron; ASTM A234 forged steel; or fabricated from carbon steel pipe conforming to ASTM A53.
5) All grooved couplings, fittings, valves and specialties shall be the products of a single manufacturer.
6) Grooved manufacturer must be ISO 9001 certified.
c. Copper system: ANSI B16.22, wrought copper with the following connection methods.
1) Soldered or brazed:
a) 2" and smaller: Make connections using 95%-5% tin-antimony solder joints above grade and sil-fos brazing below grade.
b) 2 ½" and larger: Sil-fos brazing or brazed and flanged.
2) With prior approval a grooved copper tubing connection system
a) Grooved copper tubing connection system: Victaulic CTS, Tyco-Grinnell, for above grade joints.
i) Grooved couplings: Victaulic Style 607 (Quick Vic)
ii) Coupling gaskets shall be pressure responsive type, Grade "EHP" EPDM.
iii) Fittings shall be wrought copper per ANSI B16.22, or bronze sand castings per ANSI B16.18.
iv) Grooved manufacturer must be ISO 9001 certified.
v) Flaring of copper tube to IPS dimensions is unacceptable.
3. Joints: 2" and smaller, grooved joints (except in the case of piping located in shafts which must be welded); 2-1/2" and larger, ANSI B16.25 bevel weld, ANSI B16.5 flanges, or ANSI B16.11 socket weld, grooved.

B. Pre-insulated Below Grade Piping System
1. Acceptable Manufacturers:

a. Perma-Pipe
b. Rovanco (with materials as specified herein)
c. Therma Cor (with materials as specified herein)

2. Contractors shall bid exclusively on approved materials and manufacturers. It is the responsibility of all bidders to obtain a letter from the underground system manufacturer, prior to bid, indicating that they are submitting pricing in complete compliance with these specifications.
3. Prefabricated Piping System

C. All underground chilled water distribution lines, as shown on the contract drawings, shall be factory pre-engineered, pre-fabricated and pre-insulated. All straight sections, fittings, anchors and other accessories shall be factory prefabricated to job dimensions, and designed to minimize the number of field welds. Each system layout shall be computer analyzed and submitted by the piping system manufacturer to determine stresses and movements of the service pipe. The system design shall be in strict conformance with ANSI B31.1 latest edition, and stamped by a registered professional engineer employed by the pre-insulated piping system manufacturer.

D. Service Pipe shall be Domestic Standard Weight, A53, Grade B SML or ERW. All joints shall be butt-welded for sizes 2 ½ inches and greater, and socket welded for 2 inches and below. Where possible, straight sections shall be supplied in 40 foot random lengths with 6 inches of piping exposed at each end for field joint fabrication.

E. Service Pipe Coating: The exterior of the steel service pipe surface shall be abrasive blast-cleaned to a minimum of a near white surface, SSPC-SP10-63T. Profile must be a minimum of 1.5 mil peak to valley range. Any areas of rust bloom or oil shall be wiped and reblasted. The epoxy coating shall be a two part coating consisting of a base material and curing agent spray applied to a minimum thickness of 8-12 mil. The coated pipe shall be holiday tested at 1,000 volts to ensure a void free coating. Areas of the pipe not passing the holiday test shall be patch coated and retested. The manufacture shall holiday test the pipe prior to insulating and the installing contractor shall holiday test all field applied epoxy at the field joints

F. Sub-Assemblies, fittings, end seals, and anchors shall be designed and factory prefabricated onto the longest practical pipe. Field insulation of fittings shall not be allowed.

G. Anchor plates shall be encased with the same FRP exterior protection as the straight sections of the pipe. The thickness of the coating shall be the same as used for straight sections. Exposed steel anchor plates shall not be allowed. The service pipe insulation shall be polyurethane foam with 2 lb/ft^3 minimum density, 90% minimum closed cell content, Insulation Compressive Strength of 40 psi, and maximum initial thermal conductivity of 0.16 $Btu\text{-}in/hr\text{-}ft^2\text{-}F^o$. The insulation shall completely fill the annular space between the service pipe and the jacket and shall be bonded to both. Systems using open cell insulation or a nonbonded design shall not be allowed. The polyurethane foam insulation shall be tested by the manufacturer for mechanical and thermal properties to assure compliance with the above values. All test samples will be taken from production material, identified, tagged and tested in accordance with the table below. Test reports showing results will be furnished to the owner and/or engineer for approval. Data supplied by the polyurethane foam chemical supplier is not acceptable.

Attribute	ASTM STD	Sample Frequency	Requirement
Insulation	D 1622	Once per Batch	$\geq$ 2.0 lb/ft^3

Density			
Insulation Compression Strength	D 1621	Once per Batch	≥ 40 PSI
Insulation Closed Cell Content	D 2856	Once per Batch	≥ 90%
Insulation Thermal Conductivity	C 518	Once per Batch	< 0.16 BTU-inch/hr/ft²/ºF

All insulation shall be provided to a minimum thickness of one & one half (1½) inch

H. All insulation shall be provided to a minimum thickness of one & one half (1½) inch

I. The outer protective jacket shall be either fiberglass (FRP) filament wound directly onto the urethane foam insulation or Fiberglass pipe with a minimum wall thickness of .085" with poured or injected urethane insulation systems. Thermoplastic casing material PVC or Polyethylene, shall not be allowed for direct buried piping. All straights and fittings shall be factory pre-insulated and jacketed. Jackets over fittings and anchors shall be either chopped spray-up FRP or joined with fiberglass hand layups with thicknesses equal to the thickness of the FRP jacket on the straight lengths. No taping, glueing or shrink wraps shall be allowed on fitting fabrication.

J. Refrigerant Piping
1. Pipe: Acceptable alternatives are
   a. ASTM B88, Type K or Type L copper tubing
   b. AC/R pipe.

K. Heating Water Piping:
1. Pipe: Acceptable alternatives are:
   a. ASTM A53 Grade B, Schedule 40 black steel up to 10” diameter.
   b. ASTM B88, Type K or Type L hard drawn copper water tube for normal pressure
2. Fittings:
   a. Steel normal pressure application: 150 lb. rating. ANSI B16.3, malleable iron threaded; ANSI B16.5, flanged; ANSI B16.9, steel bevel welding
   b. Steel grooved end system **(MECHANICAL ROOM ONLY)**: Painted, grooved end system, for applications to 230 deg. F and 300 psi.
      1) Grooved joint couplings shall be ASTM A395 and A536 ductile iron. Style 77 (standard coupling), Tyco-Grinnell rigid Fig. 772 or flexible Fig 705 and 707, or Gruvlok FIG 7001 flexible or FIG 7401 rigid.
         a) Rigid Type: Coupling housings shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style 107 or 07, Tyco-Grinnell, or Gruvlok FIG 7401.
         b) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings shall be placed in close proximity to the vibration source. Victaulic Style 177 or 77, Tyco-Grinnell, or Gruvlok FIG 7001.
      2) Gasket as recommended for the intended service by the manufacturer. Gaskets shall be pressure responsive synthetic rubber, Grade “EHP” EPDM, for service up to 250°F, and Grade “E” EPDM, for service up to 230°F.
      3) Grooved fittings shall be ASTM A395 and A536 ductile iron; ASTM A234

forged steel; or fabricated from carbon steel pipe conforming to ASTM A53.

4) All grooved couplings, fittings, valves and specialties shall be the products of a single manufacturer.

5) Grooved manufacturer must be ISO 9001 certified.

c. Copper system: ANSI B16.22, wrought copper with the following connection methods.

1) Soldered or brazed:

a) 2" and smaller: Make connections using 95%-5% tin-antimony solder joints above grade and sil-fos brazing below grade.

b) 2 ½" and larger: Sil-fos brazing or brazed and flanged.

2) With prior approval a grooved copper tubing connection system is acceptable for mechanical room application only.

a) Grooved copper tubing connection system: Victaulic CTS or Tyco-Grinnell for above grade joints.

i) Grooved couplings: Victaulic Style 607 (Quick Vic), Gruvlok FIG 6400.

ii) Coupling gaskets shall be pressure responsive type, Grade "EHP" EPDM.

iii) Fittings shall be wrought copper per ANSI B16.22, or bronze sand castings per ANSI B16.18.

iv) Grooved manufacturer must be ISO 9001 certified.

v) Flaring of copper tube to IPS dimensions is unacceptable.

3. Joints: 2" and smaller, soldered or brazed (piping located in shafts shall be welded); 2-1/2" and larger, ANSI B16.25 bevel weld, ANSI B16.5 flanges, ANSI B16.11 socket weld, or grooved.

L. Temperature and Pressure Relief Valve Discharge Piping:

1. Hydronic Water System (150 psig and 212°F. maximum):

a. Pipe: Type L copper ASTM B-88

b. Pipe: Schedule 40 black steel, ASTM A 53 Grade B.

c. Fittings: ANSI B16.22, wrought copper.

d. Fittings: 150 lb. rating. ANSI B16.3, malleable iron threaded.

e. Joints: ANSI B16.22, wrought copper, with 95%-5% tin-antimony solder joints.

f. Joints: 2" and smaller, threaded (except in the case of piping located in shafts which must be welded); 2-1/2" and larger, ANSI B16.25bevel weld, ANSI B16.5 flanges, or ANSI B16.11 socket weld.

2.3 VALVES: GENERAL

A. General: Valve ratings shall exceed respective system operating pressures by 50% (minimum). All valves shall be line size unless otherwise noted.

B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of balancing valve or circuit setter. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.

C. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

D. Acceptable Manufacturers (manufacturer and model number listed for individual valves indicates minimum acceptable by all manufacturers):
   1. Check, or Butterfly: Milwaukee, Nibco, Victaulic, Tyco-Grinnell (note: Commercial grade U.S. manufactured products only).
   2. Ball, and Drain Valves: Milwaukee, Nibco.
   3. Hydronic System Pressure Reducing Valves: Cash-Acme, Cla-Val, Watts, or Wilkins.
   4. Hydronic Pressure Relief Valves: Cash-Acme, Cla-Val, Watts, or Wilkins.
   5. Solenoid Valves: ASCO, Gould or Automatik
   6. Pressure Independent Temperature Control valves: Belimo, Flow Control Industries, Delta Control Products.

E. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on the valve body.

F. Operators:
   1. Provide 90 degree lever operator for ball valves.
   2. Provide 90 degree lever operator for lubricated natural gas plug valves. Exterior located natural gas plug valves shall be provided with removable manual wrench handle, one wrench for each 10 valves.
   3. Provide 90 degree locking lever operator for butterfly valves through 6” size. For 8” size and greater, provide gear operator and handwheel.
   4. Provide valve stem extension for lever-operated valves on insulated piping, so handle will clear insulation.
   5. Provide valves size 2 ½” and larger located more than 10 feet from floor in equipment room areas with chain operated sheaves. Provide chain and extend down to 5ft above floor and hook clips on chain arranged to clear walking aisles.

G. Valve Features:
   1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features. Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
   2. Bypass: On valves 6" and larger comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving. Provide a 3-valve bypass, minimum 1" size, to consist of two threaded shut-off valves and a plugged drain valve.
   3. Drain: Comply with MSS SP-45, and provide ¾” threaded pipe end with cap on chain.
   4. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
   5. Grooved: Valves shall be joined using grooved joint couplings of the same manufacturer. Copper tubing valve grooved ends shall be copper tubing sized.
   6. Threaded: Valve ends complying with ANSI B2.1.
   7. Solder-Joint: Valve ends complying with ANSI B16.18.
   8. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

2.4 HVAC SERVICE VALVES: MAXIMUM 125 PSIG SYSTEM WORKING WATER PRESSURE

A. Butterfly Valves:
   1. 2-1/2" and Larger:

a. MSS SP-67, lug type, ductile iron body, stainless steel disc, stainless steel stem, EPDM seat, memory stop control, lever handle thru 5" size and worm gear operator for 6" and larger. Mount stem in horizontal position. Milwaukee #ML234E for level handle operator and Milwaukee #ML534E for gear operator with memory stop or approved equal by Nibco #LD3022
b. 2-1/2" through 12" grooved end type, PPS (Polyphenylene Sulfide) coated ASTM A395 and A536 ductile iron body, elastomer encapsulated ductile iron disc with integrally cast stem, memory stop control, lever handle thru 5" size and worm gear operator with memory stop for 6" and larger. Mount stem in horizontal position. Victaulic Vic®-300 M, Tyco Grinnell Model B302.
c. 2-1/2" through 6" copper tube dimensioned grooved end type, CDA-836 cast bronze body, elastomer encapsulated ductile iron disc with integrally cast stem, memory stop control, lever handle thru 5" size and worm gear operator for 6". Mount stem in horizontal position. Victaulic Series 608, Tyco-Grinnell Model B680.

B. Ball Valves:
1. 2" and Smaller:
a. 600 psi, 2-piece bronze body, stainless steel ball, Reinforced PTFE seat, stainless steel stem, Zinc plated steel handle, full port. Threaded steel ends for iron pipe and soldered ends for copper pipe. Threaded steel pipe: Milwaukee #BA-400S. Soldered copper pipe: Milwaukee #BA-450S. or approved equal by Nibco Threaded steel pipe: Nibco #T-585-70-66. Soldered copper pipe: Nibco #S-585-70-66

C. Check Valves:
1. 2" and Smaller: Class 125, MSS SP-80, ASTM B62 and ASTM B16, cast bronze body, screwed cap, swing type, bronze disc. Threaded steel ends for iron pipe and soldered ends for copper pipe. Threaded steel pipe: Milwaukee #509T. Soldered copper pipe: Milwaukee #509 or approved equal by Nibco Threaded steel pipe: Nibco #T-433. Soldered copper pipe: Nibco #S-433
2. Silent Check 2-1/2" and Larger:
a. Class 125, ASTM A126 class B cast iron body, flanged globe style, silent non-slam design, spring loaded, center guided, bronze trim, stainless steel spring and screws. Milwaukee #1800 or approved equal by Nibco #F-910
b. ASTM A395 and A536 ductile iron body, grooved ends, stainless steel spring and shaft.
1) 2-1/2" and 3": PPS (Polyphenylene Sulfide) coated, aluminum bronze disc with mounted elastomer seal and machined seat.
2) 4" – 14": Black enamel coated body, elastomer encapsulated ductile iron disc with welded-in nickel seat.
3) Victaulic Series 716 or approved equal by Tyco-Grinnell Model 590.

D. Drain Valves:
1. Threaded, Class 600, bronze body, 2-piece ball valve, ¾" hose outlet with cap and chain. Milwaukee #BA-100H or approved equal by Nibco #T-585-70-66-HC

E. Lubricated Plug Valve:
1. ½"-6", Class 125, MSS SP-78, 200 psi, lubricated plug type, iron or semi-steel body, loose, wrench operated, straight way pattern round port, combination button head fitting and lubricant screw, Teflon seal and discs. Rockwell model "Super Nordstrom".

F. Combination Valve Sets for supply side of reheat coils: Griswold Isolator S combination valve, including isolation ball valve, 20 mesh stainless steel strainer, P/T test valve, and drain valve.
1. Acceptable product shall be Griswold, Nexus valves.

2.5 PRESSURE INDEPENDENT FLOW CONTROL VALVES (100% OUTSIDE AIR UNIT CHILLED WATER COIL CONTROL VALVES)

A. Modulating control valves shall be pressure independent. The flow rate through the valve shall not vary more than + or - 5% due to system pressure fluctuations across the valve in the selected operating range. Controls contractor shall furnish the valve actuator. The actuator shall be shipped to valve manufacturer for mounting and calibration.

B. All air handler coils shall utilize proportional control electronic valves.

C. The rangeability of the valve shall be 100:1 (minimum).

D. The valve bodies shall be of cast iron and rated for 150 PSI working pressure. All internal parts shall be stainless steel, teflon, brass, or bronze. Valve flow characteristics shall be able to be changed without removing the valve from the piping system.

E. Balancing valves shall not be required where pressure independent control valves are installed. Flow performance curves shall be provided with each valve.

F. The actuator shall modulate the control valve from 0 to 100% full rated flow.

G. Three pressure/temperature ports (Pete's Plugs) shall be installed at the factory in each valve. Two ports shall be used to measure inlet and outlet pressure to the valve. The third port is used to measure internal pressure within valve.

H. Manufacturer: Delta P Valve by Flow Control Industries, Inc., Belimo PICCV. Valves and actuator shall be provided by controls contractor and installed by mechanical contractor.

2.6 PRESSURE INDEPENDENT CHARACTERIZED CONTROL VALVES PICCV (VAV BOX REHEAT COIL CONTROL VALVES)

A. Electronic valves at all variable air volume terminals reheat coils shall be spring return actuator with MFT 0-10VDC control. . The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory.

B. The valve bodies shall be of forged brass body and rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and TEFZEL characterizing disc.

C. All actuators shall be electronically programmed by use of external computer software for the adjustment of flow. Programming using actuator mounted switches or multi-turn actuators are not acceptable.

D. Balancing valves shall not be required where these control valves are installed. Flow performance curves shall be provided with each valve.

E. Pressure/temperature ports (Pete's Plugs) shall be installed at the factory in each valve larger than 1”. Two ports shall be used to measure inlet and outlet pressure to the valve.

F. Manufacturer: Delta Control Products AutoTouch, Belimo PICCV, Valves shall be provided by controls contractor and installed by mechanical contractor.

G. 3-way coils ONLY: Belimo 3-way spring return, MFT proportional control “Characterized Control Valves” combined with Griswold’s Isolator R with automatic flow cartridge, integrated isolation ball valve, and two T/P test ports. Belimo 3-way valve shall be provided by controls contractor installed by mechanical contractor. Griswold valve shall be provided and installed by mechanical contractor.

2.7 HYDRONIC SYSTEM PRESSURE REDUCING VALVES

A. Single seated, direct operated type; high capacity, having bronze body with strainer, by-pass feature, pressure gauge tappings and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and fall-off at inlet and outlet pressure indicated.
1. 25-75 psig range: Watts #U5 series.
2. 10-25 psig range: Watts #N256

2.8 HYDRONIC SYSTEM PRESSURE RELIEF VALVES

A. Pressure Relief Valves: Constructed in accordance with ASME, 125-pound setting, and so stamped. Size as required. Watts #740 Series.

B. Temperature and Pressure Relief Valve: Constructed in accordance with ASME, 125-pound setting (or pressure setting as indicated on construction documents), and so stamped. Size as required. Watts #100XL, 40XL, 140, N240, or 340 Series.

2.9 THERMOMETERS AND GAUGES

A. General:
1. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.
2. No mercury shall be used in thermometers due to hazardous material classification.
3. Acceptable Manufacturers: Weklser, Ashcroft, Trerice, Marshalltown or US Gauge.

B. Thermometers:
1. Bi-Metal Type: Provide bi-metal glass thermometers of materials, capacities, and ranges indicated, designed and constructed in service indicated. Accuracy shall be 1% +/- full scale with adjustable recalibration.
   a. Case: Type 300 series stainless steel, hermetically sealed, glass window, 4-1/2” diameter dial, with adjustable angle.
   b. Adjustable Joint: Die cast aluminum, finished to match case, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.
   c. Scale: Satin faced, non-reflective aluminum, permanently etched markings.
   d. Stem: Stainless steel, adjustable angle socket, length to suit installation.
2. Range: Conform to the following:
   a. Hot Water: 20°F - 240°F with 2°F scale divisions.
   b. Cold Water: -40°F - 160°F with 2°F scale divisions.

C. Thermometer Test Wells:
1. Provide thermometer test wells as indicated, constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2 inch extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

D. Temperature/Pressure Gauge Connector Test Plugs (Pete’s Plugs):
1. Provide temperature gauge connector plugs pressure rated for 500 psi and 200° F (93° C). Construct of brass or stainless steel, equip with ½” NPT fitting, with self-sealing valve core

type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion thermometer or pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

E. Pressure Gauges:
1. General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
2. Type: General use, 1% accuracy ANSI B40.1 grade A, phosphor bronze bourbon type, bottom connection.
3. Case: Drawn steel or brass, glass lens, 4-1/2" diameter.
4. Connector: Brass with ¼" male NPT.
5. Scale: White coated aluminum, with permanently etched markings.
6. Pressure differential range shall be 100 psig minimum for the appropriate application with maximum 1 psig divisions.

F. Pressure Gauge Cocks:
1. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Gauge cock shall be 1/4-1/2" threaded end, 2-piece bronze body ball valve. Milwaukee #BA-100.
2. Syphon: ¼" straight coil constructed of brass tubing with ¼" male NPT on each end.
3. Snubber: ¼" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

2.10 PIPING SPECIALTIES

A. General:
1. Provide factory fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or provide proper selection to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is installer's option.

B. Pipe Escutcheons:
1. Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.
2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.
3. Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.

C. Low Pressure Y-Type Pipeline Strainers:
1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125% of the working pressure of piping system, with Type 304 stainless steel screens, with 3/64" perforations at 233 0.045" perforations per square inch.
2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with hose bibb. Sarco, Keckley, Wheatley or Mueller.
3. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with 3/4" drain valve. Sarco, Keckley, Wheatley or Mueller.
4. Grooved Ends, 2 ½" and Larger: Ductile iron body, bolted screen retainer with off center blowdown fitted with ¾" drain valve. Victaulic style 730/W730 or 732/732 Tyco-Grinnell Fig.

S853 and S55, Gruvlok FIG 7260/758G, or approved equal.

D. Drip Pans:
1. Provide drip pans fabricated from 16-gauge galvanized sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top by structural angles. Provide hole, gasket, and flange at low point for watertight joint and 1" copper drain line connection.

E. Air Vent with Valves:
1. Install in all closed and open loop water systems at high points of systems and at any other point necessary to free system of air. A shut-off valve shall be provided in riser to each automatic vent valve to facilitate servicing. A minimum 3/8 inch type "L" copper tubing drain line shall be run to floor sink, floor drain or other approved drain receptacle to carry away water that valve discharges. Manual type vent may be used in lieu of automatic type, where specifically shown on the Drawings. Provide Hoffman #79 or equal by Amtrol, Watts, or Dole.

F. Waterways:

G. Provide red brass nipples 6 times diameter in length, 6” minimum length. Unions:
1. Unions shall be of type specified in following schedule:
   a. Black Steel, 2" and smaller: 250 lb. screwed malleable iron, ground joint, brass to iron seat.
   b. Black Steel, 2-1/2" and larger: 150 lb. cast iron screwed flanged, flat faced, full faced gasket.
   c. Soldered Copper or Brass Pipe, 2" and smaller: 150 lb. cast bronze or copper, ground joint, non-ferrous seat with soldered ends.
   d. Screwed Copper or Brass Pipe, 2" and smaller: 150 lb. cast brass, ground joint, brass to brass seat, with threaded ends.
   e. Flanged Copper or Brass Pipe, 2-1/2" and larger: two (2) 150 lb. cast bronze flanges.
   f. Where grooved joint piping systems are utilized, unions are not required. Grooved joint couplings shall serve as unions.
   g. Manufacturer: EPCO, Mueller, Stanley G. Flagg, Victaulic, Tyco-Grinnell, or Watts.

H. Flanges:
1. Provide flanges at flanged connections to equipment, tanks and valves. Faces of flanges being connected shall be alike in all cases. Connection of raised-face flange to flat-faced flange not permitted.
2. Use ASTM A307, Grade B, bolts and nuts for cast iron flanges and ASTM A193 for steel flanges. Regular square head unfinished bolts with heavy semi-finished hex nuts ASTM A194. Cadmium plated where exposed to weather. Rating: 150 lb. or 300 lb. in high pressure portions.
3. Type of pipe and corresponding flanges as follows:
   a. Screwed Black Steel Pipelines: 125 lb. black cast iron screwed flange, flat faces.
   b. Welded Steel Pipe, 150 lb. black forged steel welding flanges, 1/16" raised face ASTM A181 Grade I. Use flat face when connected to flat faced companion flange.
   c. Grooved Steel Pipe, Class 150, ASTM A395 and A536 ductile iron flange adapter, with pressure responsive synthetic rubber gasket. Victaulic Style 741, Tyco-Grinnell Fig. 71, or Gruvlok FIG 7401.

I. Flange Gaskets:
1. Type: full faced or flat ring to suit flange facings.
2. Shall conform to ASTM F-104
3. Minimum thickness: 1/16”
4. Manufacturer: Garlock style 3200, or approved equal.

J. Pipe Sleeves:
1. Provide fire proof sleeve assemblies utilizing UL rated sealant systems at all fire rated penetrations. For non-rated sleeve penetrations pack the annular space between the pipe and sleeve with fiberglass and/or mastic.
2. Sleeves shall provide a minimum ½ inch annular clearance around pipe.
3. Sheet metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gauge; 4" to 6", 16 gauge; over 6", 14 gauge.
4. Steel pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
5. Iron pipe: Fabricate from cast iron or ductile-iron pipe; remove burrs.
6. Plastic and copper pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
7. Sleeves through interior concrete walls and floors: Telescopic, submerged, adjustable sleeves by Adjust-to-Crete, AMI or Shamrock. Floor sleeves to extend a minimum of 1" above finished floor.
8. Through exterior walls and floor on grade: 150-pound class cast-iron pipe sleeve. Where waterproof membranes are used, provide membrane clamps. For insulated piping, sleeve diameter shall not be less than diameter of insulated pipe.

K. Sleeve Seals:
1. All sleeves shall be sealed to prevent intrusion of moisture, dust or insects.
2. Underground: For sleeves passing through exterior or foundation walls, provide mechanical link seal assembly.
3. Aboveground: For sleeves passing through walls or floors provide a non-toxic 3-hour rated fire resistant silicone foam sealant with a Flame Spread Rating of 20. Sealant to be tested and approved under UL 263, ASTM E119, and NFPA 251 Standards. All fire rated penetrations shall be sealed with approved UL System.
4. Local Approvals: All seals to be provided shall be in accordance with the regulations of all governing agencies of the city, county, and State Fire Marshal's Office.

2.11 PIPE COATING

A. All underground steel and copper pipe fittings and all above ground steel and copper pipe and fittings in corrosive air environments shall be covered with one of the following methods:
1. Twice Wrap 20 Mill Scotch Wrap PVC No. 51, 50% overlap.
2. Prefabricated extruded plastic cover with joints sealed with two coats of 20 Mill Scotch Wrap No. 51.

2.12 SUPPORTS AND ANCHORS (SEE SECTION 230500)

2.13 EXPANSION COMPENSATORS AND FLEXIBLE PIPING CONNECTIONS

A. General: Pipe expansion, in general, is to be absorbed in bends, swing joints, expansion loops, and offsets. All piping mains, branches and runouts shall be installed to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Stresses shall be within allowable limits of ANSI B31.1 for pressure piping. Vertical piping for domestic hot water, chilled water, heating water shall be provided with expansion joints at each floor. Expansion products to conform to the standards of the Expansion Joint Manufacturer's Association. Expansion joints shall not require packing. Installer shall select materials and pressure/temperature ratings to suit intended service. Select packless expansion joints to provide 150% absorption capacity of calculated maximum piping expansion between anchors. All connections shall have ends to match piping system application.

B. Expansion Compensators (Pipe Compression and Extension): Multiple stainless steel bellows

and stainless steel liner with shroud and end fittings. Keflex #311 series or approved equal.

C. Flexible Expansion Joint/Seismic Connector for Steel Pipe: Stainless steel hose and braid, 180° return, CSA approved, and end fittings. Metraflex #Metraloop, Unisource V-SF21 Style, or approved equal.

D. Flexible Connection for Steel Pipe (Piping and Equipment Located Outside the Building): Stainless steel hose and braid, with threaded or flanged ends. Metraflex #SST or approved equal. Provide steel supports to prevent sagging is required.

E. Three grooved joint flexible type couplings may be used in lieu of flexible connectors on steel pipe for vibration attenuation and stress relief. Grooved joint couplings shall be placed in close proximity to the vibration source. For services up to 250°F. Victaulic Style 177 or 77, Tyco Grinnell Fig. 705 and 707 couplings, or Gruvlok FIG 7401.

F. Flexible Connection for Copper Pipe: Bronze hose and braid, copper tube ends. Metraflex #BBS, Unisource V-BF11 Style, or approved equal. Provide steel supports to prevent sagging is required.

G. Flexible Rubber Connectors (Pump Connections): Concentric spool type expansion joint, single or double arch. Chlorobutyl tube and cover, meeting ASTM specification D2000 Grade 2AA610AB, L13. The body shall be reinforced with rectangular body rings and a minimum of six bias plies of polyester fabric. A hypolon coating shall be applied completely and uniformly to the cover. All expansion joints shall be rated 190 PSI/26 inch vacuum at 250° F for sizes up to and including 12 inch.

1. For heating hot water service and critical pump connections. Furnish with fluorelastomer tube and cover to ASTM D2000 Grade 1HK710. The body shall be reinforced with rectangular body rings and six bias plies of fiberglass/kevlar fabric rated 190#/26 inch vacuum at 400° F. Provide _ inch thick galvanized flat (not L shaped) back up rings and control rods to limit maximum axial extension. Manufacturer shall provide documentation utilizing oven aged and cold flexibility tests to verify elastomer capability. Each batch of compound manufactured shall be tested to verify it conforms to the ASTM specifications listed below. Garlock #204HP. No known equals.

	CHLOROBUTYL	**VITON**
Specific Gravity	ASTMD 792	ASTMD 792
Durometer Shore A	ASTMD 2240	ASTMD 2240
Tensile	ASTMD 412	ASTMD 412
Elongation	ASTMD 412	ASTMD 412

	POLYESTER	**FIBERGLASS/KEVLAR**
Thread Count	ASTMD 3775	ASTM 1910
Gauge	ASTMD 1777	ASTMD 1777
Weight	ASTMD 3776	ASTM 1910
Breaking Strength	ASTMD 1682	ASTMD 1682

2. For chilled water, and non-critical pump connections. Furnish with fluorelastomer tube and cover to ASTM D2000 Grade 1HK710. The body shall be reinforced with rectangular body rings and six bias plies of fiberglass/kevlar fabric rated 190#/26 inch vacuum at 250° F. Provide _ inch thick galvanized flat (not L shaped) back up rings and control rods to limit maximum axial extension. Garlock #206 EZ-FLO or approved equal.
3. Three grooved joint flexible type couplings may be used in lieu of flexible connectors on steel

pipe for vibration attenuation and stress relief. Grooved joint couplings shall be placed in close proximity to the vibration source. For services up to 250°F. Victaulic Style 177 or 77 Or Gruvlok FIG 7401.

H. Flexible Ball Pipe Joints: Provide flexible ball pipe joints where indicated for piping systems, with materials and pressure/temperature ratings selected by installer to suit intended service. Design joints for 360° rotation, and with minimum of 50° angular flexing movement for sizes ¼" to 4". Provide two composition gaskets for each joint. Barco or approved equal.
1. Certify carbon steel joints for environmental shock testing in accordance with MIL-S-4456 or MIL-S-901C.
2. Comply with Section II of ASME Boiler and Pressure Vessel Code and ASME B31 Power Piping for materials and design of pressure containing parts and bolting.
3. Test each assembly with steam at working pressure of piping system for zero leaks before shipment.

I. Expansion Joints for Grooved Piping: For piping systems fabricated from grooved pipe and couplings, use one of the following methods for expansion compensation:
1. Combination Couplings and Nipples: Provide expansion joints constructed of grooved short pipe nipples and flexible couplings, designed by manufacturer to suit intended service. Provide removable ties to hold joint compressed or expanded during piping fabrication, depending on application. Total joint end movement is dependent on the number of couplings/nipples in the joint. Select couplings and gasket materials to match balance of piping system. Victaulic Series 155 or Gruvlok FIG 7240.
2. Slip-Type Expansion Joints: Provide slip-type expansion joints constructed of carbon steel pipe and couplings, designed by manufacturer to suit intended service. Joint shall be gasketed expansion joint, with grooved ends. Slide section coated with PTFE modified PPS (Polyphenylene Sulfide) coating. Joint suitable for axial end movement up to 3". Victaulic Style 150. Select couplings and gasket material to match balance of piping system.
3. Three flexible couplings: Use three flexible couplings (Victaulic 177, 75 or 77, Tyco-Grinnell Fig. 705 and 707, or Gruvlok FIG 7401) for the first three connections in close proximity to a pump or chiller to eliminate flexible rubber connectors.

J. Pipe Alignment Guides: Provide pipe alignment guides on both sides of expansion joints, and elsewhere as indicated on drawings. Guide shall be of carbon steel construction with split guiding cylinder and integral anchor base and internal four finger two-piece spider. Cylinder wall thickness shall be equal to schedule 40 wall thickness of pipe being guided. Spider shall be capable of clamping directly to pipe and moving only in an axial direction while inside cylinder. Anchoring directly to building substrate. Metraflex #Style IV or equal.

K. Expansion Loops: Provide field fabricated pipe expansion loops as detailed on the drawings or in place of mechanical expansion joints. Expansion loops in IPS steel and roll grooved copper tubing systems shall be accommodated with loops or bends consisting of (8) Victaulic or Gruvlok couplings, (4) 90 degree elbows, and (3) grooved end pipe spools provided in water systems up to 250 deg F in accordance with recommendations for expansion compensation.

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.

B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal or otherwise irregular work unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

3.3 INSTALLATION

A. Coordinate the work between the various Mechanical Sections and with the work specified under other Divisions of the work or contracts toward rapid completion of the entire project. If any cooperative work must be altered due to lack of proper supervision or failure to make proper provisions in time, then the work hereunder shall include all expenses of such changes as are necessary in the work under other contracts, and such changes shall be directly supervised by and made to the satisfaction of the Engineer.

B. The cooperative work not included in the Mechanical Division related to the general construction work is as follows:
1. All formed concrete work
2. Framed openings in masonry and other Architectural and Structural elements
3. Wood grounds and nailing strips in masonry and concrete

C. Inspect all material, equipment, and apparatus upon delivery and do not install any that may be subject to rejection as a result of damage or other defects. Provide tarps and visqueen cover to protect equipment and piping delivered to and stored at the site.

3.4 WORKING PRESSURES

A. All fittings, valves, pipe, specialties equipment shall be rated for the working pressure subjected in the installed locations.

B. Drawings indicate working pressure in each system. The rating of the equipment and material shall not be less than that of the system pressures.

3.5 PIPE SIZES TO EQUIPMENT

A. General: Pipe sizes indicated on drawings shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within one foot of equipment.

B. At temperature control valves with sizes smaller than connected lines, reduction shall be made immediately adjacent to valve.

3.6 PIPING INSTALLATION

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints or couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16 inch misalignment tolerance. Comply with ASME B31 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2 inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1 inch clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.

C. Elevator Machine Rooms, Switchgear, Generator, Telecommunications, Telephone Rooms, and Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

D. Cleaning: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any).

3.7 PIPING INSTALLATION (PRE-INSULATED BELOW GRADE SYSTEM)

A. Slope all piping as to vent and drain to building or Vaults

B. Utility Marking Tape shall be installed over the entire length of the underground piping. Install plastic tape along both sides of the center line of the trenches at the elevation of approximately 12 inches above the top of pipe line.

C. Anchors shall be installed as per the manufacturer's recommendations. Concrete shall be cast over the anchor plate and conduit and shall be large enough for firm anchorage into undisturbed soil.

D. All underground piping systems must be inspected by the Owner's representative prior to backfilling.

3.8 EXCAVATION AND BACKFILL

A. Perform all necessary excavation and backfill required for the installation of mechanical work in accord with Division 2. Repair pipelines and other work damaged during excavation and backfilling.

B. All piping shall be fully bedded on sand. Place a minimum 4-inch deep layer on the leveled trench bottom for this purpose.

C. The trench shall be evenly backfilled with similar materials as the bedding in 6 inch compacted layers to a minimum height of 6 inches above the top of the insulated piping system. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil as required by the contract documents. Earth backfill shall be free of rocks over 2" in diameter and foreign matter. Disposal of excess materials as directed.

D. The installing contractor shall handle the system in accordance with the directions furnished by the manufacturer and as approved by the architect and engineer. The steel casings shall be air tested at 15 psig and the service piping shall be hydrostatically hammer tested to 150 psig or 1

1/2 times the operating pressure, or as specified in the contract documents. The test pressure shall be held for not less than one hour.

3.9 FLUSHING AND CLEANING PIPING SYSTEMS

A. Water Piping (chilled, heating,): Clean systems with chemicals specified in Section 232500 HVAC Water Treatment. Follow the method provided below or a method recommended by the suppliers of the chemicals specified in Section 232500.

1. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and similar deleterious substances without damage to any system component. Provide temporary piping or hoses to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any components which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris-carrying velocity of 2.5 to 6 feet per second, if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and contractor's booster pumps. Flush until clean as approved by the University of California Berkeley, Architect or Engineer.
2. Cleaning: Using products specified in Section 232500, circulate systems at normal temperature to remove adhering organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and similar substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Before cleaning isolate equipment which is "clean" and where dead-end debris accumulation must not occur. Sectionalize system if possible, to circulate at velocities not less than 6 feet per second. Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.
3. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body using the velocity of this throttling action. Flush for not less than one hour.

3.10 WATER TREATMENT EQUIPMENT AND SYSTEMS

A. Close and fill systems as soon as possible after final flushing to minimize corrosion.

3.11 ANTIFREEZE CHARGED PIPING

A. Where indicated on plans or schedules or other specification sections charge piping with antifreeze solution coordinated to provide freeze protection to 10°F below the ASHRAE 99.6 heating db (Freeze Protection Design Temperature).

Freeze Protection Design Temperature	Freeze Protection (% Propylene Glycol)	Burst Protection (% Propylene Glycol)
20	18	12
10	29	20
0	36	24
-10	42	28
-20	46	30

B. Unless otherwise specified, provide percent of fluid by volume of inhibited propylene glycol.

C. Dow Chemicals Dowfrost, Interstate Intercool, or equal inhibited mixture.

D. Provide charging valves, drains, vents, and other hardware as necessary to charge the solution into the piping system.

E. Provide a calculation sheet indicating system volume in gallons and amount of glycol required.

F. Provide a post charging test of the percent of glycol and submit results for review by engineer and University of California Berkeley.

3.12 WELDING

A. Qualifications of Welders: Welders performing work under this Contract shall be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB). Welding to be in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.
   1. Submit for approval the names, identification, and welder's assigned number, letter or symbol of welders assigned to this project.
   2. The assigned identification symbol shall be used to identify the work of each welder and shall be indelibly stamped immediately upon completion of each weld.
   3. Welders shall be tested and certified for all positions.
   4. Submit identifying stenciled test coupons made by each operator.
   5. Any or all welders may be required to retake welding certification tests without additional expense.
   6. When so requested, a welder shall not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.
   7. Recertification of the welder shall be made after the welder has taken and passed the required tests.
   8. Where piping 1-1/2 inches and smaller is butt or socket welded, submit 3 samples of test welds for approval.

3.13 PIPING SYSTEM JOINTS

A. All piping shall be cut squarely, free of rough edges and reamed to full bore. Piping shall be mechanically cleaned prior to make-up of joints and fully inserted into fittings.

B. Provide joints of type indicated in each piping system.

C. Thread pipe in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

D. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM. B-32, in accordance with IAPMO IS 3-93, ASTM B-828 and Copper Development Association recommended procedures. Joints shall be cleaned by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes shall be applied liberally to the outside of the pipe and the solder cup of the fitting. Fluxes shall be water soluble for copper and brass potable water applications, and shall meet CDA standard test method 1.0 and ASTM B813-91. Solder

shall be applied until a full fillet is present around the joint. Solder and flux shall not be applied in such excessive quantities as to run down interior of pipe. Lead solder or corrosive flux shall not be present at the jobsite.

1. Manufacturers:
   a. Solder: JW Harris "Bridgit" or Englehard "Silvabrite 100".
   b. Flux: Laco "Flux-Rite 90", MW Dunton "Nokorode CDA Flux", Hercules "Fluid Action Solder Flux".

E. Piping shall be capped during construction to prevent entry of foreign material.

F. Grooved Joints:
1. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall meet AWWA C-606 requirements.
2. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer.
3. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
4. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically inspect the product installation. Contractor shall remove and replace any improperly installed products.

G. Weld pipe joints in accordance with recognized industry practice and as follows:
1. Weld pipe joints only when ambient temperature is above 0° F.
2. Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
3. Use pipe clamps or tack-weld joints with 1 inch long welds, 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and at edges of each weld. Weld by procedures which will ensure elimination of unsound or un-fused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.
5. Do not weld out piping system imperfections by tack-welding procedures. Re-fabricate to comply with requirements.
6. At Installer's option, install forged branch-connection fittings whenever branch pipe is indicated, or install regular T-fitting.

H. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

I. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

3.14 VALVES

A. General: Except as otherwise indicated, comply with the following requirements.
1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided as necessary.
2. Install valves, except butterfly valves, with stems pointed up, in vertical position where

possible, but in no case with stems pointed downward from horizontal plane without prior written approval. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

3. Install butterfly valves with stems mounted horizontally.
4. All valves mounted higher than 10 feet above floor in mechanical rooms and where indicated shall be installed with stem horizontal and equipped with chain wheels and chains extending to 5 feet above floor.

B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends of types of pipe/tube connections:
1. Copper Pipe, 2-1/2" and Smaller: One of the following, at installer's option:
   a. Soldered-joint valves
   b. Grooved-joint valves
2. Copper Pipe, 2-1/2" and Larger: Grooved-joint valves.
3. Steel Pipe, 2" and Smaller: Threaded joint valves.
4. Steel Pipe, sizes 2 ½" and larger: One of the following, at installer's option:
   a. Flanged valves
   b. Lug valves
   c. Grooved-end valves

D. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

E. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

F. Fluid Control: Except as otherwise indicated, install gate, globe, ball, plug, circuit setter, glove, and butterfly valves to comply with ASME B31.9.

G. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

H. Wafer Check: Install between 2 flanges in horizontal or vertical position.

I. Ball Valve: Ball valve used on gas systems shall be UL listed, CSA approved for pressure of system, no exception

J. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

K. Valve Identification: Tag each valve in accordance with "Mechanical Identification" section.

L. Cleaning: Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.

M. Install so handles are readily available. Locate valves and valve handles for appropriate maintenance access.

N. Gasket and O Ring Material: Valve manufacturer is responsible for submittals. Provide gasket and O ring material best suited for the both piping systems.

3.15 TEMPERATURE GAUGES

A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor without supplemental illumination. All gages to be installed with snubbers to absorb system shock.

B. Install in the following locations, and elsewhere as indicated:
1. At inlet and outlet of hot water heaters
2. At inlet and outlet of boilers
3. At inlet and outlet of chillers
4. At inlet and outlet of heat exchangers

3.16 MECHANICAL SLEEVE SEALS:

A. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form a watertight seal.

B. Fire Barrier Penetration Seals: Fill entire opening with sealing compound in compliance approved and listed UL system number. Adhere to manufacturer's installation instructions.

3.17 EXPANSION LOOPS

A. Expansion Loops: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as determined by installer for adequate expansion of installed piping system. Subject loop to cold spring which will absorb 50% of total expansion between hot and cold conditions. Provide pipe anchors and pipe alignment guides as indicated, and elsewhere as determined by installer to properly anchor piping in relationship to expansion loops.

B. Expansion Compensation for Risers and Terminals: Install connection between piping mains and risers with at least five pipe fittings including tee in main. Install connections between piping risers and terminal units with at least four pipe fittings including tee in riser.

3.18 EXPANSION COMPENSATORS

A. Install as noted on plans. Where plans do not indicate spacing of guides or other pertinent information, install per manufacturer's recommendations.

3.19 PIPE INSPECTIONS

A. Inspections shall be done by UCB Inspection Services.

B. It is the intent of the Contract Documents that systems be inspected at completion of each phase while under tests required for administrative authorities, and prior to concealment, i.e. "Rough-in" "Top-out" and final.

C. Inspection - Below Grade: All piping installed below grade shall be inspected prior to burial by the Architect, the University of California Berkeley's Representative or the Engineer. Provide photographs of underground piping in Operation and Maintenance Manuals including location and depth of pipes. Contractor must notify Architect no less than 24 working hours prior to

inspection time. Should the piping be buried without approval the contractor may be requested to uncover the piping at no delay to the project and at no additional cost to the University of California Berkeley's.

D. Inspection - Above Grade: All piping installed above grade shall be inspected upon completion and prior to finish of walls and ceilings by the Architect, the University of California Berkeley's 's Representative or the Engineer. Contractor must notify Architect no less than 24 working hours prior to inspection time. Should the piping be hidden within the structure prior to inspection approval the contractor may be requested to uncover the piping at no delay to the project and at no additional cost to the University of California Berkeley's.

3.20 PAINTING (SEE SECTION 230500)

3.21 IDENTIFICATION MARKERS (SEE SECTION 230500)

3.22 WATER ANALYSIS AND TREATMENT

A. Upon completion of systems installation, cleaning, and filling, engage a qualified water treatment firm, acceptable to the Architect and Engineer. The water treatment firm shall perform a chemical analysis on each system listed hereinafter, and shall submit to the Engineer a report, including the following:
   1. Analysis of heating water, chilled water, and condenser water systems
   2. Initial treatment of each system
   3. Recommendations regarding subsequent, periodic, or continuous treatment on each system

B. Contractor is to furnish and install initial treatment as specified in paragraph A, item 2 above.

C. For all systems contractor is to provide for periodic testing at 6 months and 12 months after startup and shall provide all recommended treatment for full first year of system operation.

3.23 TESTING

A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.

B. Piping: Remove from the system, during testing, all equipment which would be damaged by test pressure. Replace removed equipment when testing has been accomplished. The systems may be tested in sections as the work progresses; however, any previously tested portion shall become a part of any latter test of a composite system. Correct leaks by remaking joints with new material.

C. Test time will be accrued only while full test pressure is on the system, unless indicated otherwise. "Tolerance" shall be no pressure drop, except that due to temperature change in a 24-hour period. Inspect and test all work prior to burying or concealing. Test pressure shall be one and one-half times the system operating pressure or the listed test pressure below, whichever is greater:

SYSTEM	TEST MEDIUM	TEST PRESSURE	TOLERANCE – TEST PERIOD
Chilled Water	Water	100 psig	None - 8 hours
Tanks	Water	1.5 x working pressure	None - 24 hours
Heating Water	Water	100 psig	None - 8 hours
Refrigerant Piping	Air	200 psig	None – 8 hours

D. Valves: Test all valve bonnets for tightness. Test operate all valves at least once from closed-to-open-to-closed position while valve is under test pressure. Test all automatic valves, including solenoid valves, and temperature and pressure relief valves, safety valves, and temperature and pressure relief valves not less than three (3) times.

E. Piping Specialties: Test all thermometers, pressure gauges, and water meters for accurate indication; automatic water feeders, and air vents for proper performance. Test all air vent points to ensure that all air has been vented.

END OF SECTION

SECTION 233113
AIR DISTRIBUTION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this Section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 230500 - Basic Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
1. Ductwork
2. Ductwork Specialties
3. Flexible Connections
4. Sealants, Adhesives and Tapes
5. Flashings
6. Bird Screens
7. Duct Access Panels and Doors
8. Control Dampers
9. Backdraft Dampers
10. Louvers
11. Diffusers, Grilles, and Registers
12. Fire and Smoke Dampers
13. Variable Air Volume (VAV) Terminal Units
14. Elevator Shaft Vents

1.3 ACOUSTICAL MECHANICAL GENERAL PROVISIONS

A. Work Included in this section includes acoustical performance requirements of the following:
1. Acoustical Flexible Air Ducts
2. Acoustical Duct Lining
3. Terminal Units
4. Grilles and Diffusers

B. Related Work Not Included in this Section:
1. Vibration Isolation
2. Prefabricated Silencers
3. Maximum Sound Power Levels for Mechanical Equipment

C. Requirements documented in this section are for acoustical performance only. Performance requirements documented in the Mechanical General Provisions section must also be met.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230500: Basic Materials and Methods

B. Section 230593: Testing, Adjusting and Balancing

C. Section 230700: Mechanical Insulation

D. Section 230900: Controls and Instrumentation

1.5 QUALITY ASSURANCE

A. Codes and Standards: Provide products conforming to the requirements of the following:
1. ARI 885-98 “Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminal and Air Outlets.”
2. AMCA-210 - Laboratory Methods of Testing Fans for Rating Purposes.
3. ANSI S1.23 - Designation of Sound Power Emitted by Machinery and Equipment.
4. ASC-A7001 - Standard for Duct Sealants.
5. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip. Type 304 or 304 stainless steel.
6. ASTM A525 - Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) Hot-Dip Process. G90 zinc-coated.
7. ASTM A527/A527M - Standard Specification for Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
8. TIMA AAC-101 - Standard for fiberglass duct liner with erosion proof facing.
9. UL 181 - Factory-Made Air Ducts and Connections, Class 1.
10. ASTM E477-06a Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
11. Comply with NFPA 90A Installation of Air Conditioning and Ventilation Systems.
12. Comply with NFPA 90B Installation of Warm Air Heating and Air Conditioning Systems.
13. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
14. NFPA 255 Standard Method of Test Surface Burning Characteristics of Building Materials.
15. UL Test for Surface Burning Characteristics of Building Materials.

B. APPLICABLE STANDARDS AND TEST CONDITIONS
1. Air Diffusion Council Flexible Air Duct Test FD72R1: Paragraph 3.2.1, Sound Attenuation.
2. ASTM C1071-05e1 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
3. ANSI/ASTM C423-90a Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
4. ASTM E795-92 Standard Practices for Mounting Test Specimens During Sound Absorption Tests.
5. ASHRAE Standard 70-2006 Method of Testing the Performance of Air Outlets and Air Inlets.
6. ARI 885-98 Standard for Estimating Occupied Space Sound Levels in the Applications of Air Terminals and Air Outlets.
7. ARI 880-98 Air Terminals

C. Conform to NFPA 90A "Standards for the Installation of Air Conditioning and Ventilating Systems".

D. Provide and construct ductwork systems in conformance with the latest editions of the following documents:
   1. SMACNA "HVAC Duct Construction Standards-Metal and Flexible - 1995" (HDCS)SMACNA "Accepted Industry Practice for Industrial Duct Construction" for duct pressures above +5" W.G. positive pressure or below -5" W.G. negative pressure. Where differences exist between SMACNA and the prevailing building code, the gauge or construction method of the submitted ductwork shall be the more stringent of the two standards
   2. ASHRAE Systems and Equipment Handbook "Duct Construction" chapter
   3. ASHRAE Fundamentals Handbook "Duct Design" chapter

E. Alternatives: The SMACNA standards and publications referenced in this Section of the specifications establish ductwork construction requirements.
   1. Alternatives to these standards and publications may be submitted. Approval will be based on demonstration that such alternatives are equivalent and satisfy the functional requirements described in the referenced standards.
   2. Such demonstration shall include evidence that the alternatives proposed were tested in accordance with SMACNA procedures and with test results certified by an independent testing laboratory.

F. All ductwork and equipment shall be seismically supported and braced per the SMACNA “Seismic Restraint Manual: Guidelines for Mechanical Systems”.

G. Flame/Smoke Rating: All materials, including sealants and adhesives, exposed within plenum shall have a flame-spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.

1.6 SUBMITTALS

A. Prior to construction, submit for approval on all materials and equipment:
   1. Ductwork
   2. Ductwork Specialties
   3. Flexible Connections
   4. Sealants, Adhesives and Tapes and calculated leakage estimate based on Class 3 (3 cfm/sq.ft). leakage.
   5. Flashings
   6. Bird Screens
   7. Duct Access Panels and Doors
   8. Backdraft Dampers
   9. Control Dampers
   10. Diffusers, Grilles, and Registers
   11. Fire and Smoke Dampers
      a. Submit a schedule of selected dampers listing the following information for each damper: Location, nominal size, free area velocity, and pressure drop at free area velocity.
   12. VAV Boxes
   13. SMACNA “HVAC Duct Construction Standards - Metal and Flexible"
   14. Provide catalog cuts and data sheets on the specific silencers utilized.
      a. Provide documentation showing compliance with the performance requirements documented in this Specification Section including Flamespread Classification,

Smoke Development Rating, and a detailed description of the acoustical fill material intended to be used.

b. Include a list showing the silencer used, its location, its size, pressure drop at scheduled CFM, certified test data on Dynamic Insertion Loss, Self-Noise Power Levels and Aerodynamic Performance for Reverse and Forward Flow test conditions.

c. Provide copies of the independent laboratory test reports for the silencers being submitted.

B. Acoustical submittals

1. Provide submittal information in accordance with the requirements specified in this section and in Submittal Procedures.

2. Provide submittal documenting the following:
   a. Itemized list referencing items being submitted and page numbers where the information indicated below can be found for each submitted item.
   b. Manufacturer's model and catalog data.
   c. Complete connection diagrams for each Trade.
   d. Dimensions, capacities, ratings materials and finishes.
   e. Tabulated data sheet clearly marked with items being proposed.
   f. Acoustical test data measured in an accredited laboratory under the standards required in this submittal for each item being submitted.
      1) Acoustical test data must be provided based on the design operating conditions. For equipment with multiple design configurations, such as terminal units and grilles an itemized list of each piece of equipment, the location, the operating conditions, and the acoustical performance must be provided.

C. Shop Drawings: Provide shop drawings of sheet metal ductwork and plenums as follows:
1. Draw to a scale not less than 1/4" to one foot, with sheet sizes equal to Contract Drawings.
2. Show duct sizes, where possible use even duct sizes.
3. Show fitting details.
4. Show coordination with lighting fixtures, fire dampers, smoke dampers, piping, diffusers, grilles, registers, fans, major electrical runs, cable trays and bus ducts.

D. Certifications: Provide a duct schedule, certified by an officer of the sheet metal fabrication subcontractor, that the ductwork conforms to SMACNA standards, and for each sheet metal system furnished on the project include:
1. System name.
2. Duct material.
3. Duct gauge.
4. SMACNA rectangular reinforcement number.
5. SMACNA intermediate reinforcement number.
6. SMACNA transverse reinforcement number.
7. Rod diameter and type.
8. Sealant type.
9. Attachment method.
10. Duct system design pressure.

E. Construction IAQ Management Plan: Collaborate with the general contractor to submit and implement an IAQ Management Plan for the construction process meeting the requirements of the SMACNA IAQ Guidelines. This plan should address the protection of the ventilation system components during construction and cleanup of contaminated components after construction is

complete. SMACNA IAQ Guideline recommends control measures in five areas. The IAQ Management Plan should address how compliance has been achieved in these required five areas as follows:

1. HVAC Protection
   a. Shutdown of return side of existing HVAC system in areas effected by heavy construction.
   b. Provision of temporary filters if existing or new systems must remain operational during construction.
   c. Dampering of supply and returns and sealing of openings in areas subject to construction dust.
2. Source Control
   a. How will reduction of contaminants be reduced at the source?
   b. What steps will be taken to employ low emitting products and sealants.
   c. How will air handling equipment be cycled off when not needed.
3. Pathway Interruption
   a. Describe how the construction space will be ventilated as required to dilute contaminants.
   b. Describe how occupied spaces adjacent to construction areas will be kept at positive pressure relative to spaces under construction.
4. Housekeeping: Describe how the following housekeeping objectives will be implemented:
   a. Reduction of dust generated by work will be suppressed.
   b. Maintaining a frequent cleaning frequency for dust and particulates.
   c. Remove spills or excess applications of solvent-containing products as soon as possible.
   d. Remove accumulated water and keep work areas as dry as possible.
   e. Protect insulation materials from exposure to moisture.
5. Scheduling: Describe how overlap of construction activity and ongoing building occupancy activities will be minimized.

F. Field Manual: Submit one copy of the SMACNA "HVAC Duct Construction Standards - Metal and Flexible". Maintain a second copy on the project site.

G. Any ductwork installed without prior approval by the specifier, shall be replaced at the expense of the contractor.

H. The contractor must comply with the enclosed specification in its entirety. If on inspections, the specifier finds changes have been made without prior approval, the contractor will make the applicable changes to comply with this specification, at the contractor's expense.

I. At the discretion of the specifier, sheet metal gauges, and reinforcing may be checked at various times to verify all duct construction is in compliance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged components. Remove damaged products from project site.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. All interior ducts shall be constructed with G-60 or better galvanized steel (ASTM 527) LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions shall be G-90 or better galvanized steel LFQ, chem treated. Construct all ducts and plenum of gauges, and with joints, bracing, reinforcing, and other construction details in accordance with the latest construction standards previously listed. Metals shall be manufactured by United States Steel, Kaiser, Rolok or equal.

B. Duct dimensions indicated on drawings are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.

C. Ducts shall be constructed of material gauges and reinforcement per SMACNA pressurization classifications to meet 150% of the pressure requirements for external static pressure scheduled on drawings for the fans serving each system. Where differences exist between SMACNA and the prevailing building code, the gauge or construction method of the submitted ductwork shall be the more stringent of the two standards. See also Part III Execution for matrix of materials and pressure requirements.

2.2 DUCTWORK FABRICATION

A. Joints – Sealing
1. Duct tape is not allowed. Rolled elastomeric duct sealants are not allowed.
2. Solvent-based and oil-based sealants are not allowed indoors.
3. Seal all transverse joints - this includes mechanical joints similar to Ductmate on all supply, return, exhaust and outside air intake ducts.
4. All sealant systems for outdoor application to be suitable for use in exposure to water. Vulcum 801 and 351.
5. All sealant systems for indoor application to be meet VOC limits as specified in South Coast Air Quality Management District Rule #1168 limiting VOC's to 100 g/l. Sealants by Hardcast, Ductmate, Mon-Eco Industries, United McGill or equal, as recommended for ductwork application.
6. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, suitable for high velocity and high pressure applications, UL 181B-M listed, UL 723 classified, and complying with NFPA requirements for Class 1 ducts.
   a. Outdoor Application: Not permitted where subject to moisture exposure.
   b. Indoor Application: Hardcast Iron Grip, Ductmate PROseal, Mon-Eco EZ Seal 44-44, or equal.
7. Two-Part Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermally with tape to form hard, durable airtight seal. Hardcast Two Part II, McGill Uni-Cast, or equal.

B. Joints - Rectangular Ducts
1. Slip drive joints, standard seams, flanges or welding as required by SMACNA HVAC Duct Construction Standards for system static pressure. Ductmate, MEX Industries, or equal are acceptable joint methods, but must be sealed as described previously. Transverse joints shall be constructed per Figure 1-4 for types T-8 through T-25. T-1 and T-5 slip joints are NOT allowed. Joint T-2, T-3, T-6 and T-7 reinforced slip joints are allowed below 2" static pressures.

C. Joints - Round
   1. Exposed Ductwork: Slip drive and sheet metal screws.
   2. Concealed Ductwork: Sheet metal screws.

D. Elbows
   1. Construct long radius elbows with centerline not less than 1.5 times the duct width. Shorter radius elbows may be used where required to fit in restricted spaces, or as shown. Provide single thickness turning vanes on all short rectangular radius elbows less than 25" wide. Provide double thickness turning vanes for short rectangular radius elbows 25" wide and greater. Number of vanes per SMACNA. Elbows with square throat and radius heel are NOT allowed.

E. Transitions
   1. Construct transitions with minimum slope of 1 to 5 ratio and in conformance to SMACNA.

F. Branch Connections
   1. Provide 45° entry boots or radius taps for rectangular duct take-offs and conical or bellmouth taps for round duct take-offs. Straight 90° taps are not allowed, except where round take-off duct size equals round branch duct size. Provide volume dampers at take-offs for balancing if not specifically noted as provided at outlet or inlet. Provide insulation guards at transitions to lined ductwork.

2.3 RECTANGULAR DUCTWORK

A. Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA “HVAC Duct Construction Standards Metal and Flexible” 1995 Edition. This shall be subsequently referred to as the SMACNA Manual. All ductwork must comply with all local, code requirements. Ductwork shall be constructed of galvanized steel. Diagonally cross break all panels on ducts 30 inches wide and larger, or bead using automatic bead machine with beads at 12 inches on center or less. All connections shall utilize 45° boot take-offs. Bullhead tees and straight taps are not permitted. All ductwork shall be stainless steel in, and around, magnetically/electrically sensitive rooms.

2.4 ROUND DUCTWORK

A. Round and oval ductwork shall be constructed to SMACNA round ductwork requirements of galvanized sheet steel. Spiral lock seams, only, to 50" diameter. Larger than 50" may be welded longitudinal or spiral lock seam. Lap or snap lock seams are not permitted for round ductwork of any size. Provide beaded sleeve joints or flanges with gasket joints. Elbows shall be spot welded and sealed . All elbows shall be long radius type with centerline radius to duct diameter of 1.5, exceptions will only be allowed at restricted space locations. All connections shall utilize welded conical tees, aluminum conical fitting with damper by Flexmaster #CBD, or 45° boot take-offs by Flexmaster #STOD. Spin-in type or other types of butt tees, bullhead tees or straight taps are not permitted. Flat oval shall be utilized in space-restricted areas.

2.5 FLEXIBLE DUCTWORK

A. Flexible one-inch thick insulated round ductwork may be utilized where shown on the Drawings and at the last seven (7’) feet to each air outlet and inlet, unless shown otherwise on the plans.

Maximum of only one 90° bend in any length. No intermediate joints are allowed. Connect each end with stainless steel screw operated drawbands. Support duct to maintain smooth shape without sagging.

B. The sound attenuation of the acoustical flexible air duct shall meet or exceed the values tabulated tested in accordance with Air Diffusion Council Flexible Air Duct Test FD72R1: Paragraph 3.2.1 in a laboratory accredited for the testing procedure.

C. Minimum Straight Duct Insertion Loss in Decibels per Length of 10 Feet with No Airflow.

Acoustical Flexible Duct Inner Diameter	Straight Duct Insertion Loss (dB) per Octave Band Center Frequency (Hz)					
	125	250	500	1000	2000	4000
6 inches	5	10	18	22	22	20
8 inches	4	9	17	22	22	18
12 inches	3	7	15	22	22	16

D. The material shall be Casco Silentflex II, Thermaflex M-KE Acoustical Flex Duct, or approved equal.

2.6 ACOUSTICAL DUCT LINER

A. Acoustic Duct Lining shall be installed where shown on the drawings and as specified for low velocity supply, return and exhaust ductwork. Liner is to be utilized to line vertical supply duct risers, mechanical shafts conveying return air, terminal box discharge plenums, and other horizontal duct runs where shown on drawings. Dimensions of lined ducts given on the drawings indicate the inside dimensions of duct after the lining has been installed. Black-coated (vinyl, acrylic or neoprene) duct lining shall be adhered by 100% covering of a fire retardant adhesive (3M EC-1128, Benjamin-Foster 85-20, or equal). When width of duct exceeds 12” and also on sides when height exceeds 24”, use non-ferrous mechanical fasteners such as welded pins and speed clips, 12” on center maximum lateral spacing and 18” on center maximum longitudinal spacing. Start fastening within 3” of upstream transverse edge of the liner and within 3” of the longitudinal joint. Mechanical fasteners shall not pierce the duct walls. The pins shall be cut off flush, washers shall be used and installation made so that no gaps or loose edges occur in the insulation. Apply a brushcoat of Benjamin-Foster 30-36 to washers, extending onto lining surface a minimum of 2”. Top pieces shall be supported by the side pieces. Provide insulated build out frames for attaching dampers at running vanes where required.

B. All transverse and longitudinal abutting edges of duct lining shall be sealed and lapped 3” with a heavy coat of Foster 30-36, in accordance with the manufacturer's recommendations. All exposed edges shall be installed with sheet metal nosings. At all openings in the ductwork there shall be a galvanized metal flange, equal in depth to adjacent lining and having a 1½” lip to hold lining in place. All bolt holes shall be sealed airtight.

C. Internal Duct lining shall be installed in complete accordance with the Sheet Metal and Air-Conditioning Contractors National Association (SMACNA) Duct Lining Application Standard. Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1 from SMACNA. Adhesive shall be water-based and conform to Adhesive and Sealant Council Standards for Adhesives for Duct Liner ASC-A-7001C.

D. Acoustical Lining shall be Semi-rigid inorganic fiberglass. The lining must have an erosion resistive coating suitable for air velocities up to 4000 ft/min and have a minimum density of 3 lbs/ft^3. The flamespread rating cannot exceed 35 and fuel contributed and smoke developed rating cannot exceed 50. The bond strength shall exceed 20 lbs/ft^3 and thermal conductivity should not exceed 0.26 BTU inches per hour ft^2 degree F.

E. The sound absorption coefficient shall meet or exceed the values documented below when tested under ASTM C423-90a in configuration A documented in ASTM E795:

Thickness	Absorption Coefficient per Octave Band Center Frequency (Hz)					
	125	250	500	1000	2000	4000
1 inch	0.05	0.20	0.65	0.90	0.95	0.90
2 inches	0.15	0.75	0.95	0.95	0.95	0.95

F. Acoustical duct liners shall comply with the following requirements and standards:
1. ASTM C 1071, Type 1.
2. NFPA 90A and 90B.
3. Resist fungal growth.
4. Per UL 723 test method, flame spread shall not exceed 25, and smoke developed shall not exceed 50.
5. Per test method ASTM C423 using Type A mounting, minimum allowable NRC shall be 0.45.

G. The following are acceptable, subject to the above:
1. Internal Duct Lining:
   a. Aeroflex Type 150 from Owens-Corning Fiberglass, Toledo, OH.
   b. Linacoustic/Spiracoustic Type 150 from Manville Products Corp., Denver, CO.
   c. Ultralite Type 150 from Certain Teed Corp., Valley Forge, PA.
   d. Pre-approved equal to above.
2. Mechanical Fasteners:
   a. Gemco TYPE IH-A from Goodloe E. Moore, Inc., Danville, IL.
   b. Eckoustic-Klip from Eckel Industries, Inc., Cambridge or MA.
   c. Pre-approved equal to above.

2.7 DUCTWORK SPECIALTIES

A. General: Where specifically called for, materials for use in fabricating ductwork specialties shall be identical to that used to fabricate ductwork. See drawings and Part 3, Execution for schedule.

B. Volume and Splitter Dampers: Galvanized sheet metal blade and frame with Ventfabrics Inc., Ventlok operating hardware. For accessible dampers, provide #641 self -locking dial regulators and #644 self-locking dial regulators for insulated ductwork, #637 square end bearing, and #635 spring end bearing, as applicable. For inaccessible dampers, provide #666 or #677 concealed locking damper regulator with bearings as above. For static pressures above 3" W.G., provide #640 HiVel dial regulator and #609 HiVel end bearing for accessible dampers. Regulators shall extend to and through ceiling with neatly installed hardware at the finished ceiling. For inaccessible dampers requiring adjustment through diffusers use Young Regulator, Bowden cable control system.

C. Multi-louver Volume Dampers: 16 gauge galvanized steel frame. Opposed, 6" wide, 16 gauge galvanized steel blades. Concealed linkage in frame. Ruskin #CD35/OBD or equal.

D. Flexible Connections: Provide flexible connectors at the discharge and inlet of fans, air handlers, rotating mechanical equipment, and where shown on the Drawings for proper vibration isolation. Neoprene impregnated glass cloth with 24 gauge galvanized metal frame. Neoprene-only connectors are not allowed. Minimum dimensions - 3" metal, 3" fabric, 3" metal. Ventfabrics #Ventglas or approved equal by Duro Dyne, Q Industries, consolidated Kinetics, Ductmate Proflex or Elgen.

E. Ducts through roof shall be 16 gauge (or minimum of 2 gauges heavier than attaching ductwork), flashed and counterflashed, and provided with storm collars to secure a watertight construction.

F. Bird Screens: 14 gauge, ½", galvanized wire mesh, set in a galvanized steel frame, screw set.

2.8 DUCT ACCESS PANELS AND DOORS

A. In sheet metal work, hollow core double construction of same or heavier gauge material as duct in which installed. Use no door smaller than 12" by 12" for simple manual access or smaller than 24" by 24" where personnel must pass through infrequently. Use 24" by 60" minimum for filters and more frequent maintenance. Use Ventlok or approved hinges and latches on all doors; 100 Series hinges and latches on low pressure system doors up to 18 " maximum dimension, 200 Series on larger low pressure system doors and 333 Series on high pressure systems. Construct doors up to 18 " maximum dimension with one inch overlap fit and gasket with ¾" by ⅛" sponge rubber, fit larger doors against 1½" by ⅛" flat stock or angle frame and gasket with ¾" by ⅛" sponge rubber or felt. Door swing to be opposite airflow. CESCO, Vent Products, Air Balance, Ductmate Sandwich or equal. Access doors smaller than 12" x 12" can be used for visual inspection of dampers, etc. on small ductwork less than 12" wide but must be of maximum size that will fit on duct with 6" x 6" as minimum size. All access doors smaller than 12" x 12" must be approved by Engineer for the specific application prior to ordering.

2.9 BACKDRAFT DAMPERS

A. Damper Types:
   1. Heavy Duty Backdraft Dampers: Provide counterweight type complete with frame, end bearings, counterbalance assembly, blades, and linkage. Pressure drop to be no more than 0.24"w.g. at 1000 fpm. Install at outside air intakes, exhaust outlets, and where shown on Drawings. Pacific Air Products #PRD-100AL, Ruskin #CBD2, NCA, or equal by Swartout, American Warming or Vent Products.
   2. Nonmetallic Backdraft Damper: Provide complete with 16ga frame, neoprene coated fiberglass blades, galvanized expanded metal grill. Ruskin NMS2.

B. Application Requirements:
   1. Generator Discharge Damper: Heavy Duty Backdraft Damper. Size at no more than 1000 fpm velocity.
   2. Outside Air Intakes except where a control damper is required – Heavy Duty Backdraft Damper.

2.10 DIFFUSERS, GRILLES AND REGISTERS

A. All diffusers, grilles, and registers shall be selected to provide proper air distribution for the intended occupant application. All supply air devices shall be selected to provide a maximum air velocity of 50 fpm at three feet above the floor, unless otherwise noted. Manufacturer's

representative shall carefully review Architectural and Mechanical drawings and ensure diffuser/grille/register selections will provide proper air distribution at NC 25 or less. Manufacturer at no additional expense to the University of California Berkeley's shall replace diffusers, grilles, and registers not providing proper distribution or excessive noise at scheduled airflow.

B. All frames shall be selected to fit the ceiling type. Verify with Architectural Drawing. Each diffuser, grille and register shall be individually capable of balancing via duct mounted balancing dampers or attached opposed blade dampers. Provide unit opposed blade damper where individual duct mounted balancing dampers are not provided.

C. The manufacturer's NC rating for grilles, diffusers, and registers shall not exceed the values documented on the project drawings.

D. The manufacturer's NC rating shall be determined using the sound power levels measured in accordance with ASHRAE Standard 70-2006 and calculated in accordance with ARI 885-98.

E. Sizes, capacities and patterns shall be as shown on the Drawings. Manufacturer: Price, Titus, or Krueger.

2.11 COMBINATION FIRE/SMOKE DAMPERS

A. Combination Fire/Smoke Dampers:
   1. General Requirements:
      a. Install at rated corridor wall or ceiling penetrations, occupancy separation walls, area separation walls and where shown on plans. Low leakage fire/smoke damper (Leakage Class 1 unless otherwise stated below) with electric actuator. Fire damper shall be equipped for vertical wall penetrations with manufacturer supplied sleeve and fail closed on loss of power. Each damper shall be equipped with a controlled 15 second electric heat-actuated release device. This device is to be equipped with a push-button reset. No manual fusible links are permitted. Manufacturer shall provide factory assembled sleeve of 16" minimum length. Installation shall be in accordance with damper manufacturer's instructions. Coordinate power and smoke detector connections with electrical installer. Integral smoke detection and actuating devices may be used if listed and approved for such service. Comply with CBC and Fire resistive standard 12-7-2 Fire Dampers. All combination smoke and fire dampers shall automatically reset from closed to open position upon the reapplication of power to actuators.
      b. Actuators: All gear and housing shall be steel. The actuator shall be direct coupled and employ a steel toothed cold-weld clamp for connecting to damper shafts. Aluminum clamps or set-screw attachments are not acceptable. Actuator shall be UL listed and manufactured under ISO 9001 quality control.
         1) Actuator shall carry a manufacturer's 5-year warranty.
         2) Actuator shall have microprocessor based motor controller providing electronic cut off at full open so that no noise can be generated while holding open. Holding noise level shall be inaudible. Actuator shall be incapable of burning out if stalled before full rotation is reached.
         3) Dampers shall be installed straight and true, level in all planes, and square in all dimensions. Dampers shall move freely without undue stress due to twisting, racking, bowing, or other installation error.
         4) Actuator shall have UL555S Listing by the damper manufacturer for 350°F and be rated for 20,000 cycles minimum. Actuator shall draw no more than

0.23A at 120V running, or 0.1A holding at 120V (27 VA and 10 VA respectively for 24V power) for 70 in-lb torque.

5) Stall and instantaneous type actuators are not acceptable.
6) Do not install in area where moisture can penetrate damper or actuator nor where actuator temperature exceeds 120°F.
7) All smoke and combination fire and smoke dampers shall be provided with Belimo Aircontrols FSNF120 (-S), FSNF24 (-S) actuators with auxiliary switches, or approved equal.

2. Dampers for Low Velocity Applications (2000 fpm or below):
   a. Fire damper shall have 6" wide galvanized steel blades with silicone rubber edge seals.
   b. Pressure drop of a typical 24” x 24” size damper shall be no more than 0.05” w.g. at 1000 fpm velocity.
   c. Basis of Selection: Ruskin #FSD-60 or approved equal by Pottorff #FSD-151
3. Dampers for High Velocity Applications (2001 fpm or above):
   a. Identical to above except, fire damper shall have 6" wide galvanized steel airfoil blades with silicone rubber edge seals.
   b. Pressure drop at 2000 fpm velocity to be no more than 0.08”w.g. for a 24” x 24”size.
   c. Basis of selection to be Ruskin FSD 60 with airfoil blade or approved equal air foil damper by Pottorff FSD-151
4. Dampers for Ceiling Application:
   a. Where indicated on plans install at rated corridor ceiling penetrations.
   b. Integral smoke detection and actuating devices may be used if listed and approved for such service.
   c. Basis of Selection: Ruskin #FSD36-C or approve equal by Pottorff #FSD-172
5. Required Options:
   a. Provide open or closed indicator option assembly consisting of a single pole and a double throw switch used to indicate damper blade position. Output from switch to position indicator light (LED, provided by Division 26) is by automatic temperature control contractor. Include switch mounting bracket, crank arm, blade bracket and linkage from blade to the switch.
   b. Provide a test module to permit test cycling of the damper/actuator in the field

2.1 EXECUTION

B. Install in accordance with the manufacturer's recommendations to obtain the submitted acoustical and air flow performance.

C. Locate as shown in the drawings.

D. Orient the internal baffles (splitters) of the silencers so they are parallel to the plane of any elbow within 3 duct diameters of the silencers.

E. Do not locate silencers within one duct diameter from elbows, fan inlet, or return openings unless indicated on the drawings and approved by the design team.

2.12 VARIABLE AIR VOLUME TERMINAL UNITS

A. Furnish and install variable volume zone boxes of the sizes and capacities shown on the Drawings.

B. The control assemblies shall be pressure independent and shall be able to be reset to any airflow between zero and maximum scheduled CFM. The valves shall be normally open. The differential static pressure of the basic assembly shall not exceed 0.25" W.G. for all sizes with inlet velocities of 2,000 FPM or less.

C. The air valve shall be galvanized steel or die cast aluminum; damper shafts shall operate in rustproof Delrin or equal, self-lubricating bearings. The air valve shall seat against durable gaskets and not exceed a 2% leakage rate per ARI standards.

D. The control device shall be designed to maintain constant flow regardless of inlet flow deflection. Duct inlets at 90° or less to the control device shall not alter the maximum or minimum factory setting by more than 10%. The assembly shall incorporate a multi-point averaging differential pressure sensor mounted on the inlet.

E. The assembly casing shall be constructed of 22 gauge zinc-coated steel, internally lined with ½" thick, fiberglass insulation which complies with UL 181 and NFPA 90A. All cut edges of fiberglass exposed to the airstream shall be coated with NFPA-90A approved sealant.

F. Hot Water Coil: Where scheduled on drawings, provide a single or double row hot water heating coil with aluminum fins mechanically bonded to copper coils. Coil velocity shall not exceed 700 FPM and static pressure loss shall not exceed .35" w.g. for a double row coil or 0.20”w.g. for a single row coil. Coil shall be pressure tested to 200 PSIG. Maximum water pressure drop shall be limited to 5 feet w.g. unless otherwise noted.

G. Controls to be direct digital. Provide boxes without operator. Provide factory mounted low voltage transformer of sufficient capacity to power the DDC controls. Coordinate control with temperature Control Contractor. Provide factory mounted operator and thermostat control if not provided by Control Contractor.

H. Terminal units shall be tested in accordance with ARI Standard 880-98

I. Manufacturer: Titus DESV, Price SDV, Enviro-Tec, or approved equal by Krueger

2.13 ELEVATOR SHAFT VENTS

A. Furnish and install elevator shaft vents at top of each elevator shaft over 25’ high as required by code. (CBC).

B. Vents to be sized with throat area equal to 3.5% of elevator shaft hoist way area with minimum size of 3 sq. ft.

C. Vents to be Greenheck with bird screen and prefab curb or Loren Cook Company or the equivalent.

D. Locate to miss beams and coordinate size and location of roof opening with structural.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Installation of all products shall be in accordance with the manufacturer's instructions and recommended procedures.

B. Acoustical Flexible Ductwork
1. Install in accordance with manufacturer's requirements and as specified in other relevant sections of this Specification.
2. Clean ductwork; close openings and open ends with temporary covers to keep construction dust out of ducts.
3. Install ductwork with clearance around equipment to allow normal operating and maintenance activities of equipment.
4. Acoustical flexible ductwork cannot be used to penetrate partitions extending full height. Sheet metal ductwork must be used to penetrate any full height partition.
5. Replace any flexible ductwork torn before or during installation.
6. Install as shown on drawings and so there is at least five feet of acoustical flexible ductwork between all grille or diffusers and dampers or terminal boxes.
7. Acoustical flexible ductwork must be installed so there are no kinks allowing laminar air flow.

C. Internal Acoustical Lining for Mechanical Ductwork
1. Install in accordance with manufacturer's requirements and as specified in other relevant sections of this Specification.
2. Locate as shown on drawings.
3. Dimensions of lined ductwork or plenums are clear inside dimensions with lining installed.
4. All portions of the area designated to receive acoustical lining shall be covered. All joints shall be butted and there shall be no interruptions or gaps.
5. The coated surface of the acoustical liner shall face the air stream.
6. The acoustical liner shall be adhered to the sheet metal with 100% coverage of adhesive and all joints shall be coated with adhesive.
7. Provide continuous sheet metal edge protectors at entering and leaving edges of lined duct sections.
8. Duct liner shall be secured with mechanical fasteners which shall compress the duct liner as required below:
    a. fasteners shall start within 3 inches of the upstream transverse edges of the liner and 3 inches from longitudinal joints and shall be spaced a maximum 12 inches around the perimeter of the duct or plenum.
    b. They may be a maximum of 12 inches from a comer break.
    c. They shall be placed no more than 6 inches from a longitudinal joint of the liner.
    d. They shall be placed no more than 12 inches from a corner break.

D. Grilles, Registers, and Diffusers
1. Install in accordance with manufacturer's requirements and as specified in other relevant sections of this Specification.

E. Terminal Units
1. Install in accordance with manufacturer's requirements and as specified in other relevant sections of this Specification.
2. Connections to terminal units cannot be made with flexible duct unless specifically noted on project drawings.

3.2 DUCTWORK MATERIAL APPLICATION SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
1. All duct system appurtenances are to be the same material as ductwork including volume dampers and access panels.

3.3 DUCTWORK AND SPECIALTIES INSTALLATION

A. Ductwork is generally diagrammatically indicated and shall be generally installed as indicated. Do not scale Drawings for exact location of ducts. Install ducts to best suit field conditions and cooperate with other trades. Do not penetrate Structural members without consent of Architect or Structural Engineer. Check with Structural drawings prior to locating any penetrations. Duct sizes are indicated as net inside dimensions on the Drawings. The indicated dimensions shall be altered at the job site for the purpose of avoiding interferences and clearance difficulties to other dimensions producing the same air handling characteristics, provided such altered dimensions are approved by the Architect. Ducts shall be constructed in accordance with the latest edition of codes and standards identified in Part 1 and as shown on the Drawings.

1. Clean and pretreat surfaces before application of sealant. Conform to the manufacturer's cleaning procedures. Install sealants in conformance with manufacturer's instructions.
2. Vertical ducts or horizontal ductwork penetrating fire rated ceilings, roofs, walls and floors shall be fire separated with UL listed and labeled fire dampers. Provide additional fire dampers indicated on the Drawings and as otherwise required by the IBC and building inspector. Provide approved firestopping between damper frames and firewalls. Install fire dampers in accordance with NFPA Standards, requirements of the State Fire Marshal, and applicable codes. Ensure that fire dampers are installed in the open position.
3. Provide 16 gauge metal sleeve with 1" clearance and pack space around ducts through walls tight with fiberglass, and seal with Schuller Duxseal or approved 3M fire proof caulking, as required. For exposed ducts through walls, provide flat, sheet metal escutcheon to conceal fiberglass and wall opening.
4. Grilles, Registers and Diffusers: Install flush, squared, tightly sealed, and entirely covering sheet metal ductwork and gaskets. Thread sheet metal mounting screws tightly into sheet metal. All frames shall be selected to fit the ceiling type. Verify with Architectural Drawing. Each diffuser, grille and register shall be individually capable of balancing via duct mounted balancing dampers or attached opposed blade dampers. Provide unit opposed blade damper only where individual duct mounted balancing dampers are specifically noted as not provided. Duct connections shall fit securely to necks or collars behind face area. Provide all necessary transition pieces and duct collars to make connections from ductwork to neck sizes. Where ducts connect directly to necks or collars provide a minimum straight duct section of two times the duct diameter to the last elbow. Where minimum straight duct sections are not physically possible provide sheet metal plenum sized for approximately 500 fpm air velocity with duct tapped directly to side of plenum. Where building walls, floors and ceilings form portions of duct or plenum, provide gasketed angles or channels at junction points, securely bolted and sealed to building structure.
5. Install turning vanes in all mitered elbows in all ducts, so that tips are parallel with the sides of the ducts. Vanes shall be single thickness type. Tips of acoustical turning vanes on outside radius shall be flush with acoustical lining.
6. Provide flexible connections to completely isolate fans from direct contact with all sheet metal work.
7. Provide access panels or doors, as required, for access to valves, controllers, fire dampers and humidifier dispersion tubes. Access doors required in Product Conveying Vapor/Moisture Ductwork (see applicable paragraph above) shall not be installed in the bottom of the duct or in a manner to allow leaks.
8. Volume Dampers: Provide manual volume dampers in all low pressure supply, return and exhaust branch ductwork to grilles, diffusers, inlet and outlet openings to facilitate balancing of systems. These are to be provided as part of contract whether shown on plans or not. Where ceilings are not accessible, provide access door or remote damper operator.

9. Splitters and splitter dampers shall not be installed in medium or low pressure supply ductwork to VAV systems.

B. Hangers and Supports: Securely fasten all ductwork to the building construction by means of hangers, supports, guides, anchors, and sway braces to maintain duct alignment, to prevent sagging, and to prevent noise and excessive strain on ductwork due to movement under operating conditions.
   1. Maximum spacing between hangers shall not exceed eight (8) feet.
   2. Adequately mount and anchor all material and equipment as required. Include lateral bracing as required to prevent horizontal, seismic movement. Refer to IBC and architectural Drawings for seismic requirements.
   3. Do not support ductwork from fans or any other pieces of equipment.
   4. Powder driver fasteners shall not be used to support rectangular ducts of 40" maximum dimension. Powder driven fasteners shall not be allowed in existing facilities where electronic equipment is located.
   5. Support round duct, 30" and larger, with two hangers at each support point.
   6. Hangers and supports shall conform to SMACNA section "Hangers and Supports". Nail inserts, hangers and supports to formwork before slabs are poured. Cut off or remove nails, strap-ends and other projections, flush with concrete after forms are removed.
   7. Support vertical ducts, passing through floors with two continuous angles screwed to the duct and bearing to the floor and conforming to SMACNA section "Riser Support-From Floor". Blocking or shimming ducts will not be permitted.

C. Other:
   1. Fans: Align fans, motors, and drives. Install fans to render bearings accessible for lubrication without dismantling fans or ducts. Provide extended bearing oilers as required. Mount all fans on vibration isolators as specified.
   2. Insulation: Properly and neatly apply insulation on all material and equipment and apparatus, as specified, including all fittings. Apply insulation over clean, dry surfaces, with adjoining sections firmly butted together and canvas smoothly pasted over. When vapor barriers are specified, install continuous overall external surfaces of the entire system.
   3. Duct Sizing: Where duct sizes are not specifically shown on the plans or must be modified due to physical limitations, supply ducts may be sized at a maximum velocity of 1,500 fpm or 0.08" sp friction per 100 feet, whichever provides the larger duct, and return/exhaust/intake ducts may be sized at a maximum velocity of 1,000 fpm or 0.06" sp friction per 100 feet, whichever provides the larger duct.

3.4 CONSTRUCTION AND SEALING CRITERIA

A. 233113 – Unless called out otherwise on drawings the pressure classification of ductwork shall be as follows:

Duct system:	**Location**	**Working pressure**	**Build to SMACNA pressure class**	**Build to SMACNA seal class:**
Low press Supply Air	From 100% Outside Air Unit to air terminal units	low pressure	+1” wc	B
Low press		low pressure	+1” wc	B

Duct system:	Location	Working pressure	Build to SMACNA pressure class	Build to SMACNA seal class:
Supply Air	Downstream of air terminal units to grilles, registers or diffusers.			
Transfer air	From grille to grille, or acoustic boots or "z" bends	Low pressure	+0.5" wc	C
General exhaust	From grille to exhaust fan	-1" wc	-2" wc	B
General exhaust	From exhaust fan to discharge at ambient	+1" wc	+2" wc	B

B. 233113 – The default leakage classification of ductwork is as follows:

Duct working press. class:	Low pressure - +/- 0.5"wc	+/-1" – +/-3"	+/-4" – +/-10" wc
SMACNA Seal Class	C	B	A
Sealing Applicable	Transverse joints only	Transverse and longitudinal Joints	Joints, seams, and all wall penetrations
Rectangular sheet metal SMACNA Leakage Class	24	12	6
Round sheet metal SMACNA Leakage Class	12	6	3

3.5 MANDATORY CALIFORNIA DUCTWORK TESTING

A. All duct systems shall be sealed to a leakage rate not to exceed 6% of the fan flow if the duct systems are:
   1. Connected to a constant volume, single zone system, air conditioners, heat pumps or furnaces, and
   2. Serve less than 5,000 square feet of floor area, and
   3. Have more than 25% duct surface area located in one or more of the following places:
      a. Outdoors, or
      b. In a space directly under a floor where the U-factor of the roof is greater than the U-factor of the ceiling, or
      c. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces, or
      d. In an unconditioned crawlspace, or
      e. In other unconditioned spaces.
   4. The leakage rate shall be confirmed through field verification and diagnostic testing in accordance with procedures set forth in the Nonresidential ACM Manual.

3.6 COMBINATION FIRE, SMOKE DAMPER INSTALLATION

A. Install per manufacturer's and UL installation requirements.

B. Interlock operation of all fire smoke dampers to close dampers when the fans associated with the dampers are shut down. This also includes dampers in transfer ducts associated with system fans.

3.7 CONTROL DAMPER INSTALLATION

A. Note that installation of control dampers is a part of the mechanical contractor's work regardless of whether they are specified in this section or as part of products to be selected by the Control Contractor.

B. When electric actuators are provided, dampers shall be installed to allow direct over the shaft mounting of actuators. No connecting rods and stand off brackets shall be necessary.

C. Dampers shall be installed straight and true, level in all planes, and square in all dimensions. Dampers shall move freely without undue stress due to twisting, racking (parallellogramming), bowing, or other installation error.

D. Blades shall close completely. Leakage shall not exceed manufacturer's specifications at rated static.

E. Structural support shall be provided as necessary for all multi-section dampers.

F. Where blankoffs or structural supports obstruct duct or air passages, the decrease in free area shall not exceed 15% of the damper face area unless otherwise specified here or on plans.

G. No individual damper section may exceed 20 sq. ft.

3.8 SEISMIC REQUIREMENTS

A. See Section 230548 for specific requirements.

B. All HVAC equipment and machinery shall be anchored to withstand forces generated by earthquake motions. As a minimum, equipment and equipment frames shall be designed to withstand a force of 100% of the weight of the equipment and frame acting at its center of gravity. Anchorage of the equipment and/or frame to the structure shall be for a force of four times gravity also acting at the center of gravity.

C. The seismic calculations shall be the responsibility of contractor.

3.9 EQUIPMENT

A. Install equipment as shown on plans and in accordance with manufacturer's installation recommendations.

3.10 SUPPLY DIFFUSER AND REGISTER LOCATIONS

A. Coordinate location of supply outlets with ceiling mounted smoke detectors. Locate outlets or outlet distribution so as to prevent airflow from inhibiting the operation of smoke detectors. Locate ceiling outlets a minimum of 3'-0" from smoke detectors.

3.11 PAINTING

A. Where the interior surfaces of ductwork are visible through the blades of supply outlets, return inlets, and exhaust inlets - paint the interior visible surfaces with one coat of flat black paint.

3.12 FIELD QUALITY CONTROL

A. Do not insulate or conceal ductwork before inspection by University of California Berkeley's Representative, Architect or Engineer. If ductwork is insulated and concealed prior this inspection the Contractor shall remove insulation and ceiling to permit inspection at no additional cost to the University of California Berkeley.

B. . The Contractor shall replace the insulation and ceiling after final inspection at no additional cost to the University of California Berkeley.

C. Ductwork Deflection Criteria:
   1. Maximum inward and/or outward deflection at sheetmetal panels shall be ¾" under maximum static pressure operating conditions. Additional intermediate stiffening angles shall be installed where deflections exceed ¾".
   2. Maximum inward and/or outward deflection at sheetmetal elbows and joints shall be ¼" under maximum static pressure operating conditions. Additional stiffening angles shall be installed where deflections exceed ¼".

D. Acceptance of duct systems shall be contingent upon conformance with the requirements specified in Section 230593 "Testing, Adjusting and Balancing".

3.13 ADJUSTING AND CLEANING

A. Clean the inside of plenums, casings, enclosures, fans, and accessible ductwork before starting fans. Blowout coils and condensate piping with compressed air. Install a clean set of filters in each system prior to testing and balancing. Proceed with testing and balancing. All dampers shall be locked in place.

END OF SECTION

SECTION 237312
100% OUTSIDE AIR UNIT

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 230500 - Basic Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this Section shall comply with all the requirements of Division 01, and shall include, but not necessarily be limited to, the following:
   1. 100% Outside Air Unit
   2. Fans

B. Related Work Not Included in this Section:
   1. Acoustical Mechanical General Provision
   2. Vibration Isolation
   3. Prefabricated Silencers

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230500: Basic Materials and Methods

B. Section 230593: Testing, Adjusting and Balancing

C. Section 230902: Variable Frequency Drives (VFD)

D. Section 233113: Air Distribution

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide 100% Outside Air units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be fabricated by the Contractor.

B. Codes and Standards: Provide air handling units conforming to the requirements of the latest addition of the following:
   1. Air Movement and Control Association (AMCA):
      a. 99 Standards Handbook
      b. 210 Laboratory Methods of Testing Fans for Rating [Unit shall bear AMCA Certified Rating Seal]
      c. 300 Reverberant Room Method for Sound Testing of Fans [Unit shall bear AMCA Certified Rating Seal]

d. 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data
e. 500 Test Method for Louvers, Dampers, and Shutters

2. American National Standards Institute (ANSI):
   a. 9 Load Ratings and Fatigue Life for Ball Bearings
   b. 11 Load Ratings and Fatigue Life for Roller Bearings
   c. 900 Test Performance of Air Filter Units
3. Air-Conditioning and Refrigeration Institute (ARI):
   a. 410 Forced-Circulation Air-Cooling and Air-Heating Coils
   b. 430 Central-Station Air-Handling Units
4. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. 15 Safety Code for Mechanical Refrigeration
5. National Electrical Manufacturers Association (NEMA): Except for motors, provide electrical components required as part of air handling units, which comply with NEMA Standards.
6. National Fire Protection Association (NFPA): Provide 100% Outside Air unit internal insulation having flame spread rating not higher than 25 and smoke developed rating not higher than 50:
   a. 70 National electrical Code
   b. 90A Standard for the Installation of Air Conditioning and Ventilating Systems
   c. 90B Standard for the Installation of Warm Air Heating and Air Conditioning Systems
7. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA): Comply with applicable SMACNA standards including "HVAC Duct Construction Standards - Metal and Flexible."
8. Underwriters Laboratories, Inc. (UL): Except for motors, provide electrical components required as part of air handling units, which have been listed and labeled by UL.
9. Units shall be listed and labeled by either UP or ETL for air handler construction.
10. AMCA Standard 300-08 Reverberant Room Method for Sound Testing of Fans
11. AMCA Standard 301-06 Methods for Calculating Fan Sound Ratings from Laboratory Test Data

1.5 PRODUCT SUBSTITUTIONS

A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:
   1. The proposed substitution does not affect dimensions shown on drawings.
   2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
   3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
   4. Maintenance and service parts available locally are readily obtainable for the proposed substitute.

B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.

C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to this proposed substitution.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for 100% Outside Air unit showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, and finishes of materials, installation instructions, sound and vibration test report, and bearing life calculations.
   1. Direct drive fan wheels shall be factory dynamically balanced and shall meet or exceed guidelines in AMCA 204-96 for Balance Quality and Vibration Levels for Fan Application Category BV-3. Following fan assembly, the complete spring isolated fan assembly shall be tested using an electronic balance analyzer with tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 Axial). The maximum allowable velocity shall not exceed 0.125 inches per second peak amplitude (filter in) on any of 5 readings and shall not exceed .5 mils @ 1170 rpm. A copy of the Vibration test report (Vibration Nomograph) shall be provided with the Operation and Maintenance Manual upon request. The fan assembly shall also be vibration tested at design RPM with the spring isolators at the specified deflection, with the tunable filter utilized and frequencies from 500 cpm to 50,000 cpm shall be scanned to detect misalignment, bearing defects, mechanical looseness or foundation weakness. A copy of the balance test data for this project showing calculations for deflection and critical speed of the shaft and wheel assembly shall be submitted to the engineer review

B. Shop Drawings: Submit shop drawings showing unit dimensions, weight loadings, required clearances, field connection details and methods of support. Draw to a scale of one half inch to one foot. Include field fabricated mixing boxes, dampers and duct connections.

C. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals.
   1. Submittal shall include: Name of local vendor and contact person, including 24hr emergency service phone number, and list of recommended spare parts.

D. Provide submittal information in accordance with the requirements specified in this section and in Submittal Procedures.
   1. Include the following:
      a. Itemized list referencing:
         1) Items being submitted
         2) Documenting the acoustical test standard used.
         3) Sound Power Levels in octave band format ranging from 63Hz to 8000Hz.
         4) Page numbers specifically referencing pages for cutsheets, details, test data, and manufacturer’s installation recommendations.
      b. Acoustical test data measured in a laboratory accredited under the standards required in this submittal.
         1) Acoustical test data must be reported at the design operating conditions.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver unit to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect unit against dirt, water, chemical, and mechanical damage. Do not install damaged unit - remove from project site.

1.9 WARRANTY

A. Provide one-year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Greenheck or approved equal. By listing manufacturers it is not intended to imply that their standard construction is approved or that they are equal. All manufacturers must meet, or exceed, minimum requirements of these specifications.

2.2 GENERAL

A. The manufacturer shall provide the factory assembled 100% Outside Air unit in configuration as indicated on the drawings. The unit shall include all specified components installed at the factory. Field fabrication of units and their components will not be accepted.

B. All units shall be inspected by the customer prior to shipment. Inspection shall be of the unit completely assembled.

C. The unit shall be designed to be supported by a concrete pad

D. Units too large to be legally shipped by truck may be shipped to the site in sections. Otherwise units shall be shipped in one piece.

2.3 CASING

A. Formed,single wall metal cabinet with fiberglass duct liner insulation fabricated to permit access to internal components for maintenance. Underside of unit shall have formed metal panels covering base panel insulation.
   1. Outside casing: Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel. Base rail is 12 gauge, galvanized (G90) steel.
   2. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
   1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.

a) Thickness: 1 inch (25 mm)
b) Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
c) Location and application: Floor of each unit shall be insulated with 1 inch thick rigid fiberglass insulation, covered on one surface with integral aluminum foil. [Full interior coverage of entire cabinet to include walls and roof of unit shall be semi-rigid type and installed between inner and outer shells of all cabinet exterior components when double walls are specified]. [Full interior coverage from “Heating on”] [Full interior coverage from “Cooling on”] [entire unit]

C. Access panels: Unit shall be equipped with insulated removable access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge galvanized G90 steel. Removable access panels shall incorporate a formed drip edge.

D. Supply Air blower assembly: Blower assembly consists of an electric motor and a belt driven, double width, double inlet forward curve blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on minimum 1.125 inch thick neoprene vibration isolators

E. Control center / connections: unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections

F. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall

G. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices

H. Chilled water coil: A water coil for cooling shall be factory-installed in the unit for connection to a building water source

I. Motorized dampers / Intake Air: Motorized damper of insulated low leakage type shall be factory installed

J. Freeze protection: Freeze protection consists of an adjustable temperature sensing bulb that will disable the fan motor. Freeze protection is not a substitute for draining of water-filled coils.

2.4 FANS

A. Blower section construction, Supply Air: Belt drive motor and blower shall be assembled onto a minimum 14 gauge galvanized steel platform and must have [neoprene vibration isolation devices, minimum of 1-1/8 inches thick] [helical coil spring vibration devices].

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.

D. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.

E. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, “Laboratory Methods of Testing Fans for Rating.”

2.5 MOTORS AND DRIVES

A. General: Blower motors greater than ¾ horsepower shall be “NEMA Premium™” unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley.

B. Fan motors shall be premium efficiency, inverter duty rated motors.

2.6 FILTERS

A. Prefilters shall be 30% efficient, pleated and disposable. Each filter shall consist of a non-woven cotton and synthetic fabric media, media support grid and enclosing frame. The filter shall be listed by Underwriters’ Laboratories as Class 2.

B. Prefilters shall be installed in a prefabricated channel rack.

C. Prefilters shall be lift-out where access is available upstream of the filter, or slide out when access is not available.

2.7 FINAL FILTERS

A. Final filters shall be high performance, deep pleated, totally rigid and disposable. Each filter shall consist of high density microfine glass fiber media, media support grid, contour stabilizer and enclosing frame.

B. The final filter media shall be of high density microfine glass fibers laminated to a non-woven synthetic backing to form a lofted filter blanket. The filter media shall have an average of 90-95% on the ASHRAE Test Standard [52-76] and an average arrestance of not less than 99% on that standard. Filters shall be listed by Underwriters’ Laboratories as Class 2.

C. Holding frames shall be factory fabricated of 16 gauge galvanized steel and shall be equipped with gaskets and 2 heavy duty positive sealing fasteners. Each fastener shall be capable of withstanding 25 lbs. pressure without deflection and be attached or removed without the use of tools.

D. Final filters shall be lifted out where access is available upstream of the filter, or equipped with a side slideout when access is not available.

2.8 FILTER GAUGES

A. The manufacturer shall provide Dwyer 2000 magnehelic gauges.

B. Magnehelic gauges shall be accurate to ±2% of full range.

C. One gauge shall be provided for each filter bank.

D. Gauges shall be recessed into the cabinet casing.

2.9 OUTSIDE AIRFLOW MEASURING SYSTEM

A. Provide an integral airflow/temperature measurement control damper package. Package shall not require any additional duct work or sleeve, when installed accordance with the manufacturer's specified placement guidelines. Provide TAMCO/EBTRON Series AIR-IQ.

B. Provide a factory-assembled, extruded aluminum (6063T5) sleeve, not less than .080" thick for each damper section. Sleeve depth, including damper frame, shall be 18" and include a 3" radius aluminum entry flare.

C. Provide extruded aluminum (6063T5) damper frames, not less than .080" thick and 4" deep. Damper blade profile shall be of same construction. Glade seals shall be extruded EPDM or silicone.

D. Bearings shall be composed of a Celcon inner bearing fixed to a 7\16" aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting I no metal-to-metal or metal-to-plastic contact.

E. Damper air leakage shall not exceed 3 cfm/ft^2 against 1" w.g. differential static pressure.

F. Provide one thermal dispersion airflow/temperature (ATMD) measuring device for each location. Differential pressure based devices, including pilot tubes and arrays are not acceptable.

G. Each ATMD shall consist of one or more factor-mounted, multi-point, measuring probes and microprocessor based transmitter (remotely mounted by MC). Each sensor probe shall consist of one to eight independent sensor nodes in a gold anodized, extruded aluminum (6063T5) tube with aluminum mounting brackets.

H. Each sensor node shall consist of two hermetically sealed bead in glass thermistors. Thermistors shall be potted in an engineering thermoplastic assembly using waterproof, marine epoxy. Each sensor node shall be wind tunnel calibrated at 16 pointes to NIST traceable airflow standards.

I. All internal wiring between thermistors and probe connecting cables shall be Kynar jacketed. All cables shall be UL listed. Each node shall have a temperature accuracy of +\- 0.14F and +\- 2% airflow accuracy. The assembly shall be capable of reading airflow rates over the full range of 0 to 5,000 fpm.

J. The transmitter shall be powered by 24VAC, be over voltage and over current protected, and have a watchdog circuit to provide continuous operation after power failures. The power requirement for the ATMD shall not exceed 22 V-A. The transmitter shall have two isolated and fused analog output signals and one RS-485 network connection. Each analog output shall be

field configurable as linear 0-5VDC, 0-10VDC or 4-20mA signals. The RS-485 network connection shall be field configurable as BACnet MS/TP or Modbus RTU.

K. The RS-485 connections shall be capable of transmitting the average airflow rate, average temperature, and individual airflow rates of each sensor node and individual temperatures of each send\sor node and system status.

L. The ATMD shall be UL973 listed and be BTL listed.

2.10 AIR LEAKAGE TESTING

A. The unit manufacturer shall factory pressure test the 100% Outside Air Unit unit to ensure the leakage rate of the casing does not exceed 1.0% of the unit air flow at 1.5 times the rated static pressure. A leakage test shall be performed with VSD and humidifier panels installed.

B. The test shall be conducted in accordance with SMACNA duct construction manual. A calibrated orifice shall be used to measure leakage airflow.

C. An officer of the manufacturing company shall certify test results and forward copies of the certified test results to the consultant.

D. “Double duct” or “side by side” units shall have each duct or side tested independently.

E. Positive pressure plenums shall be tested positively and negative pressure plenums shall be tested negatively.

2.11 ELECTRICAL

A. The manufacturer shall factory wire, test, and have the 100% Outside Air unit approved by CSA, ETL or UL. All 120V duplex convenience outlets shall be weather tight and GFI protected.

B. The manufacturer shall supply one [1] single point power connection for each unit. The manufacturer shall wire all 120 V/208V/60 Hz/1 Ph components such as lights, convenience outlet, controls, etc. from a panel with circuit breakers for each type of electric device. The panel for 120 V/208 V/60 Hz/3 Ph is fed from a separate service (field provided).

C. The manufacturer shall label and number code all wiring and electrical devices in accordance with the unit electrical diagram. The manufacturer shall mount the devices in a control panel inside the unit’s service enclosure or on the outside and ensure the control panel meets the CSA, ETL or UL.

D. The manufacturer shall provide a system of motor control including all necessary terminal blocks, motor contactors, motor overload protection, grounding lugs, auxiliary contactors and terminals for the connection of external control devices or relays. The manufacturer shall individually fuse all fan and branch circuits.

E. The manufacturer shall provide wiring from the motors to the motor control in accordance with CSA, ETL or UL and contained by EMT conduit with liquid tight connections. The manufacturer shall seal the casing penetrations in a manner that eliminates air leaks.

F. Factory installed VFDs shall be provided. VFDs shall be wired and provided with full wiring details for controls integration. Supply fan is to be powered by drives complete with bypass starter section. See Section 230902 for additional requirements.

2.12 DRAINS

A. The manufacturer shall provide 1" capped floor drain connections on the side of the unit for complete drainability of the base pan for the following sections:
   1. Fresh air plenums
   2. Sections upstream and downstream of coils

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Examine site to verify if site is ready to receive work. Provide a layout drawing of air handler and fan locations to electrical installer.

C. Install minimum 30% efficiency air filters in unit during installation phase. Do not operate the unit without filters in place.

D. Assemble units by bolting sections together.

E. Install 3" flexible duct connection at inlets and outlets of units.

F. Install condensate drain piping and traps in accordance with manufacturer's instructions and as shown on the drawings.

G. Install all hydronic piping and valves in accordance with manufacturer's instructions and as shown on drawings.

H. Install a new set of pre-filters and final filters prior to final air balance and completion.

I. Control installers shall install all wiring associated with control signals into the air handlers.

J. Electrical installer shall install all line voltage power wiring and conduit. Coordinate with Division 26 work.

K. Airflow measuring arrays installed in fan inlet volutes must be designed to withstand velocities encountered in this location. Mounting system is to be warranted against failure and consequent fan damage.

3.2 MANUFACTURER'S START-UP SERVICES

A. The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, verify unit mounting, verify fan rotation, verify spring isolator adjustments, verify control wiring, verify power wiring, start-up the

fans, and check for proper operation. The service technician shall provide final adjustments to meet the specified performance requirements. Fully staffed parts and service personnel shall be within four hours travel from the job site.

B. Training of the system maintenance requirements and operation shall be accomplished by the Manufacturers associate once the Startup has been completed. Training will not exceed more than 8 hours.

END OF SECTION

SECTION 26 00 10

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the Drawings, General Conditions, Supplementary Conditions and Division 01 General Requirements.

1.2 DESCRIPTIONS:

A. This section covers general work of all sections under Division 26.

B. Provide a complete working electrical installation with all equipment called for in proper operating condition. Documents do not attempt to show or list every item to be provided. When an item not shown or listed is clearly necessary for proper operation of equipment which is shown of listed, provide the item which will allow the system to function properly that may result in an increase in contract price.

1.3 QUALITY ASSURANCE

A. Materials and Systems:

1. Labels: Provide materials listed and labeled by Underwriters' Laboratories, Inc. (UL) or testing firm acceptable to authority having jurisdiction where listing service is normally provided for product.
2. Materials: Provide new. Materials are encouraged to be prefabricated offsite and delivered as assemblies to the site.

B. Workmanship: Arrange work to obtain coordinated installation.

C. Code Compliance: Comply with applicable codes, laws, rules, regulations and standards of applicable code enforcing authorities.

D. References and Standards: All materials and equipment shall comply with all applicable standards and requirements of the standards listed below. Nothing in the drawings or specifications shall be construed to permit work not conforming to applicable laws, ordinances, rules and regulations. It is not the intent of drawings or specifications to repeat requirements of codes except where necessary for completeness or clarity.

1. American National Standards Institute (ANSI).
2. Association of Edison Illuminating Companies (AEIC).
3. Insulated Cable Engineers Association (ICEA).
4. Institute of Electrical and Electronics Engineers (IEEE).
5. National Electrical Code (NEC).
6. National Electrical Manufacturer's Association (NEMA).
7. National Fire Protection Association (NFPA).
8. Uniform Building Code (UBC).

9. Underwriters' Laboratories, Inc. (UL).
10. California Code of Regulations, Title 24, Part 3, California Electrical Code (CEC).
11. State of California Low Voltage Electrical Safety Order California Occupational Safety and Health Association (CAL/OSHA).
12. State of California High Voltage Electrical Safety Orders California Occupational Safety and Health Association (CAL/OSHA).
13. Codes and regulations noted in other sections in Division 26, applicable state and local codes, and ordinances.

1.4 SUBMITTALS

A. Submit shop drawings, brochures, and schedules, as required, by individual technical sections of the specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect from loss or damage. Replace lost or damaged material and equipment with new .

1.6 DRAWINGS AND COORDINATION WITH OTHER WORK:

A. Drawings:

1. For purposes of clarity and legibility, drawings are essentially diagrammatic.
2. Exact routing of wiring and locations of outlets, panels, etc., shall be governed by structural features and architectural finishes, interfering pipes, ducts, and mechanical equipment Contractor shall verify Architect's requirements in this regard prior to rough-in.
3. Dimensions, location of doors, partitions, and similar physical features shall be taken from
4. architectural drawings for exact location of outlets to center with architectural features, panels, etc., at the approximate location shown on the electrical drawings.
5. Mounting heights of brackets, outlets, etc., shall be required to suit equipment served.
6. Drawings may indicate, generally, routes of all branch circuits. All runs to panels are indicated as starting from nearest outlet, pointing in direction of panels. Continue all such circuits to panel as though routes were indicated in their entirety.

B. Coordination:

1. Work out all "tight" conditions involving work under Division 26 and work in other division in advance of installation. If necessary, and before work proceeds in these areas, prepare supplementary drawings under Division 26 for review, showing all work in "tight" areas.
2. Differences or disputes concerning coordination, interference or extent of work between divisions shall be decided by Contractor.
3. Coordinate electrical power and control wiring requirements for mechanical equipment with Division 25. Where conflict exists between rough-in shown on drawings and that shown on or required by equipment to be installed, obtain clarification from the Architect and provide rough-in as directed.
4. Provide templates, information, and instructions to other divisions to properly locate holes and openings to be cut or provided for electrical work.

C. Equipment Rough-In:

1. Rough-in locations shown on electrical drawings for equipment furnished by Owner and for equipment furnished under other divisions are approximate only.
2. Obtain exact rough-in locations from following sources:
   a. From shop drawings for Contractor furnished and installed equipment.
   b. From the Architect for Owner/furnished, Contractor installed equipment.
3. Verify electrical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on drawing, obtain clarifications from the Architect and provide as directed.
4. Unless otherwise shown or specified, provide connections from building wiring system to equipment terminals for equipment which is Contractor furnished and Contractor installed, Owner furnished and Contractor installed.
5. Provide plug-in receptacle cap for cord connected equipment which is Contractor furnished and Contractor installed, Owner furnished and Contractor installed. Provide new cord and cap, if required, on Owner furnished and Contractor installed equipment.
6. Provide disconnect switches, where shown or required by code for direct connected equipment.

PART 2 - PRODUCTS

2.1 MATERIALS FURNISHED:

A. Equipment shall be new, bearing label of UL or other testing laboratory acceptable to authority having jurisdiction, where labeling exists for the class of equipment.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. .

C. Where no specific make of material or equipment is mentioned, any product of reputable manufacturer which conforms to requirements of system and other applicable specification sections may be used.

D. Equipment and material damaged during transportation, installation or operation is considered as totally damaged. Replace with new. Variance from this permitted only with written approval.

E. Provide an authorized representative to constantly supervise work of Division 26, and check all material prior to installation for conformance with drawings, specifications and reviewed shop drawings.

PART 3 - EXECUTION.

3.1 INSTALLATION:

A. Manufacturer's Directions: Follow in all cases where manufacturers of articles used furnish directions covering points not specified or shown.

B. Equipment: Accurately set and leveled with supports neatly placed and properly fastened as shown and specified. Provide means of bringing in and installing equipment into position inside building.

C. Conduit Systems:

1. Worked into complete, integrated arrangement with like elements to make work neat appearing, finished.
2. Run concealed, except as shown or noted otherwise. Where exposed, install parallel with walls or structural elements, vertical runs plumb horizontal runs level or parallel with structure as appropriate, and/or groups racked together neatly with straight runs and bends both parallel and uniformly spaced.
3. Install as high as practical to maintain adequate head room shown or required. Coordinate with work of other Divisions to achieve proper headroom.
4. Clearance: Do not obstruct spaces required by code in front of electrical equipment, access doors, etc.

D. Penetrations:

1. Pack space between conduit, sleeve in walls with noncombustible materials.
2. Make penetrations through water tight floors with non-hardening sealant even though concealed within wall or furred space.
3. Make penetration through any damp proof/water proof surfaces, damp proof/water proof by appropriate means to maintain integrity of system penetrated.
4. Seal around penetrations with fire proofing material to maintain integrity of fire rating where rating occurs.

E. Hangars, Supports, Anchors and Chases:

1. Provide complete, as required, for installation of electrical work.
2. Equipment to be of metal only; no wood or combustible material will be permitted including supports
3. for outlet boxes.
4. Hangars, Anchors and Supports for Conduit Runs: As shown on drawings.
5. Provide concrete insert for attachment of hangers subject to Structural Engineer's review.
6. Provide anchors for floor and wall mounted equipment.
7. Provide supports for wall mounted equipment.

3.2 PERFORMANCE:

A. Sleeves, Chases, and Concrete Inserts:

1. Provide sleeves, chases, concrete inserts, anchor bolts, etc., before concrete is poured.
2. Sleeves and chases are prohibited in structural members, except where shown or approved in writing.

B. Cutting and Repairing:

1. Do no cutting or patching without approval. Repair damage done by this cutting equal original condition in Architect's opinion.

3.3 TESTING AND ADJUSTING:

A. Furnish all labor and testing equipment required under Division 26.

B. Test panels and branch circuits for grounds or shorts. Repair defective wiring, as required.

C. Test each individual circuit at panel for proper operation.

D. Upon completion of work, make final inspection and operate equipment under normal condition to satisfaction of the Architect.

E. Provide for all feeders for line-to-ground and line-to-line resistance with a 500-volt DC motor driven “Megger.” Minimum acceptable resistance is 100 meg ohms. Schedule all feeders and indicate line-to- ground and line-to-line resistances.

3.4 CLEANING AND PAINTING:

A. Properly prepare work under Division 26 to be finish painted under Section 00 99 00.

B. Refinish work supplied with final finish under Division 25 if damaged under Division 26.

C. After other work is accomplished, clean exposed conduits, panels (interiors and exteriors), fixtures and equipment.

3.5 EQUIPMENT IDENTIFICATION:

A. Refer to Section 26 05 53 for equipment identification.

3.6 VOLTAGE CHECK:

A. At completion of job, check voltage at several points of utilization on the system which has been installed under this contract. During test, energize all installed loads.

B. Adjust taps on transformers to give proper voltage, which is 118 to 122 volts for a 120-volt nominal system and proportionally equivalent for high voltage systems. If proper voltage cannot be obtained, inform the Architect and the Owner.

* END OF SECTION 26 00 10 *

SECTION 26 00 11

SHORT CIRCUIT/COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Electrical contractor shall retain services of an independent third party firm to perform a short circuit/coordination study and arc flash study as specified in this section.

B. Short Circuit Analysis shall terminate at each branch bus at the lowest utilization voltage secondary bus where symmetrical short circuit RMS amperes are less than 10,000 amperes (10,000 amperes total source plus all motor contribution).

C. It is the intent of these specifications to determine all locations in entire electrical system where symmetrical short circuit amperes meets or exceeds 10,000 amperes at either 208 or 480 volts.

D. Short circuit analysis shall compare interrupting ratings of all electrical protective devices connected to each bus with that of available fault current at load terminals of each protective device.

E. Independent firm should be currently involved in high-voltage and low-voltage power system evaluation.

F. This study shall be performed, stamped and signed by a registered professional engineer in State of California.

G. Credentials of individual(s) performing study and background of firm shall be submitted to Engineer/Architect for approval prior to start of work.

H. A minimum of five (5) years experience in power system analysis is required for individual in charge of study project.

I. Independent firm performing study should demonstrate capability and experience to provide assistance during start up as required.

J. Related Sections:

1. Applicable provisions of Division 01 shall govern all work under this Section.

1.2 DATA COLLECTION FOR STUDY

A. Contractor shall provide required data for preparation of studies. Engineer performing system studies shall furnish Contractor with a listing of required data immediately after award of contract.

B. Electrical Contractor shall furnish Engineer performing electrical system study all as-built wire sizes, insulation types, conduit types and circuit length for use and verification in study.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

1. ANSI/IEEE Standard 242-1986 “Buff Book.”

1.4 SUBMITTALS

A. Third party qualifications. Submit qualifications of individual(s) who will perform work for approval prior to commencement of studies. Provide name of program that will be used to perform calculations.

B. Draft report. Submit a draft of study to Engineer/Architect for review prior to delivery of study to Owner. Make additions or changes as required by Engineer/Architect.

C. Final study report:

1. Provide studies in conjunction with equipment submittals to verify equipment rating required. Study shall include entire electrical distribution system.
2. Study shall include;
   a. One-line impedance diagram which shall include pertinent equipment data and identify buses.
   b. A list of fault contributors.
   c. A list of fault levels at each bus for three-phase bolted faults and ground faults.
   d. Equipment confirmation data including feeder circuit sizes and length.
   e. Confirmation of equipment interrupting ratings.
   f. Recommendations on any required changes.
   g. Time-current plots which graphically illustrate protective device design performance versus equipment operating characteristics, and a completely separate list of protective device settings.

3. Results of electrical power system study shall be summarized in a final report. Three (3) bound copies of final report shall be submitted.
4. Report shall include following sections;
   a. Field study findings.
   b. Descriptions, purpose, and scope of study.
   c. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
   d. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
   e. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
   f. Recommended are flash labeling as required by NFPA 70E.

5. Arc flash hazard analysis study shall be performed in conjunction with short circuit study and will utilize protective device ratings and/or settings derived in protective device coordination study. Report shall include the following:
   a. Arcing fault magnitude.
   b. Device clearing time.
   c. Duration of arc.
   d. Arc flash boundary.
   e. Working distance.
   f. Incident energy.
   g. Suggested fire-resistant clothing or Personal Protection Equipment (PPE).
   h. Recommendations for ac flash energy reduction.

1.5 QUALITY ASSURANCE

A. Reference standards listed in the IEEE “Buff Book”, latest edition.

B. The short circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY

A. In short circuit study, provide calculation methods and assumptions, base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations.

B. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system.

C. Provide a ground fault current study for same system areas, including associated zero sequence impedance data.

D. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.

E. In protective device coordination study, provide time-current curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.

F. Include with each curve sheet a complete title and one-line diagram with legend identifying specific portion of the system covered by that particular curve sheet.

G. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics.

H. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

I. Include on curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices.

J. Include all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

K. Include adjustable setttings for ground fault protective devices.

L. Include manufacturing tolerance and damage bands in plotted fuse characteristics.

M. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents.

N. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

O. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within transformer characteristics, including a point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection.

P. Where primary device characteristic is not within transformer characteristics, show a transformer damage curve.

Q. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in event of secondary line-to-line faults.

R. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

S. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on Drawing one-lines.

T. Utilize equipment load data for study obtained by Contractor from Contract Documents, including addendums issued prior to bid openings.

U. Include fault contribution of motors in study. Notify Engineer in writing of circuit protective devices not property rated for fault conditions.

V. When emergency generator is provided, include phase and ground coordination of generator protective devices.

W. Show generator decrement curve and damage curve along with operating characteristic of protective devices.

X. Obtain information from generator manufacturer and include generator actual impedance value, time constants and current boost data in study. Do not use typical values for generator.

Y. Evaluate proper operation of ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss neutral grounds and ground fault current flows during a neutral to ground fault.

3.2 ARC FLASH EVALUATION STUDY

A. An arc flash evaluation study shall be performed to identify the shock hazard and appropriate personnel protective equipment (PPE) required at each switchboard, distribution board, panelboard, etc. in accordance with the referenced standards.

B. The arc flash evaluation study shall include all voltage classes of equipment from the service entrance down to and including the panelboards.

C. The company performing the arc flash evaluation study shall provide arc flash and shock hazard warning labels for all equipment evaluated. Labeling shall be as follows:

1. Label type:
    a. 4” x 6” for Hazard Class 1 or less.
    b. 5” x 7” for Hazard Class greater than 1.
    c. White vinyl or polyester with orange warning symbol and black text.
    d. Industrial grade self-adhesive backing.
    e. Printed information shall be from the evaluation study results.
    f. Labeling shall be by Created with Brady “PowerMark” Sign, Label Maker or approved equal.
2. Hazard Class 1 label information:
    a. Equipment name.
    b. Available short circuit current.
    c. Flash protection boundary.
    d. Incident energy at 18 inches expressed in cal/cm².
    e. PPE required.
3. Hazard Class greater than 1 label information:
    a. Equipment name.
    b. Available short circuit current.
    c. Flash protection boundary.
    d. Incident energy at 18 inches expressed in cal/cm².
    e. PPE required.
    f. Voltage shock hazard.
    g. Limited shock approach boundary.
    h. Restricted shock approach boundary.
    i. Prohibited shock approach boundary.

D. Labels shall be affixed to all equipment covered under the evaluation study.

3.3 FIELD SETTINGS

A. Contractor shall perform field adjustments of protective devices as required to place equipment in final operating condition.

B. Settings shall be in accordance with approved short circuit study, protective device evaluation study, and protective device coordination study.

C. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by Contractor at no additional cost to Owner.

D. A summary tabulation shall be included in study listing adjustable protective devices with recommended settings and each adjustable band included in each device.

E. High voltage relays shall have coil taps, time-dial settings and pick-up settings as plotted, identified.

F. Current transformer ratios shall be stated.

G. Relays shall be separated by a 0.45-second time margin to assure proper selectivity where feasible. Relay operating curves shall be suitably terminated to reflect the actual maximum fault current sensed by device.

H. Similar type plots shall be made for ground fault conditions and shall indicate any time delay or zone blocking.

* END OF SECTION 26 00 11 *

SECTION 26 05 19

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Building wire.
2. Cable.
3. Wiring connections and terminations.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Federal Specifications (FS):
   - FS J-C-30A; Cable and Wire, Electrical (Power, Fixed Installation).
   - FS W-S-610C; Splice Conductor.
   - FS HH-I-595C; Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic.
2. Underwriters Laboratories, Inc. (UL):
   - UL 44; Thermoset-Insulated Wires and Cables.
   - UL 62; Flexible Cord and Fixture Wire.
   - UL 83; Thermoplastic-Insulated Wires and Cables.
   - UL 183; Manufactured Wiring Systems.
   - UL 310; Electrical Quick-Connect Terminals.
   - UL 486A & B; Wire Connectors.
   - UL 486C; Splicing Wire Connectors.
   - UL 486D; Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
   - UL 493; Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
   - UL 510; Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
   - UL 854; Service-Entrance Cables.
   - UL 1569; Metal-Clad Cables.
   - UL 1581; Reference Standard for Electrical Wires, Cables and Flexible Cords.
3. National Electrical Manufacturer Association (NEMA):
   - NEMA WC-5; Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

NEMA WC-7; Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

4. Institute of Electrical and Electronic Engineers (IEEE):
   IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.

1.3 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Building wire:
   a. America Insulated Wire Corp.
   b. Rome Cable.
   c. Southwire Company.
   d. Or equal.
2. Metal Clad Cable (Type MC):
   a. ANSI/NFPA 70, Type MC.
3. Flexible Cords and Cables:
   a. Carol Cable Company.
   b. PWC Corp.
   c. ITT Royal Electric.
4. Wiring connectors and terminations:
   a. 3M Company.
   b. Ideal.
   c. Blackburn-Holub.
   d. Burndy.
   e. Thomas & Betts Corp.
   f. Beau Barrier.
   g. Or Equal.

B. Substitutions: Under provisions of Section 26 00 10: Basic Electrical Requirements.

2.2 BUILDING WIRE

A. Conductor material:

1. Provide annealed copper for all wire, conductor and cable, unless otherwise indicated.
2. Wire AWG #8 and larger shall be stranded, unless otherwise indicated.
3. Wire AWG #10 and smaller may be solid or stranded as best suited for the installation.

B. Insulation material:

1. All insulated wire, conductor and cable shall be 600 volt rated unless otherwise noted on the Drawings.
2. Thermoplastic-insulated building wire: NEMA WC 5.
3. Rubber-insulated building wire: NEMA WC 3.
4. Feeders and branch circuits larger than 6 AWG: Type THW, XHHW or dual rated THHN/THWN.
5. Feeders and branch circuits 6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.
6. Service Entrance: Type RHW or THWN.
7. Control Circuits: Type THW or dual rated THHN/THWN.
8. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation or phase tape identification.

2.3 TYPE MC

A. MC cable shall be an armored assembly of two or more dual rated THHN/THWN conductors. A full sized green insulated ground wire and a bare wire metal sheath bond conductor.

B. MC cable sheath shall be fabricated in continuous lengths from strip, spirally wound and formed to provide an interlocking design. Use aluminum or steel jacket cable.

C. Conductors shall be color-coded for the correct phase and voltage as specified herein.

D. Fittings: Fittings shall be UL listed for use with MC cable type specified.

2.4 FLEXIBLE CORDS AND CABLES (TYPE'S')

A. Provide flexible cords and cables of size, type and arrangement as indicated on the Drawings.

B. Type 'S' flexible cords and cables shall be manufactured in accordance with NEC Article 400 and composed of two or more conductors and a full size green insulated ground wire with an outer jacket of rubber or neoprene as noted.

C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as a integral component of the connector or as an independently supported unit.

D. Suspended flexible cords and cables shall incorporate safety spring(s) unless otherwise noted.

2.5 WIRING CONNECTIONS AND TERMINATIONS

A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

B. Electrical spring wire connectors:

1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.
2. Self-striping pigtail and tap U-contact connectors are permitted to be used.

C. Push in wire connectors are permitted to be used as long as they are UL listed for the application.

D. Mechanical type terminating lugs:

1. Provide tin-plated copper mechanical type lugs for installation as stipulated by the lug Manufacturer or as indicated on Drawing

E. Splicing and insulating tape - Scotch 33+ or equal.

F. Insulating putty:

1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.
2. Use putty suitable for temperatures from minus 17.8 degrees C to 37.8 degrees C with a dielectric strength of 570-volts/mil minimum.

G. Terminal strips:

1. Provide box type terminal strips in the required quantity. Install in continuous rows in terminal cabinets.
2. Use strips with ampere ratings as required.
3. Identify all terminals with numbering sequence being used for a particular system.

H. Crimp type connectors:

1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support
2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.
3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.
4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.

I. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.

J. Wire lubricating compound:

1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.
2. Shall not be used on wire for isolated type electrical power systems.

K. Bolt termination hardware:

1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.
2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.
3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, confirming to ANSI B27.2. SAE or narrow series shall not be used.
4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.

5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
   a. 1/4" bolt - 125 amps
   b. 5/16" bolt - 175 amps
   c. 3/8" bolt - 225 amps
   d. 1/2" bolt - 300 amps
   e. 5/8" bolt - 375 amps
   f. 3/4" bolt - 450 amps

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATION

A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.

B. Feeders and branch circuits in wet locations shall be rated 75 degree C.

C. Feeders and branch circuits in dry locations shall be rated 90 degree C.

D. Minimum conductor size:

1. Provide minimum AWG #12 for all power and lighting branch circuits.
2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.

E. Color coding:

1. For 120/208 volt, 3 phase, 4 wire systems:
   a. Phase A - Black
   b. Phase B - Red
   c. Phase C - Blue
   d. Neutral - White
   e. Ground - Green
2. For 277/480 volt, 3 phase, 4 wire systems:
   a. Phase A - Brown
   b. Phase B - Orange
   c. Phase C - Yellow
   d. Neutral - Gray
   e. Ground - Green
3. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted unless part of an MC Cable assembly.
4. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral unless part of an MC Cable assembly.

3.3 WIRING METHODS

A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Install all single conductors in raceway system, unless otherwise noted.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.

D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

E. Use #10 AWG conductor for 120/208 volt circuits located outside a 150 foot radius of panel source and for 277 volt branch circuits located outside a 200 foot radius of panel source, unless otherwise noted.

F. 20 amp power and lighting branch circuits containing no more than eight (8) current carrying conductors (phases and neutrals). Use #10 AWG conductors for 120/208 volt circuits located outside a 65 foot radius of panel source and for 277/480 volt circuits located outside a 250 foot radius of panel source.

G. Provide #10 AWG pig tails on all 20A and 30A wiring devices served by #8 AWG conductors and larger.

H. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with its associated phase conductor where more then one neutral is present in a conduit.

I. Install cable supports for all vertical feeders in accordance with the NEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.

J. Neatly form, train and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches and equipment assemblies.

K. Seal cable or wire, entering a building from underground, between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.

L. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.

M. Stranded wire shall be terminated using fitting, lugs or devices listed for the application.

N. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to Manufacturers published installation instructions.

3.4 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

B. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than AWG #1.

C. Wire pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
2. Use rope made of nonmetallic material for pulling feeders.
3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. Pull in together multiple conductors or cables in a single conduit.

D. Install and test all cables in accordance with Manufacturer's instructions and warranty.

3.5 MC CABLE – INSTALLATION

A. Install MC cable in accordance with manufacturer instructions and in strict accordance with CEC Article 330. Follow manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over tightened. Connector shall be firmly attached to the metal boxes.

B. Support cables every 6 feet and within 12 inches of boxes, per CEC Article 330, using one hole straps, separate spring metal clip or metal cable ties (not steel tie wire) for each cable.

C. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.

D. Bend the cable per CEC Article 330.

3.6 WIRE SPLICES, JOINTS AND TERMINATION

A. Join and terminate wire, conductors and cables in accordance with UL 486A, C, NEC and Manufacturer's instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Splices and terminations shall be made mechanically and electrically secure.

E. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.

F. Install cable ties and maintain harnessing.

G. Encapsulate splices in exterior pullboxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.

H. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least six (6) inches of tail and neatly packed in box after splice is made up.

I. Branch circuits (#10 AWG and smaller):

1. Connectors:
   a. Solderless, screw-on, reusable spring pressure wire connectors, approved for copper conductors may be used.
   b. Solderless, push-wire wire connector, approved for copper conductors may be used.
2. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.

J. Feeder circuits: (#6 to 750 MCM)

1. Join or tap conductors from #6 AWG to 750 MCM using bolted pressure connectors or insulate mechanical compression taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.
2. Terminate conductors from size #6 AWG to 750 MCM copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.
3. Field installed compression connectors for cable sizes 250 MCM and larger shall have not less than two clamping elements or compression indents per wire.
4. Insulate splices and joints with materials approved for the particular use, location, voltage and temperature. Insulate with not less than that of the conductor level that is being joined.

K. Termination hardware assemblies:

1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.
2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
3. The crown of Belleville washers shall be under the nut, if possible.
4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendation are not obtainable, the following values shall be used:
   a. 1/4" - 20 bolt at 80-inch pounds torque.
   b. 5/16" - 18 bolt at 180-inch pounds torque.
   c. 3/8" - 16 bolt at 20-foot pounds torque.
   d. 1/2" - 13 bolt at 40-foot pounds torque.
   e. 5/8" - 11 bolt at 55-foot pounds torque.
   f. 3/4" - 10 bolt at 158-foot pounds torque.

3.7 IDENTIFICATION

A. Refer to Section 26 05 53: Electrical Identification for additional requirements.

B. Color code conductors size #8 and larger using specified phase color markers and identification tags.

C. Provide all terminal strips with each individual terminal identified using specified vinyl markers.

D. In manholes, pullboxes and handholes, provide tags of the embossed brass type and also show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.8 FIELD QUALITY CONTROL

A. Pre-functional testing:

1. Visual and mechanical inspection:
   a. Inspect exposed sections of wires and cables for physical damage and proper connections.
   b. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer's published data.
   c. Inspect compression applied connectors for correct cable match and indention.
   d. Verify visible cable bend meet or exceed ICEA and Manufacturer's minimum allowable bending radius.
   e. If cables are terminated through window type current transformers, make an inspection to verify neutral and ground conductors are correctly placed for operation of protective devices.
   f. Insure wire and cable identification has been installed as specified herein.
2. Electrical testing:
   a. Contractor shall perform feeder insulation test after installation and prior to connection to utilization devices. Testing shall be as follows:
      1) 100% of all feeders 100 amp rated and above.
   b. Perform insulation-resistance test using megohm meter with applied potential of 1000V DC for a continuous duration of 60 seconds. Test conductors phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.
   c. Perform continuity test of all feeder to insure correct cable connections. Test all neutrals for improper grounds.
3. Test values: Investigate resistance values less than 50 megohms.

* END SECTION 26 05 19 *

SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary General Conditions and Division 01 - General Requirements.

B. Grounding systems and installation shall comply with IEEE Green book and Emerald book where appropriate.

1.2 DESCRIPTION

A. Work included in this Section: Conduits, wires, ground rods and other materials for the electrical grounding system.

B. Related work included in other Sections:

1. Basic Construction Materials and Methods: Section 26 05 33.

1.3 INCORPORATED DOCUMENTS

A. Section 26 00 10, Electrical General Requirements, applies to this Section.

PART 2 - PRODUCTS

2.1 GROUND ROD

A. "Copperweld" ground rod conforming to or exceeding requirements of U.L. Specification No. 467 (ANSI C-33.8). Rod shall be 1/2" diameter and 10' in length, unless otherwise noted on the drawings.

2.2 BELOW GRADE CONNECTIONS

A. Exothermic fusion welding

B. Compression fittings

2.3 HARDWARE

A. Bolts, nuts and washers shall be bronze approved for the purpose.

PART 3 - EXECUTION

3.1 SYSTEM NEUTRAL GROUND

A. Ground to the neutral conductor of every transformer to limit the maximum potential above ground due to normal operating voltage and limit the voltage level due to abnormal conditions.

B. Ground transformers with secondary voltage in the 600V class or less as follows:

1. 3 phase, 4 wire, Wye connected: ground neutral point.
2. Single phase, 3 wire: ground the mid-point of the secondary winding.

3.2 GROUNDING AND BONDING

A. Grounding and bonding shall be as required by codes and local authorities.

B. All electrical equipment shall be grounded, specifically the main switchboard, circuit breaker, panelboards, terminal cabinets, outlet boxes, transformer cases and motors of refrigeration, heating and ventilating equipment.

C. Grounding of the service and each of the distribution panels shall be completed as indicated on the Plans. The continuous grounding electrode conductor used to ground system neutral shall be connected to the grounding electrode as directed by the local authorities, verify prior to installation. Where the cold water pipe is used for neutral ground connection, the water pipe shall be 1 inch or larger and shall meet code requirements.

D. Water pipe connections shall be made with a ground fitting which bonds both conduit and conductor to water pipe. Ground connections shall be accessible for inspection at all times, shall be unobtrusive as possible.

E. Internal ground bonding conductor shall be provided within all lengths of flexible metallic conduit, unless the conduit assembly is U.L. listed for grounding.

F. A insulated copper ground conductor shall be provided in each non-metallic raceways sized in accordance with the codes. This conductor may or may not be shown on the Plans.

G. All branch circuits and feeders in metallic conduit will utilize the conduit as the ground. Feeder and motor circuit grounds shall be sized in accordance with code requirements.

H. Metal parts of pull boxes or manholes shall be grounded per code requirements.

I. Concrete encased distributed ground electrode may consist of at least 20 feet of bare copper conductor, size as indicated on the Drawings, be installed 2" above the bottom of the building concrete footing.

J. The ground system electrodes shall be tested for resistance before the equipment ground conductors are connected. Maximum ground system resistance shall be 5 ohms.

K. Ground conductors shall be copper, green insulated in raceways.

3.3 BUILDING STRUCTURAL GROUND

A. Domestic, chilled and hot water mains and fire protection metallic water pipes shall be connected to the ground bus loop with #4/0 AWG bare copper conductor.

B. Miscellaneous metal objects including piping, vessels, and structural shapes within six feet of metallic objects connected to the ground system and which are not interconnected mechanically with the grounding system, shall be interconnected with a minimum #6 AWG bare copper conductor.

* END OF SECTION 26 05 26 *

SECTION 26 05 29

SUPPORTING DEVICES

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the Drawings, General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 DESCRIPTIONS:

A. Conduit /Cabling supports.

B. Equipment supports.

C. Equipment anchoring and supports

D. Fastening hardware.

1.3 RELATED WORK:

A. Section covering Supporting from Building Structure.

B. Section covering Cast-In-Place concrete.

C. Section covering Structural Steel.

1.4 COORDINATION:

A. Coordinate size, shape and location of concrete pads with Section 01 33 01.

1.5 QUALITY ASSURANCE:

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 CONCRETE FASTENERS:

A. Drilled wedge, and expansion type concrete anchors. Acceptable manufacturers are Phillips Red-Head WS series or Ramset Trubolt.

B. Provide power driven concrete fasteners with washers. Acceptable manufacturers are Remington or Ramset.

C. Drilled sleeve type expansion anchors. Acceptable manufacturers are Ramset Dynabolt or Red-Head RM series.

2.2 CONDUIT /MC CABLE SUPPORTS:

A. Threadless slick rods, anchored by powder actuated fasteners, are acceptable.

B. Spring Type Clips attaching conduit are acceptable as long as used per manufacturer's recommendations.

2.3 CONCRETE INSERTS:

A. Pressed galvanized steel, spot insert, with oval slot capable of accepting support nuts of ¼ to ½-inch diameter thread.

B. Acceptable Manufacturers:

1. Superstrut Model 425 with AB-102 Series Nut
2. Unistrut Model M24 with M2506 Series Nut.
3. Kinline Model 279 with 650 Series Nut.

2.4 DECK INSERTS:

A. Steel plate 3/16-inch thick with treaded galvanized steel rod sized for load.

B. Acceptable Manufacturers: Superstrut Model C-475 Series or Kinline Model 293 Series.

2.5 CONSTRUCTION CHANNEL:

A. 1/2-inch by 1 ½-inch min., 14-gauge, galvanized steel channel with 9/16-inch diameter bolt holes, 1 7/8-inch on center, in the base of the channel.

B. Acceptable Manufacturers:

1. Superstrut
2. Unistrut

2.6 THREADED ROD:

A. Galvanized rod, sized for load unless otherwise shown or specified.

2.7 CABLE TIES AND CLAMPS:

A. One piece, nylon, reusable tape lashing ties.

B. Acceptable Manufacturers: Thomas & Betts Ty-Raps or Panduit Pan-ty.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Provide supporting devices as noted in other sections of division 26.

B. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using precast inserts, expansion anchors, preset inserts or beam clamps.

C. Use hollow wall fasteners in hollow masonry walls.

D. Use expansion anchors or preset inserts in solid masonry walls.

E. Use self drilling anchors or expansion anchors on concrete surfaces.

F. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

G. Do not fasten supports to piping, ductwork, mechanical equipment or conduit.

H. Do not drill structural steel members unless first accepted in writing by the Architect.

I. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

J. Install surface mount cabinets and panelboards with a minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

K. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

L. Anchor free standing equipment on concrete pads where indicated.

M. Provide seismic restraint as required by code. Engineered Details from Seismic Restraint Design Company(like ISAT) acceptable in lieu of structural engineer review/stamp.

3.2 LAYOUT:

A. Layout support devices to maintain headroom, to provide neat mechanical appearance, and to support equipment loads.

* END OF SECTION 26 05 29 *

SECTION 26 05 31

CONDUIT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Rigid steel conduit and fittings.
2. Electrical metallic tubing and fittings.
3. Flexible metallic conduit and fittings.
4. Liquidtight flexible metallic conduit and fittings.
5. Miscellaneous conduit fittings and products.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Federal Specifications (FS):
   - FS WW-C-563; Electrical Metallic Tubing.
   - FS WW-C-566; Specification for Flexible Metal Conduit.
   - FS WW-C-581; Specification for Galvanized Rigid Conduit.
2. American National Standards Institute, Inc. (ANSI):
   - ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
   - ANSI C80.3; Electrical Metallic Tubing, Zinc Coated.
3. Underwriters Laboratories, Inc. (UL):
   - UL 1; Flexible Metal Conduit.
   - UL 6; Rigid Metal Conduit.
   - UL 360; Liquid-Tight Flexible Steel Conduit.
   - UL 514B; Conduit, Tubing and Cable Fittings.
   - UL 635; Insulating Bushings.
   - UL 797; Electrical Metallic Tubing - Steel.

1.3 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Metal conduit:
   a. Allied Tube and Conduit Co.
   b. Triangle PWC, Inc.
   c. Western Tube and Conduit Corp.
   d. Spring City Electrical Manufacturing Co.
   e. Alflex Corp.
   f. American Flexible Metal Conduit Co.
   g. Or Equal.
2. Fittings:
   a. Appleton Electric Co.
   b. OZ/Gedney.
   c. Thomas & Betts Corp.
   d. Spring City Electrical Manufacturing Co.
   e. Or Equal.

2.2 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.

B. Standard threaded couplings, locknuts, bushings and elbows: Only materials of steel, die cast or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.

C. Three piece couplings: Electroplated, cast malleable iron.

D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree C minimum.

E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.

F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150 degrees C.

G. All fittings and connectors shall be threaded.

2.3 ELECTRICAL METALLIC TUBING (EMT)

A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.

B. Set screw type couplings: Electroplated, steel or cast malleable iron, UL listed. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches.

C. Set screw type connectors: Electroplated steel or cast malleable iron tight with male hub. Setscrew shall be same as for couplings.

D. Raintight couplings: Electroplate steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.

E. Raintight connectors: Electroplated steel or cast malleable iron, UL listed raintight and concrete tight, using gland and ring compression type construction.

2.4 FLEXIBLE METALLIC CONDUIT (FMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.

B. Fittings: Connectors shall be of the single screw clamp variety or Jake type.

2.5 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.

B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.6 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.

E. Fire rated penetration seals:

1. UL building materials directory classified.
2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.
3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet or wrap/strip.

F. Standard products not herein specified:

1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATION

A. Galvanized rigid steel conduit (GRS) may be used in the following applications:

1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with NEC and local Codes.
2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.

B. Electrical metallic tubing (EMT): May be used for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces.

C. Flexible metallic conduit (FMC): May be used in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices and to lighting fixtures installed in suspended ceilings, minimum sizes shall be 3/8" for lighting fixtures and control wiring and 1/2" for motor and transformer connections. U.O.N.

D. Liquidtight flexible metallic conduit (LFMC): Shall be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc. Minimum sizes shall be 1/2".

E. PVC – may be used anywhere as allowed by NEC

F. MC – may be used anywhere as allowed by NEC-except exposed below 10’ AF

3.3 PREPARATION

A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.

C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed or concealed above suspended ceiling.

D. Conduits shall not be placed closer than 12 inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

E. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.

F. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.

G. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150 feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.

H. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated or specified in the Contract Documents or not.

3.4 INSTALLATION

A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1/2" for interior applications and 3/4" for exterior and underground applications.

C. All conduit sizes indicated on the Drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the Contractor shall be responsible for resizing conduits upward to meet Code.

D. Except in electrical, communication and mechanical rooms, conduit connections to motors and surface cabinets shall be concealed unless exposed Work is clearly called for on the Drawings.

E. Install conduits in complete runs before pulling in cables or wires.

F. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.

G. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.

H. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to insure low resistance ground continuity through conduit and to prevent seizing and corrosion.

I. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.

J. In all empty conduits or ducts, install a “True Tape” conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.

K. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not indicated on the Drawings. Refer to Section 26 05 26: Grounding and Bonding.

L. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).

M. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.

N. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360 degrees, total).

3.5 PENETRATIONS

A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:

1. Where indicated on the Structural Drawings.
2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size and position of each penetration.

B. Cutting or holes:

1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw, impact electric, hand or manual hammer type drills are allowed. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
2. Provide sleeves or “can outs” for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.

C. Sealing:

1. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.
2. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.

D. Waterproofing: At floor, exterior wall and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

3.6 CONCEALED IN CONCRETE

A. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the conduits.

B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.

C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.

D. Make couplings and connections watertight.

E. Protect stub-ups from damage where conduits rise from floor slabs.

3.7 TERMINATIONS AND JOINTS

A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.

C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.

E. Stub-up connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with conduit.

F. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:

1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of a buildings expansion joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.

3.8 SUPPORTS

A. Provide supports for raceways as specified in Section 26 05 29: Electrical Hangers and Supports.

B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the NEC.

C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.

D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures or other UL listed acceptable means. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.

E. 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the threadless rod using spring steel support clips.

F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.

G. Fasteners and supports in solid masonry and concrete:

1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. After concrete installation:
   a. Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8 inch embedment.
   b. Power set fasteners not less than ¼ inch diameter with depth of penetration not less than 1-1/2 inches.
   c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.

I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

* END SECTION 26 05 31 *

SECTION 26 05 33

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the Electrical work in this section including but not limited to following:

1. Raceways.
2. Junction, Outlet, and Pull Boxes
3. Fittings
4. Wire & Cable
5. Wiring Devices
6. Floor boxes
7. Supports
8. Contactors

1.2 RELATED WORK

A. The requirements of Section 26 05 33 BASIC ELECTRICAL REQUIREMENTS apply to all work in this section.

1.3 ABBREVIATIONS

A. American National Standards Institute (ANSI)

B. Underwriters Laboratories, Inc. (UL)

C. National Electrical Manufacturer's Association (NEMA)

PART 2 - PRODUCTS

2.1 CONDUITS AND FITTINGS

A. Rigid Steel Conduit (RSC) and Intermediate Metal Conduit (IMC).

1. RSC: Full weight, galvanized conduit Federal Specifications WW-C581d, ANSI Standard C80.1, UL 6 and NEMA RN1 (Type A).
2. IMC: lightweight steel pipe galvanized, threaded. UL 1242.
3. Hot dip galvanized inside and out with hot dip galvanized threads.
4. Couplings:
   a. Galvanized steel or malleable iron and Zinc die cast are permitted.
   b. Erickson couplings: to complete conduit runs where required by segmented or phased construction.

c. Sealing fittings: threaded cast iron type. Continuous drain type to prevent passage of water vapor.

5. Locknuts:
   a. Bonding type with radial serrations.
   b. Myers or equal.

6. Bushings:
   a. Metallic with insulated throat.
   b. Galvanized steel or cast malleable iron body.
   c. Ground lug and compression screw.
   d. O-Z Gedney Type B, Thomas and Betts 1222 series or equal.

B. Electrical metallic tubing (EMT);

1. Thin wall pipe, hot-dip galvanized steel outside or malleable iron, threadless.
   a. Inside uniform enamel coating.
   b. Conformance with UL 797 and ANSI C80.3.
   c. Maximum size: 4 inches.

2. Couplings and connectors:
   a. Die cast set screw in all areas acceptable by National Electric Code.

C. Flexible steel conduit (FSC)

1. Continuous single strip, galvanized, spirally wound with interlocking convolutions.
2. Minimum diameter ½ inch, except as noted or required for wiring.
3. Bushings and connectors:
   a. Galvanized steel or malleable iron.
   b. Two clamp screws for sizes 1-1/2 inch and larger.

4. Liquid-tight: extruded liquid-tight jacket of PVC with sealing ring and insulated throat.
5. Provide separate ground conductor in all raceway sections.
6. Flexible conduits are NOT allowed for telcom raceways.

D. Conduit outlet bodies:

1. For fittings and accessories: Thomas and Betts, Midland-Ross Corp. or equal
2. For conduit: Allied Tube, Triangle, or equal.

E. Metal Clad Cable:

1. Factory assembly of conductors in corrugated metallic sheath
2. Integral equipment grounding conductor
3. Color coding of each conductor is desired.

2.2 WIREWAYS

A. Pre-fabricated channel shaped sheet metal trough.

B. Complete with all fittings and accessories. Size as noted as required by code for the number of conductors installed.

C. Baked enamel finish inside and outside, approved for support at minimum 10 feet on centers. Coated with corrosion resistant gray paint.

D. For interior use: screw cover and base, minimum thickness 16 gauge galvanized steel.

E. For exterior use: screw cover and base, minimum No. 16 gauge galvanized steel, weatherproof..

F. Acceptable manufacturers: Hoffman Engineering Co., Wiremold Co., or equal.

2.3 SURFACE METAL RACEWAYS

A. Complete with all fittings and accessories. Size as noted. Conformance with UL-5.

B. Baked enamel finish inside and out, with snap-on covers, minimum No. 20 gauge galvanized steel.

C. Two-piece system consisting of base section and cover.

D. Trade size knockouts and ground lug for conduit and branch circuit connections.

E. Divider for segregating power and signal conductors.

F. Color: as selected by the architect.

G. Dimensions:

1. Base: Minimum 0.050 inch wall thickness
2. Cover: minimum 0.040 inch wall thickness
3. Assembled base and cover: 4.750 inches wide by 1.75 inches high with cross sectional area of 7.5 square inches.
4. Divider to split raceway into equal compartments for power and signal wiring.

H. Fittings and Supports

1. Manufacturer's standard fittings and supports
2. Include bushings to prevent wire abrasion, elbows, tees, and clamps

I. Mounting: device mounting as shown on Drawings

J. Acceptable manufacturers: Wiremold Co., Thomas and Betts, or equal.

2.4 EXPANSION AND DEFLECTION FITTINGS:

A. Suitable for .75 inch deflection, expansion, or contraction of any direction allowing 30 degree angular deflection.

B. Internal flexible metal braid for ground continuity.

C. Exposed and in furred spaces: flexible conduit with external bonding jumper strip.

2.5 SLEEVES:

A. Exterior non-membrane waterproofed walls; galvanized cast iron, galvanized rigid steel with continuously welded center flange.

B. Exterior non-membrane waterproof roofs, galvanized cast iron, flashing flange and clamping ring.

C. Interior membrane waterproof floors; galvanized cast iron, flashing flange and clamping ring. Extend two inches above floor with pipe nipples. Clamp to flashing.

D. Extend flashing 10 inches around edge of raceway. Flashing subject to review.

2.6 SEALS

A. Provide raceways in waterproof sleeves.

B. Raceways in non-watertight sleeves: use sealing compound.

C. Cable seals in raceways through sleeves.

D. Thruwall cable seals.

E. Hazardous areas, cold rooms conductor water stops: Crouse-Hinds, Appleton, Killark type EYS, ESU, EYM, EYOM or SFM with matching sealing cement of fiber filler, or equal.

2.7 OUTLET BOXES

A. Applicable to junction and pull boxes 100 cubic inches and smaller.

B. Stamped steel, 4 inches, square or octagon for lighting fixtures; 1-1/2 inch deep.

C. In wall for receptacle and switches:

1. 4 inch square with raised covers and fixture studs where required.
2. 1-5/8 inch deep boxes.
3. Through-the-wall type; not permitted.

D. Die cast iron or with threaded hubs; 4 inch round, 1 1/8 inch deep on ceiling, and 4 inch square, 2 1/8 inch deep on wall.

E. Boxes for outdoors and damp locations; weatherproof.

F. Boxes without fixture or device; provide with blank cover.

G. Provide barriers between wiring energized from different systems and emergency and normal wiring.

H. Plaster rings: for adjacent plaster finish.

I. Increase depth where required for devices and wiring installed.

2.8 JUNCTION AND PULL BOXES

A. For boxes larger than 100 cubic inches.

B. Galvanized sheet steel, 16 gauge, with screw on covers. Minimum four cadmium plated machine screws. Code size.

C. Provide insulated supports for cable where required.

D. For wet locations; galvanized cast iron .

E. Provide barriers between wiring energized form different systems and emergency and normal wiring.

2.9 600 VOLT WIRE AND CABLE

A. Single conductor unless otherwise noted, Class B stranding. UL 44 and 83 listed, annealed copper.

B. Solid copper for sizes No. 10 and smaller and stranded copper for sizes No. 8 and larger.

C. Minimum size No. 12 for general use.

D. Control and alarm wire:

1. Minimum size No. 14 unless otherwise noted.
2. At 120 volts and over 200 feet total circuit length, minimum size No. 12.
3. Size conductors so that inrush condition does not adversely affect operation of the controls.

E. Insulation:

1. Type THWN/THHN.
2. For luminaire wiring and branch circuits located in wiring channels of continuous fluorescent fixtures or where ambient temperatures are over 90 degrees C see Section 26 51 00.
3. For service entrance cable or incoming feeder to main switchboard: type RHW.
4. Color coding:
   a. Required for all cables and conductors.
   b. Color coded jacket throughout for sizes no. 8 and smaller.
   c. Color coded tape at all terminations and junction or pull boxes for sizes no. 6 and larger.

F. Wire markers:

1. Self-adhesive, preprinted vinyl
2. Self-laminating wrap-around strip
3. Brady, 3M, or Thomas & Betts

G. Cable and wire manufacturers: Rome Cable, Pirelli, Southwire, American, Okonite.

2.10 WIRING FOR LIGHTING FIXTURES

A. 277 Volt Luminaire Wiring: 300 volt, 302 degree F.AF (indoor, dry locations only) SF-1 or SFF-1, beginning at separately mounted outlet box.

B. Manufactured Soft Wiring System may be used if desired.

C. Splices: Mechanical spring pressure connector(WAGO type) or crimp connector. Wire nuts are permitted

D. Fixtures fed from more than one panel: Separate neutral to each panel.

E. Minimum 3/8 inch flexible conduit connections for recessed fixtures except as noted. Maximum length: 6 foot, 0 inches.

F. Branch circuits located in wiring channels of continuous fluorescent fixture in dry locations: type THHN.

G. Low voltage wiring for lighting control:

1. Class 2 solid. Minimum size #18 AWG.
2. Color coded.
3. Plenum rated.

2.11 CABLE SUPPORTS – IF REQUIRED BY NEC

A. Wedge type: clamping device with insulation wedges.

B. Clamp type:

C. Hubbell "Kellems" grips, Spring City, OZ-Gedney or equal.

D. Porcelain saddle type support where required.

2.12 TERMINATIONS, SPLICES, AND CONNECTORS:

A. Twist-on spring loaded connectors and nylon insulated covering.

1. 3M "Scotch-Lok", T & B Type PT, Ideal "Wing Nut", Buchanan B-Cap or equal.
2. “Wago” type wire connectors are permitted.

B. Mechanical bolted pressure or hydraulic compression type:

1. Indent, hex screw, or bolt-on clamp type.
2. Corrosion resistant material.
3. Use manufacturer's recommended tooling.

C. Bus bar connections:

1. Tin plated lugs
2. Compressions type washers ("Belleville" type).

D. Cold shrink connectors

1. 3M Company, Thomas & Betts, or equal.

E. Splicing and insulating tape:

1. General purpose black color suitable up to 105 degrees C.
2. UV-proof, self extinguishing.

3. 7-mil thick vinyl with a dielectric strength or 10 kV.
4. 3M Company, Thomas & Betts, or equal.

2.13 WIRING DEVICES

A. General

1. Specification grade per NEMA Standards.
2. Finish and colors as specified or as selected by the owner's Representative.
3. Conformance with UL 20 NEMA WD-1.
4. Manufacturer: Leviton, Pass and Seymour, Hubbell or equal.

B. Lighting Switches:

1. Toggle switches (utility spaces):
   a. Heavy duty tumbler type.
   b. Phenolic compound.
   c. Toggle handle.
   d. Color white.
   e. Side screw wire connectors.

C. Receptacles:

1. Locked in mounting strap with self-grounding clip.
2. All-nylon face.
3. Triple-wipe copper alloy contacts.
4. Back and side screw wire connectors.
5. Duplex Receptacles:
   a. Rating: 15 amperes, 125 volt, single phase, unless otherwise specified or required by code.
   b. Color as selected by Owner's Representative.
6. Double Duplex Receptacles: Two duplex receptacles in on 4" by 4" outlet box with one 2-gang plate.
7. Weatherproof Receptacles:
   a. Installed in bell boxes metal outlet boxes with threaded conduit hubs.
   b. Watertight gasketed cover and permanently attached over.
   c. Provide ground fault protection for outdoor receptacles by means of integral ground fault interrupter.
8. Rating of receptacles or individual dedicated branch circuits equal rating of overcurrent device.
9. Manufacturer: Hubbel, Pass & Seymour, Leviton, specification grade.

D. Plates:

1. For switches and receptacles specified provide matching plates. color to match device.
2. In Mechanical Rooms, Janitor rooms, Storage Rooms and Utility Spaces: plastic. Color: White.
3. Weatherproof: Stainless steel, type 302 or 304 with gasketed cover.
4. Verify plate types and colors prior to installation.

2.14 SUPPORTS

A. See Section 26 05 29 ELECTRICAL HANGERS AND SUPPORTS

B. Conduit Supports:

1. Concrete fasteners: expansion type concrete anchors.
2. Conduit straps:
   a. Hot-dip galvanized, cast malleable iron, one-hole type strap.
   b. Cast clamp-back and spacers as required.

3. Channel support:
   a. Galvanized steel channel.
   b. Size as required by seismic calculations.
   c. Superstrut: Uni-strut.

C. Individual Fixtures: Carry weight of fixture to building construction, clear of ducts or pipes.

2.15 FIRESTOPPING MATERIALS

A. Firestopping sealants and compounds.

B. Conforming to ASTM E-814 and Ul-1479.

C. Suitable for gypsum, wood, and concrete penetrations.

D. Fire rating: up to 3 hours. Not less than required by code for the rating of the barrier penetrated.

E. Manufacturer: Nelson, 3M Company, Carborundum, Dow, Hilti, or equal.

F. See Section 07270.

2.16 FIRESTOP PILLOWS

A. Compressible firestop pillows.

B. Non-toxic and re-usable.

C. Confirming to ASTM E0-814 and UL-1479.

D. Manufacturers: Nelson, 3M, or equal.

2.17 PULL CORD

A. 1/8 inch minimum Polypropylene.

B. Minimum breaking strength: 200 lbs.

2.18 CONTACTORS

A. Mechanically held.

B. Coil Voltage as indicated or as required.

C. 2-wire or 3-wire control module as indicated or as required.

D. Enclosure: suitable for the installation location indicated.

E. Manufacturer: ASCO 917, Square D.

PART 3 - EXECUTION

3.1 GENERAL

A. Install equipment, devices, raceways, and supports based on coordination with all other trades and with building space conditions.

1. Verify all outlet locations with the Owner's Representative prior to rough-in.
2. Drawings are diagrammatic.
3. Coordinate installation with building spaces and conditions.
4. Maintain headroom throughout.

B. Installation to be in accordance with approved layout drawings.

C. Manufacturer's instructions:

1. Follow published directions in the delivery, storage, protection, installation, wiring and testing.

3.2 INSTALLATION OF RACEWAYS

A. Conduit

1. Raceways to be installed concealed, except where noted or accepted in writing by the Owner's Representative.
2. Install raceways complete prior to cable pulling.
3. Concealed in walls and above ceilings: RSC, IMC, or EMT.
4. In wet locations RSC, IMC or EMT.
5. Through concrete and structural members: only where shown on the structural drawings.
6. Align and run conduit parallel with or at right angles to building lines.
7. Raceways for hung ceiling outlets and fixtures to be run in hung ceilings.
8. Run raceways in walls vertically.
9. Conduit system to be mechanically and electrically continuous throughout.
10. Telecommunications conduits.
11. In unfinished spaces: route parallel to the building planes as high as possible.
12. Conduit sizing
    a. Use: minimum unless otherwise noted.

B. Joints

1. To be cut square, threaded, reamed smooth and drawn up tight.
2. Threaded joints to be coated with graphite base joint compound to assure ground continuity.

C. Bends or offsets:

1. To be made with standard conduit ells.
2. Field bends may be made with an approved bender or hickey, or hub-type conduit fittings.
3. Number of bends per run: conform to code limitations except for signal systems maximum two 90-degree bends between pulling points.

D. Conduit terminations:

1. Rigid conduit to be secured to all boxes with two locknuts.
2. EMT conduit: use SS fittings.
3. Cap all unused conduits and identify destination point.
4. All terminations to be bonding type.
5. All conduit ends to have insulated bushings.

E. Supports:

1. For multiple conduit runs: use trapeze hangers attached each conduit with U-bolts or other approved fasteners and rods.
2. Support with 1/4 inch rods.
3. For single conduits use individual conduit hanger.
4. Provide U-bolt or pipe straps at each grating level of riser raceways.
5. Vertical conduits: support so that no weight is carried by cabinet, pullbox, or junction boxes.
6. Support independent of ceilings, ceiling supports, lighting fixtures, mechanical piping, ducts, and similar apparatus.
7. In masonry and concrete:
   a. Use steel or malleable iron concrete inserts set in place prior to concrete pour.
   b. For existing construction:
8. Use steel expansion anchors not less that 1/4 inch bolt size and not less than 1-1/8 inch embedment.
9. Power set fasteners not less that 1/4 inch diameter with depth of penetration not less than three inches.
10. Supports to be mounted to structure:
    a. Toggle bolts on hollow masonry
    b. Expansion shields or insets on concrete
    c. Machine screws on metal
    d. Wood screws on wood.
    e. Nails, rawl plugs, plastic anchors, or wood plugs: not permitted.

F. Outlet Boxes

1. Support boxes independently of raceways, walls and partitions.
2. Set outlet boxes square and true with building finish and secure to building structure by adjustable strap irons.
3. For concealed conduits install boxes flush to finished surface.
4. Verify outlet locations in finished spaces with Architectural drawings of interior details and finishes.
5. Provide barriers between switches connected to different phases for voltages exceeding 150 volts to ground.
6. Increase size of boxes as required by devices installed.
7. Offset back-to-back outlets with minimum six inch separation.
8. In the event of uncertainty or discrepancy notify the owner's Representative. Do not proceed until uncertainty or discrepancy is resolved.
9. Provide plaster rings for drywall installation.

G. Junction and pull boxes:

1. Furnish and install pullboxes where required by code and where necessary in the raceway system to facilitate conductor installation.
   a. In general, conduit runs of more that 150 ft., or with more than four right-angle bends, to have a pullbox installed at a convenient intermediate location.
   b. Boxes to have removable screw covers.

2. Install clear of other work.
3. In finished spaces:
   a. Conceal junction and pull boxes.
   b. Maintain accessibility with placement near removable ceiling tiles.
   c. In hard rock ceiling spaces: locate boxes near access panels.

4. Support from building structure, independent on conduit. Outlet boxes for fixtures recessed in hung ceiling shall be accessible through opening created by removal of fixture.
5. Coordinate motor terminal boxes with motor branch circuit conduit and wiring.
6. Identify all boxes with circuit and source panel number.

H. Penetrations

1. Waterproof through exterior walls and floors below grade: use rigid steel.
2. Through interior concrete walls and floors:
   a. Use rigid steel sleeves.
   b. For walls extend sleeve 2 inches on both sides of wall.
   c. Sleeves for future use: provide with threaded cap.

I. Seals:

1. Provide where conduits penetrate classified hazardous areas.
2. Use to prevent transmission of condensed water vapor from cold to warm spaces.
3. In finished spaces: install in flush steel boxes with blank coverplates.

3.3 INSTALLATION OF WIRE AND CABLE

A. Prior to installation of cable thoroughly clean and wipe dry all conduit and wireways before pulling any wires. Use "Ideal 77, Yellow", "Minerallac #100", or equal pull-in compound. A mechanical wire puller may be used where needed.

B. Unless specifically indicated, separate raceways for emergency system conductors.

C. Color coding:

1. 208/120 volt system:
   a. Phase A – Black
   b. Phase B – Red
   c. Phase C – Blue
   d. Neutral – White
   e. Ground - Green
2. 480/277 volt system:
   a. Phase A – Brown
   b. Phase B – Orange
   c. Phase C – Yellow

d. Neutral - White
e. Ground - Green

D. For all branch circuits:

Provide separate grounding conductor sized same as phase conductors.

E. Identification

1. All conductors to be identified at the source and load terminations, and each junction and pull box.
2. For feeders indicate number, size, phase and points of origin and terminations.
3. For branch circuits indicate source panel and breaker number
4. For control or alarm wiring indicate wire number and points of origin and termination.

F. Supports

1. Spacing per code.
2. Support in each terminal and pullbox with strap type supports.
3. Arrange cables neatly for individual inspection, removal, and replacement.
4. In vertical raceways: per code.

3.4 INSTALLATION OF DEVICES

A. In mechanical rooms, electrical/telephone closets, janitor rooms, storage rooms, and utility spaces: use snap switches.

B. In all finished spaces:

1. Flush mounted.
2. Ganged with adjacent devices.

C. Use 4" Square 1 1/2" deep box min. with single gang ring for all single gang devices.

D. Multi-gang boxes are permitted where more than one device is indicated to be located in one box.

E. Coordinate number of gangs required where adjacent dimmers are located in one same box.

F. Verify mounting heights and locations of all devices prior to rough-in with Owner's Representative.

G. Identify cover plates of all new and re-wired receptacles with panel name and circuit number.

3.5 INSTALLATION OF NAMEPLATES

A. Provide nameplates on to equipment to be identified.

B. Double stick silicone

3.6 TERMINATIONS, SPLICES AND TAPS

A. For conductors No. 10 and smaller:

1. Compression type of twist-on spring loaded connectors and nylon insulated covering.

B. For conductors No. 8 and larger up to #2/0:

1. Mechanical bolted pressure or hydraulic compression type using manufacturer's recommended tooling.
2. Insulate splices with insulating putty and tape.
3. Provide terminal blocks with required lug sizes in splicing cabinets where indicated.

C. Use compression type cable lugs and connectors of same metal as conductor to match cables with marking indicating size and type. For copper lug connections to bus bars provide anti-seize compound.

D. For termination lug and bolt type connectors use tin plated lugs and compression type washers.

E. For exterior lighting circuits and similar outdoor areas:

1. Water-tight connections

F. Maintain continuity of neutral and ground conductors throughout entire circuit. Removal of devices such as receptacles and lamp holders is not to cause interruption of these conductors.

3.7 INSTALLATION OF FIRESTOPPING MATERIALS

A. Install in accordance with the manufacturer's instructions.

B. Install as directed by the authority having jurisdiction.

C. Provide fire rated approved type sealant equivalent to the rating of the barrier being penetrated for raceways and wire passing through slots, sleeves or openings in fire partitioned areas.

D. Add fire barriers tight to conductors from transformer vaults and network protector compartments. Seal all unused penetrations.

3.8 TESTS

A. See Section 26 00 10
B. Megger Tests:
1. Required for feeders.
2. Conducted with minimum 500 volt DC megger.
3. Perform between phases, between phases and neutral, and between each conductor to ground.
4. Correct or replaced circuits with resistance values below 500,000 ohms.
5. Determine values with switchboards, panelboards, fuseholders, switches, and over current devices in place. Keep switches and breakers in open position during tests.

* END OF SECTION 26 05 33 *

SECTION 26 05 36

CABLE SUPPORT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. All Interbuilding Communications infrastructure and wiring shall follow UCB-CDC Sections 16-6 through 16-9.
2. Cable Support within the building but outside the TelcomRm.
   a. J- Hooks may be used as the primary special systems cable support system with the building. The minimum size of the J-Hook shall be 2" and spaced a minimum of 2' and a maximum of 5' on center.
3. Provide 18" wide ladder, as described on the details, for cable support in the Telcom Rm. Ladder tray will have radii downturns at each point where the cables transition from horizontial to vertical

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. The University of California – Berkeley Facilities Services – Construction Design Standards.
2. National Electrical Manufacturer Association (NEMA):
   NEMA VE 1; Cable Tray Systems
3. American Society for Testing Materials (ASTM):
   ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   ASTM A510 General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
   ASTM A633 Electrodeposited Coatings of Zinc and Steel

1.3 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. GS Metals Corp. "Globetray".
2. B-Line Systems, Inc.
3. Chalfant.
4. MP Husky Corp.
5. PW Industries, Inc.
6. Mono-Systems, Inc. (center support)
7. Cablofil EZ Tray
8. Or Equal

B. Support system:

1. Wire basket/ladder tray shall be pendant hung via threaded rods.
2. No hardware required to mount basket to bracket. Simply bend tabs of bracket down around wires.
3. If applicable, when mounting to a wall, use 3/8” material.

PART 3 - EXECUTION

3.1 PREPARATION

A. Location of cable/ladder tray shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment. Provide offsets as required to avoid obstruction of cable tray with other trades.

B. Exposed cable/ladder trays shall be run parallel or at right angles to the centerlines of columns and beams.

C. Cable/ladder trays shall not be placed closer than 12 inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

3.2 INSTALLATION

A. Install cable/ladder tray in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Shall conform to NEMA VE 1 requirements.

C. Support cable/ladder tray at each connection point, at the end of each run and at other points to maintain spacing between supports of 10 feet maximum.

D. If code required-Provide lateral bracing support along cable/ladder tray spaced at a maximum of 30'-0" on center. Bracing shall consist of 1 5/8" x 1 5/8" construction channel attached to one side of trapeze channel and installed at a 45-degree angle up to structural slab. Anchor bracing channel to slab with expansion bolts. Alternate bracing on both sides of cable tray where applicable.

E. Use expansion connectors where indicated in NEMA VE 1.

F. Provide bonding continuity between cable tray sections and fittings and ground per NEC.

3.3 PENETRATION

A. Provide E-Z path fire stop assembly wherever wall penetration is required..

* END SECTION 26 05 36 *

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS:

A. Refer to the Drawings, General Conditions, Supplementary Conditions, and Division 01General Requirements.

1.2 DESCRIPTIONS:

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit color coding.

D. Conduit markers.

E. Panelboard directories.

PART 2 - PRODUCTS

2.1 NAMEPLATES:

A. Type NP: Engraved, three layer, laminated plastic with black letters on white background.

2.2 LEGEND PLATES:

A. Type LP: Die stamped metal legend plate with mounting hole and positioning key.

B. Paint fill, engraved characters.

2.3 WIRE AND TERMINAL MARKERS:

A. Self adhering, pre-painted, self laminating vinyl wrap around strips.

B. Acceptable Manufacturers: Thomas & Betts WSL or Brady B191 series.

PART 3 - EXECUTION

3.1 INSTALLATION

A. De-grease and clean surfaces to receive nameplates and labels

B. Install nameplates and labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws, rivets or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

3.2 WIRE IDENTIFICATION:

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

B. Provide conductor phase color coding as per Section 26 05 33.

3.3 NAMEPLATE ENGRAVING:

A. Provide Type NP name plates of minimum letter height as noted below.

1. Panelboards, switchboards and motor control centers shall be ¼ inch to identify equipment designation, and 1/8 inch to identify voltage rating and source.
2. Individual circuit breakers, switches and motor starters in panelboards, switchboards, and motor control centers shall be 1/8 inch to identify circuit and load served including location.
3. Individual circuit breakers, enclosed switches, and motor starters shall be 1/8 inch to identify load served.
4. Transformers shall be ¼ inch to identify equipment designation; 1/8 inch to identify primary and secondary voltages, primary source, and secondary load and location.
5. Equipment cabinets, terminal cabinets, control panels and other cabinets enclosing apparatus hall be 3/8 inch to identify equipment and designation.

B. Provide vinyl labels of minimum letter height as noted below:

1. Receptacles shall be 1/8 inch to identify panelboard and circuit fed from. Attach to cover plate.

C. Provide Type LP metal legend plates for attachment to panel mounted operator's devices such as pilot lights, push buttons, selector switches, etc.

3.4 PANELBOARD DIRECTORIES:

A. Provide typewritten directories arranged in numerical order showing number of room in which each device served by each panelboard circuit is located.

B. Verify room numbers to be used with Architect. Room numbers will not necessarily be those sindicated on the drawings.

C. Mount directories in a 5-inch by 89-inch metal frame under a clear plastic cover inside each panelboard door.

* END OF SECTION 26 05 53 *

SECTION 26 09 26

LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS:

A. Refer to the General Conditions, Supplementary General Conditions and Division 01 General Requirements.

B. The Lighting Control System shall be a minium local control based system that that complies with minimum building and energy code requirements. .

1.2 DESCRIPTION:

A. Work included in this Section:

1. Lighting Control.

B. Related work included in other Sections:

1. Basic Construction Materials and Methods: Section 26 05 33.
2. Grounding: Section 26 05 26.

1.3 RELATED WORK

A. Section 26 00 10, BASIC ELECTRICAL REQUIREMENTS, applies to all work in this Section.

1.4 SUBMITTALS

A. Shop drawings and/or manufacturer's literature describing all required components and installation details.

B. Control wiring diagrams.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide and install a complete lighting control system as described above. All equipment shall be Listed by Underwriters' Laboratories, Inc.

B. The exact size and arrangement for the equipment shall be coordinated with the equipment manufacture to insure that appropriate clearance as required by Underwriters' Laboratories, Inc. has been met.

C. The system shall be complete including any transformers, relays, rectifiers, motor masters, remote control interface nodules, switches, switch plates, relay cabinets and wire required.

PART 3 - EXECUTION

3.1 GENERAL

A. The system shall be installed, connected and tested in conformance with the manufacturer's specific instructions.

B. Refer to drawings for typical wiring diagram.

* END OF SECTION 26 09 26 *

SECTION 26 13 13

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Fuses.
2. Molded case circuit breakers.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Federal Specification (FS):
   - FS W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service.
   - FS W-F-870; Fuseholders (for Plug and Enclosed Cartridge Fuses.
2. Underwriters Laboratories, Inc. (UL):
   - UL 248(1-16); Low-Voltage Fuses.
   - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
   - UL 512; Fuseholders.
   - UL 1066; Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.
3. National Electrical Manufacturer Association (NEMA):
   - NEMA AB 1; Molded Case Circuit Breakers.
   - NEMA SG 3; Low-Voltage Power Circuit Breakers.
4. Pacific Gas & Electric (PG&E) – Section G2 – Protection and Control Requirements for Generation Entities - Power Generation Interconnection Handbook:
   - Paragraph G2.14 Emergency Generator Requirements.
   - Table G2-5; Section G2 – Protection and Control Requirements for Generation Entities document.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 00 10: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.

2. Describe product operation, equipment and dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
5. Provide current let-through and melting time information for each type and rating of fuses.
6. Submit Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.6 WARRANTY

A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Fuses:
   a. Bussmann Division, Cooper Industries.
   b. Gould Shawmut Co.
   c. Or Equal.

2. Circuit breakers:
   a. Eaton Electrical/Cutler-Hammer.
   b. General Electric.
   c. Siemens/I-T-E.
   d. Square D.
   e. Or Equal.

B. Substitutions: Under provisions of Section 26 00 10: Basic Electrical Requirements.

2.2 FUSES

A. General: All power fuses shall be time-delay, current limiting type, unless otherwise noted on the Drawings. All fuses shall be the product of a single Manufacturer and shall be selectively coordinated when applied in 2:1 ratios. Types of fuses shall be as follows:

1. Motor branch circuit fuses (0-600 amperes): UL Class J dual element, time delay type fuse. Motor branch circuit fuses shall be sized for Type 2 coordination for the motor controller and back-up motor overload protection and shall be coordinated with motor starter overload relay heaters. See Section 26 29 00: Motor Controls.

B. Control and instrument fuses shall be suitable for installing in blocks or fuseholders. Exact type and rating shall be as recommended by the Manufacturer of the equipment being protected.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Branch and feeder circuit breakers shall be molded case, bolt on and trip indicating, except in residential units.

B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.

C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 14,000 RMS symmetrical amps for 480 volt systems and 10,000 RMS symmetrical amps for 208 volt systems.

D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.

E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.

F. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.

G. All terminals shall be rated for aluminum or copper wire.

H. Circuit breakers with trip ratings 400 amp and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100 amps shall be installed in distribution type panels.

I. Circuit breakers with trip ratings 401 amps through 1600 amps shall have solid-state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, short-time and long-time settings.

J. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.

K. Provisions in the boards shall be able to accept any combination of 1, 2 or 3 pole circuit breakers as indicated. Provide all necessary bus, device supports and mounting hardware sized for frame, not trip rating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.

C. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable NEC and NEMA standards for installation.

3.3 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt and debris.

* END SECTION 26 13 13 *

SECTION 26 22 13

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS:

A. Refer to Drawings, General Conditions, Supplementary Conditions, and Division 01 General Requirements

1.2 DESCRIPTIONS

A. Dry type, two winding transformers, 600-volt class

1.3 REFERENCE

A. American National Standards Institute (ANSI) /National Electrical Manufacturers's Association (NEMA) ST1 Specialty Transformers.

B. ANSI/NEMA ST 20 Dry Type Transformers for General Applications.

C. Institute of Electrical and Electronics Engineers (IEEE) C57.110.

1.4 SUBMITTALS:

A. Submit product data..

B. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation's system type and rated temperature rise.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products.

B. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

C. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet or snow if handled in inclement weather.

PART 2 - PRODUCTS

2.1 DRY TYPE, TWO WINDING TRANSFORMERS

A. Acceptable Manufacturers:

1. Powersmith E-Saver-C3L

B. Dry Type Transformers: ANSI/NEMA ST20, factory assembled, air cooled, dry type transformers. 480V primary,120/208V, 3 phase ,4 wire secondary. Rated as shown on drawings.

C. Energy Efficient, naturally ventilated with 220 degree C insulation, 130 degree temperature rise.Rated KVA as noted on plans.

D. To achieve the highest efficiency, least no-load losses, and to allow for the right sizing of equipment, transformer shall be E-Saver-C3L by Powersmith

E. Winding Taps, Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.

F. Winding Taps: Transformers 15 KVA and Larger: ANSI/NEMA ST20, four 2.5 percent above and two 2.5 percent below rated voltage, full capacity taps on primary winding.

G. K-Factor: as noted on plans.

H. Sound Levels:

1. Maximum sound levels are as follows:

KVA Rating	Sound Level
0 to 9	40 db
10 to 50	45 db
51 to 150	50 db
151 to 300	55 db
301 to 500	60 db

I. Impedance: 4 percent minimum or as otherwise noted.

J. Basic Impulse Level: 10 KV minimum.

K. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

L. Mounting: Transformers 75 KVA and less shall be suitable for wall, floor or trapeze mounting; transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.

M. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

N. Enclosure: ANSI/NEMA ST20, Type 1. Provide lifting eyes or brackets.

O. Isolate core and coil from enclosure using vibration absorbing mounts.

P. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

PART 3 - EXECUTION

3.1 PREPARATION

A. A concrete pad for transformer as shown on the drawings will be provided by others.

3.2 INSTALLATION

A. Set transformer plumb and level.

B. Mount transformers on molded neoprene vibration isolating pads suitable for isolating the transformer noise from the building structure, Kinetics Model RD or approved equal.

C. Provide seismic restraints as necessary.

D. Where transformers are indicated as being wall mounted, provide support design furnished and approval by a structural engineer registered in the State of California.

3.3 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

* END OF SECTION 26 22 13 *

SECTION 26 24 13

MAIN SWITCHBOARD

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary General Conditions and Division 01 General Requirements.

1.2 DESCRIPTION

A. Work included in this Section: main service switchboard.

B. Related work included in other Sections:

1. Basic Construction Materials and Methods: Section 26 05 33.
2. Grounding: Section 26 05 26.

1.3 INCORPORATED DOCUMENTS

A. Section 26 00 10, Electrical General Provisions, applies to all work in this Section.

1.4 SUBMITTALS

A. Manufacturer’s literature describing the product and shop drawings.

PART 2 - PRODUCTS

2.1 SWITCHBOARD

A. Enclosure:

1. Each switchboard shall consist of a dead-front, completely metal enclosed self-supporting structure, conforming with UL 891, NEMA PB2 and NEMA SG5. Construction shall consist of vertical sections of the universal frame type bolted together and braced with self-tapping bolts. Sides, top and rear shall be covered with Captive-bolt fastened steel plates having formed edges all around. Front plates shall be sectionalized and removable. All plates shall be fabricated from 12 gauge steel and shall have die-formed edges all around. The switchboard frame shall be suitable for use as floor sills in indoor installations. Corners shall be reinforced with rigged gussets internal and external to the structural members.
2. Switchboards shall have depth as required to house all equipment contained within it. Switchboards shall be constructed so that the back and front of all sections align. Construction of the board shall allow maintenance of incoming line terminations, device connections and all bus bolted connections.

3. All devices shall be accessible and removable from the front unless rear access is shown on the drawings.
4. Provide necessary hardware to permit locking every overcurrent protective device handle in the "off" position.
5. Provide access doors to all termination, meter and relay compartments.
6. Furnish cable pull sections or top cable pull boxes where shown on the Drawings complete with cable tie down supports. Where cable pull section or pull boxes contain
7. Switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL869.
8. Utility metering compartment section shall be fabricated to meet all utility company requirements. Where separate vertical section is required for utility metering, match and align with switchboard enclosure.

B. Bus assembly and terminations:

1. Switchboard bus bars and connections shall consist of copper of sufficient cross sectional area to continuously conduct the rated full load current with the temperature rise limits as set forth in the NEMA standards. Bolted connections using Belleville washers are required for all internal connections, including those between protective devices and bus.
2. Bus arrangement shall be phase A-B-C-N left-to-right, top-to-bottom, front-to-rear as viewed from the front. Horizontal and vertical bus ampere rating shall be uniform from end-to-end.
3. All bussing to and from an overcurrent protective device shall be rated to the frame sizing, not the trip rating.
4. Where "SPACE" is indicated in the switchboards, cross connectors and mounting hardware shall be installed to match the frame size ampere rating noted on the Electrical Drawings. All "SPACES" shall be ready for installation of overcurrent protective devices at a future time.
5. Shipping splits and provisions for future bus extension shall be provided with necessary bus splices.
6. Each switchboard shall contain a full length, bottom/front located ground bus which is securely connected to each vertical section. Ground bus shall be sized in accordance with UL891, Table 25.1.
7. Termination Lugs: Multi-barrel mechanical solderless connector with hex socket screws for use with aluminum/copper conductors.
8. Switchboards shall be fully rated for a value determined by the Short Circuit and Coordination Study.
9. Neutral bus shall be 100 percent rated unless otherwise shown on the drawings.
10. Main service switchboards:
    a. Removable neutral link: Provide removable bolted bus section for the purpose of disconnecting the ground circuit conductor from the premises wiring at the supply side of the service in accordance with NEC article 230-75.
    b. Main bonding jumper: Connection between the grounded circuit conductor and the equipment ground conductor at the supply side of the service. Size in accordance with NEC table 250-94 or 12-1/2% of the area of the largest phase conductor in accordance with NEC article 250-79(c).

C. Switching and overcurrent protective devices:

1. Main overcurrent protective devices shall be fixed mounted insulated case breaker with interrupting rating, and frame and trip ratings as shown on drawings.
2. Feeder overcurrent protective device(s) shall be fixed mounted molded case breaker with as shown on drawings.
3. Devices interrupting rating shall match that of switchboard for which the device is installed.

4. Devices shall be manually operated unless shunt trip and/or electrically operated devices are indicated on drawings.

D. Ground fault protection:

1. General: A solid-state, ground fault protection system shall be provided integral on the main device if indicated on drawings. It shall consist of integral phase current sensors, appropriate solid-state relaying equipment to provide the desired ground fault current sensitivity and time-current response characteristics. Provide neutral ground fault current transformer for four wire systems.
2. Device settings: Adjustable pickup current sensitivity for ground fault currents from 200 amperes to 1200 amperes shall be provided. A calibrated dial shall be provided for setting the current pickup point in the field. Time delay shall be adjustable from 0 to 60 cycles. Settings for individual relays shall be as directed by the short circuit/coordination study specified in Section 26 00 11: Power System Study. A locking screw shall be provided to retain both adjustments at desired setting.

E. Instrumentation and controls:

1. All internal devices (relays, transformers, etc.) shall be tagged as to rating and function with permanently fastened engraved nameplates.
2. Control and signal circuits: Control devices (contactors, relays, time clocks, etc.) shall be mounted in a separate compartment which is fully barriered from the overcurrent protective device compartments. Control devices shall be accessible through a separate hinged cover panel.

F. Refer to electrical drawings for the following:

1. Mounting style: voltage; terminal lug size, location and quantity; bus ampacity; interrupting capacity of bus and overcurrent protective devices, quantity, poles and rating of overcurrent protective devices. The AIC value for distribution equipment is the minimum rating of all components, values are in RMS symmetrical amps.
2. If shown on the electrical drawings, provide contactors, relays, time clocks, etc. mounted within switchboard.

G. Miscellaneous requirements:

1. Circuit numbering: Starting at the tope, odd numbered circuits in sequence down the left hand side and even numbered circuits down the right hand side.
2. Nameplates: Engraved nameplates shall be provided for each device and all “SPACES” located in the switchboard. An engraved nameplate shall also be provided indicating the switchboard designation. See Section 26 05 53: Electrical Identification for requirements.
3. All control wires shall be labeled with wire markers and referenced to the control wiring diagrams. Provide colored wires with colored stripes to facilitate trouble-shooting and locating both ends of wires. Do not use wires with all the same wire color. Use fork, crimp type terminations on all control wires.
4. Provide a test block and plugs for voltage and current monitoring at each main switch. Provide engraved legend plates to indicate function of each test point.
5. Vertically mounted mains shall have the operating handle in the up position when energized.

H. Finish:

1. Five step zinc phosphastizing pre-treatment, one coat of rust inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 60 (light gray).

2. A seven step spray wash, electroplate primer with final baked-on enamel finish, ANSI 61 (light gray) is an acceptable finish alternative.

PART 3 - EXECUTION

3.1 CLEARANCES

A. Minimum code required clearances around switchboard must be maintained.

3.2 INSTALLATION

A. Free-standing switchboards shall be accurately aligned, leveled and bolted in place on full-length channels securely fastened to concrete floor.

B. Switchboard shall be anchored and braced to withstand seismic forces.

3.3 MOUNTING HARDWARE

A. Provide all necessary blocking, channels and other hardware for securing switchboard to building structure.

* END OF SECTION 26 24 13 *

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS:

A. Refer to Drawings, General Conditions, Supplementary Conditions, and Division 01 General Requirements

1.2 DESCRIPTIONS

A. Work included in this Section: Panelboards.

B. Related work included in other Sections:

1. Basic Construction Materials and Methods: Section 26 05 33.
2. Grounding: Section 26 05 26.

1.3 INCORPORATED DOCUMENTS

A. Section 26 00 10, Electric General Requirements, applies to all work in this Section.

1.4 SUBMITTALS:

A. Manufacturer's literature describing the product and shop drawings showing dimensions, mounting method, trim, appearance, circuit breakers, sizes, bus ratings, lug arrangements, nameplates and finish.

PART 2 - PRODUCTS

2.1 GENERAL CLASSIFICATION

A. Panelboards shall be of the bolt-on circuit breaker type, complete with number of branch circuits indicated. Panels shall be labeled by Underwriters' Laboratories, Inc. and shall be manufactured by Square D. G.E. Cutler-Hammer, Westinghouse, Eaton, Siemens.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Cabinets shall be of code gauge galvanized sheet steel, have dead front assemblies, door in door trim and sized to provide a minimum wireway of four inches at the top, bottom and sides. All panelboards shall be keyed alike. Exposed portions of the panelboards shall be furnished with two (2) coats of dry enamel (ANSI 61) unless otherwise noted on the Drawings. Where flush cabinets are indicated, the maximum depth shall be 5 ¾". All latches shall be flush, no "T" flush or plastic pulls shall be approved.

B. Panel boards utilized on a 208/120 VAC distribution system shall contain neutral bus rating as indicated.

C. Refer to drawings for specific details of panelboards.

1. Busses shall be electrical grade copper, sized in accordance with the requirements of Underwriters' Laboratories, Inc.
2. Attach circuit breakers to bus in such a way that circuits 1, 3, and 5, or 2, 4, and 6; or any three similarly odd (or even) numbered circuits form one three-phase, four-wire circuit,
3. Provide all mounting and connection hardware for future breakers, identified on drawings as SPACES, or for the full length of usable bus.
4. Each panelboard shall be provided with a separate ground bus which is secured directly to the interior of the panelboard cabinet. This bus shall be constructed like the insulated neutral bus, but securely bonded to the enclosure.

D. CIRCUIT BREAKERS

1. Panel circuit breakers used to switch lighting circuit shall be of the "SWD" (Switching Duty Breaker) type.
2. Handle-ties shall be provided for all single pole circuit breakers which provide over-current protection to individual undergrounded conductors of multi-wire branch circuits.
3. Acceptable circuit breakers are Square D, General Electric and Cutler-Hammer, Eaton, Westinghouse.

E. Nameplate:

1. Provide engraved phenolic laminated nameplate on outside of each panel showing panel designation in minimum ¼" high letters on top line and voltage and phases in 5/32" high letters on second line.

F. Circuit Director:

1. Each branch circuit breaker shall have a permanently fixed identification number of metal or plastic attached beside it to the panel. A single circuit directory completely typewritten, mounted in metal frame and protected with a clear plastic cover, shall be provided on the interior face of the panel door. Directory shall list circuit number, load supplied and, if practical, the room number or area where the load is located. Turn over bound directories in Excel or Access format to owner, files segmented by floor and room.

PART 3 - EXECUTION

3.1 CLEARANCES

A. Maintain minimum code required clearances around panelboards.

3.2 MOUNTING HEIGHT

A. Mount panelboards with center of top circuit breaker handle no higher than 6'6" above finished floor. Mount flush mounted panelboards as indicated on architectural elevation drawings.

B. Panels shall be secured to the structure using screws, bolts or other threaded fasteners.

3.3 MOUNTING HARDWARE

A. AProvide necessary blocking, channels and other hardware needed to secure panelboards to walls, building columns of other parts of building structure. Fasten to the structure with bolts, or cap screws, or studs and nuts

* END OF SECTION 26 24 16 *

SECTION 26 24 19

DISTRIBUTION PANELS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary General Conditions and Division 01 General Requirements.

1.2 DESCRIPTION

A. Work included in this Section: distribution panels.

B. Related work included in other Sections:

1. Basic Construction Materials and Methods: Section 26 05 33.
2. Grounding: Section 26 05 26.

1.3 INCORPORATED DOCUMENTS

A. Section 26 00 10, Electrical General Provisions, applies to all work in this Section.

1.4 SUBMITTALS

A. Manufacturer's literature describing the product and shop drawings.

PART 2 - PRODUCTS

2.1 DISTRIBUTION PANELS

A. Distribution panels shall be metal enclosed dead-front, flush or surface mounted as indicated on the Drawings, general purpose circuit breaker type, conform to the applicable Standards of underwriters' Laboratories, Inc., be UL labeled, and shall be manufactured by the manufacturer of the service equipment.

B. Cabinet shall be of galvanized code gauge steel, hot rolled steel to standard dimensions with no knockouts. Wiring space shall be as required by Underwriters' Laboratories, Inc., but in no case shall any gutter be less than 6" wide unless specifically approved by the Engineer. Front trim shall be of stretcher leveled steel with door secured by concealed continuous hinges or continuous hinges and a combination spring catch lock, keyed the same as other panelboards. Finish for exposed section of the panel shall be two coats of ANSI 61, light gray enamel over a rust inhibitor.

C. Circuit breakers shall be bolt on and of the indicating type, providing On, Off, and Tripped positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position between On and Off. Multi-pole breakers shall be so designed that an overload on one pole caused all poles to open. The circuit breakers shall be quick-make and quick-break on manual, as well as automatic operation and have inverse time characteristics secured through the use of bi-metallic tripping elements supplemented by a magnetic trip element.

D. The panelboard interior shall be factory assembled, complete with circuit breakers or circuit breakers and motor starters as shown on Drawings. Interior shall be so designed and assembled so that any individual breaker or starter can be replaced without disturbing adjacent units, or revolving main bus or branch circuit connectors. Main busses, back pans and circuit breakers of distribution and power panelboards shall be of such a design that branch circuit sizes may be changed without additional machining, drilling, or tapping. Bus bars shall be copper and bolted to all connections. Bus bars capacity shall consist of sufficient cross sectional area to continuously conduct the rated full load current with the temperature rise limits as set forth in the NEMA standards.

PART 3 - EXECUTION

3.1 CLEARANCES

A. Minimum code required clearances around panelboards and distribution panel must be maintained.

3.2 MOUNTING HEIGHT

A. Mount panelboards with center of top circuit breaker handle no higher than 6’-0” above finished floor.

3.3 MOUNTING HARDWARE

A. Provide all necessary blocking, channels and other hardware for securing distribution panels to walls, building columns or other parts of building structure.

* END OF SECTION 26 24 19 *

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Wall switches.
2. Wall dimmer switches.
3. Receptacles.
4. Floor boxes.
5. Coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. Federal Specification (FS):
   - FS W-P-455A; Plate, Wall Electrical.
   - FS W-C-596; Electrical Power Connector, Plug, Receptacle and Cable Outlet.
   - FS W-S-896; Switch, Toggle.
2. National Electrical Manufacturer's Association (NEMA):
   - NEMA WD-1; General-Purpose Wiring Devices.
   - NEMA WD-5; Specific-Purpose Wiring Devices.
3. Underwriter's Laboratories (UL):
   - UL 20 General-Use Snap Switches.
   - UL 231; Power Outlets.
   - UL 310; Electrical Quick-Connect Terminals.
   - UL 498; Attachment Plugs and Receptacles.
   - UL 514A; Metallic Outlet Boxes.
   - UL 514D; Cover Plates for Flush-Mounted Wiring Devices.
   - UL 943; Ground-Fault Circuit-Interrupters.
   - UL 1681; Wiring Device Configurations.
   - UL 1682; Plugs, Receptacles and Cable Connectors of the Pin and Sleeve Type.
   - UL 1686; Pin and Sleeve Configurations.

1.3 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Switches, receptacles and coverplates:
   a. Hubbell.
   b. Pass & Seymour.
   c. Leviton.
2. Floor boxes:
   a. Hubbell.
   b. Walker.
   c. Or Equal.

B. Substitutions: Under provisions of Section 26 00 10: Basic Electrical Requirements.

2.2 WALL SWITCHES

A. Standards: Provide general-purpose 120/277 VAC switches that conform to NEMA WD-1 Specifications.

B. Color: Device color shall be as selected by the Architect, unless otherwise noted.

C. Wall switches:

1. Provide twenty ampere, 120/277 volt, Specification grade, toggle handle style, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with totally enclosed case.
2. Single pole, single throw switches: Hubbell #1221 series, Pass & Seymour #20AC1 series or Leviton #1221 series. or Hubbell #2121 series, Pass & Seymour #26021 series, or Leviton #5621-2 series or equal
3. Double pole, single throw switches: Hubbell #1222 series, Pass & Seymour #20AC2 series, Leviton #1222 series. or Hubbell #2122 series, Pass & Seymour #26022 series, Leviton #5622-2 series or equal.
4. Three way switches: Hubbell #1223 series, Pass & Seymour #20AC3 series, Leviton #1223 series. or Hubbell #2123 series, Pass & Seymour #26023 series, Leviton #5623-2 series or equal.
5. Four way switches: Hubbell #1224 series, Pass & Seymour #20AC4 series, Leviton #1224 series. or Hubbell #2124 series, Pass & Seymour #26024 series, Leviton #5624-2 series or equal.

2.3 WALL DIMMER SWITCHES

A. Standards: Provide dimmer switches 120 VAC that conforms to NEMA WD-2 and UL 20.

B. Color: Device color shall be ivorywhiteas selected by the Architect, unless otherwise noted.

C. Dimmers:

1. Linear slide type dimmer with smooth and continuous square law dimming curve.
2. Dimmers shall incorporate air-gap switch accessible by removing coverplate.
3. Furnish dimmer switches in ratings of 600 watts, 1000 watts and 1500 watts to accommodate lighting loads indicated connected to each switch on Drawings. Incorporate Manufacturer's derating where dimmers are ganged together.
4. Provide switches with single and multi-gang coverplate of high impact ABS plastic. Coverplate shall be snap-on type with no visible attachments or fins.

2.4 RECEPTACLES

A. Standards:

1. Provide general purpose 15 and 20 ampere, 125/250 VAC receptacles that conform to NEMA WD-1 Specifications. Specialty receptacles shall conform to NEMA WD-5 Specifications as applicable.
2. Provide NEMA 5-20R, specification as noted herein, 20 amp, 125 VAC, 2 pole, 3 wire grounding type receptacles.
3. Receptacles shall be the standard conventional style device.

B. Color:

1. Device color shall be as selected by the Architect, unless otherwise noted.

C. General purpose single outlets:

1. Provide self-grounding back and side wired with binding head staked terminal screw.
2. Use Hubbell #5361 series, Pass & Seymour #5361 series Leviton #5361 series. Hubbell #2161 series, Pass & Seymour #26361 series Leviton #16351 series or equal.

D. General purpose duplex receptacles:

1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
2. Use Hubbell #5362 series, Pass & Seymour #5362 series, Leviton #5362 series. or Hubbell #2162 series, Pass & Seymour #26362 series, Leviton #16352 series or equal.

E. Ground fault circuit interrupting (GFCI) receptacles:

1. Provide 20 amp, 125 VAC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5 milli-amp line-to-ground fault current in approximately 1/40th of a second.
2. Provide visual device with trip indication, manual reset and test mechanisms and with point of use and multi-outlet protection.

F. Special purpose receptacles: Provide Specification grade devices with the NEMA configuration, voltage and current rating, number of poles and ground provisions as noted on the Drawings.

2.5 COVERPLATES

A. General:

1. Provide all coverplates with rounded edges and corners, smooth and free of grooves, embossing or other embellishment.
2. Provide mounting screws to match the plate finish.
3. Provide gang type coverplates where two or more devices are installed at one location. Individual gangable coverplates are not acceptable.
4. Provide plates of one design, standard conventional style, throughout the Project unless otherwise specified.

B. Color: Coverplate color shall be as specified by the Architect, unless otherwise noted.

C. Plastic coverplates:

1. Provide smooth, high impact, self-extinguishing thermoplastic coverplates and 0.100 inches thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.

D. Metal coverplates:

1. Provide smooth, type 430 stainless steel coverplates, 0.035" thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.
3. Provide removable plastic film to protect coverplates during installation. Remove film at time of final acceptance.

E. Weatherproof coverplates:

1. Non-public areas:
   a. Provide, weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, vertically self-closing covers suitable for use in damp and wet locations. Covers shall allow the use of the device with the cover closed.
   b. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.
2. Public area receptacles:
   a. Provide weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, lockable, vertically self-closing covers suitable for use in damp and wet locations. Covers shall allow the use of the device with the cover closed.
   b. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wiring device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Coordinate device heights in vending, kitchen and utility areas with benches and counters.

B. Coordinate switch mounting location with Architectural details. Unless otherwise noted, locate switches on latch side of door.

3.3 INSTALLATION

A. Install wiring devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Install devices with the vertical centerline plumb and with all edges of the device flush against the adjacent wall surfaces.

C. Mount switches at 42 inches above finished floor unless otherwise noted. By architect.

D. Mount receptacles vertically with the centerline 18 inches above finished floor and with grounding slot at bottom.

E. Mount receptacles or vertically when mounting above counters, or as indicated by architect.

F. Mount GFCI receptacles above counters in bathrooms and at counters within 6'-0" of sinks, whether indicated as GFCI type or not.

G. Derate ganged dimmer switches as instructed by Manufacturer. Do not use common neutrals in dimmer circuits.

H. Provide coverplates for all outlet boxes, switches, receptacles, etc.

I. Install blank coverplates on all outlet boxes in which no device is required or installed.

J. Provide coverplates that completely cover wall opening and seat against wall.

3.4 FLOOR MOUNTED SERVICE BOXES

A. Installation:

1. Install floor boxes to be level or within 1/16" below screed line.
2. Make conduit connections and anchor box to sub-flooring.
3. Core drill hole in floor (core sized based on Manufacturer's installation instructions) for insert of poke-through device.
4. Make conduit connection to poke-through box from floor below.

B. Coordination: Contractor shall mark the location of all floor boxes with paint prior to installation or core drilling for review and approval by Architect.

3.5 FIELD QUALITY CONTROL

A. Electrical testing:

1. Test proper polarity of all receptacles.

2. Test ground continuity of all wiring devices.
3. Test ground fault interrupting device operation.

B. Visual and mechanical inspection:

1. Check proper operation of all switches.
2. Visually inspect and replace damaged or defective devices.

3.6 CLEANING

A. Clean interior of all boxes from dirt and paint prior to installation of devices.

B. Clean wiring devices and coverplates from dirt and paint over spray.

* END SECTION 26 27 26 *

SECTION 26 28 19

DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the Drawings, General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 DESCRIPTION

A. Disconnect switches

B. Fuses.

C. Enclosures

1.3 REFERENCES

A. American National Standards Institute (ANSI)/Underwriters' Laboratories, Inc. (UL) 198C High Interrupting Capacity Fuses; Current Limiting Types

B. ANSI/UL 198E Class R Fuses.

C. FS W-F-870 Fuseholders (For Plug and Enclosed Cartridge Fuses).

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Acceptable Manufacturers

1. Square D
2. General Electric
3. Cutler-Hammer

B. Fusible Switch Assemblies: National Electrical Manufacturers' Association (NEMA) KS1, quick make, quick break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in "ON" position. Handle lockable in "OFF" position. Fuse clips shall be designed to accommodate Class R fuses.

C. Non-Fusible Switch Assemblies: NEMA KS1, Type HD, quick make, quick break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch on "ON" position. Handle lockable in "OFF" position.

D. Enclosures: NEMA KS1, Type 1, unless otherwise indicated on drawings.

2.2 FUSES

A. Acceptable Manufacturers

1. Bussman
2. Gould-Shawmut
3. Littlefuse

B. Fuses 600 Amperes and Less: Dual element, current limiting, time delayed, one time fuse, 600-volt.

C. Interrupting Rating: As required.

PART 3 - EXECUTION

3.1 3INSTALLATION

A. Install disconnect switches where indicated on drawings.

B. Install fuses in fusible disconnect switches.

* END OF SECTION 26 28 19 *

SECTION 26 29 00

MOTOR CONTROL

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS:

A. Refer to the drawings, General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 DESCRIPTIONS:

A. Manual motor starters

B. Magnetic motor starters

C. Combination magnetic motor starters

D. Motor control centers

1.3 REFERENCES:

A. American National Standards Institute (ANSI)/National Electrical Manufacturer's Association (NEMA) ICS6 Enclosures for Industrial Controls and Systems.

B. ANSI/Institute of Electrical and Electronics Engineers (IEEE) 344 Recommended Practices for Seismic Qualifications of Class 1E Equipment for Nuclear Power Generating Stations.

C. FS W-F-375 Circuit Breakers, Molded Case; Branch Circuit and Service.

D. NEMA AB1 Molded Case Circuit Breakers.

E. NEMA ICS2 Industrial Control Devices, Controllers and Assemblies

F. NEMA PB1.1 Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 30 00.

B. Indicate on Shop Drawings:

1. Front and side views of motor control center enclosures with overall dimensions.
2. Conduit entrance locations and requirements, nameplate legends, and size and number of bus bars per phase and ground.
3. Electrical characteristics including voltage, frame size, and trip ratings.
4. Withstand ratings.

5. Time current curves of all equipment and components.

C. Provide product data on motor starters and combination motor starters, relays, pilot devices and switching and over current protective devices.

D. Submit manufacturer's instructions under provisions of Section 01 30 00.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 70 00.

B. Include spare parts data listing, source and current prices of replacement parts and supplies, and recommended maintenance procedures and intervals.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.

B. Deliver in 60 inches maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

C. Store and protect products under provisions of Section 01 60 00.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure and finish.

PART 2 - PRODUCTS

2.1 MANUAL MOTOR STARTERS:

A. Acceptable Manufacturers

1. Square D
2. Cutler Hammer
3. General Electric or equal.

B. Fractional Horsepower Manual Starter: Per NEMA ICS 2, AC general purpose Class A, manually operated, single pole, full voltage controller for fractional horsepower induction motors with thermal overload unit, green pilot light, NO auxiliary contact and toggle operator.

C. Motor Starting Switch: Per NEMA ICS2, AC general purpose, Class A manually operated, single pole, full voltage controller for fractional horsepower induction motors without thermal overload unit, red pilot light of neon or LED type. NC auxiliary contact and push button operator.

D. Enclosure: Per ANSI/NEMA ICS6, Type 1.

2.2 MAGNETIC MOTOR STARTERS:

A. Acceptable Manufacturers:

1. Square D
2. Cutler Hammer
3. General Electric or equal.

B. Magnetic Motor Starters: Per NEMA ICS2, AC general purpose, Class A magnetic controller for induction motors rated in horsepower.

C. Full Voltage Starting: Nonreversing type.

D. Coil Operating voltage: 120-volt, 60-Hertz

E. Size: Per NEMA ICS2, size as shown on drawings.

F. Overhead Relay, Per NEMA ICS2, melting allow.

G. Enclose Per NEMA ICS2, Type1, unless otherwise indicated on the drawings.

H. Combination Motor Starters; combine motor starters with motor circuit protector disconnect in common enclosure.

I. Auxiliary Contacts: Per NEMA ICS2, two normally opened and two normally closed contacts in addition to seal-in contact.

J. Selector Switchers: Per NEMA ICS2, HAND/OFF/AUTO in front cover.

K. Indicating Lights, Per NEMA ICS2, RUN in green on front cover. Neon or LED type.

L. Control Power Transformers: 120-volt secondary, 50 VA minimum in each motor starter.

M. All motors 25 HP and operator shall have a CT remote load monitoring by the building management system output shall fully integrate with BMS.

2.3 CONTROLLER OVERCURRENT PROTECTION

A. Motor Circuit Protector: Per NEMA AB1, circuit breakers with integral instantaneous magnetic trip in each pole.

2.4 MOTOR CONTROL CENTER – IF REQUIRED:

A. Acceptable Manufacturers:

1. Square D
2. Cutler Hammer
3. General Electric or equal.

B. Motor Control Centers, Per NEMA ICS2, Class I, Type B

C. Motor Starts as scheduled

D. Voltage Rating, 480 volt, 3 phase, 3 wire, 60 hertz or as required.

E. Horizontal Bussing: Copper with a continuous current rating of 600 amperes. Include copper ground bus entire length of control center.

F. Vertical Bussing: Per NEMA ICS2, copper.

G. Integrated equipment Short Circuit Rating: At 22,000 amperes rms symmetrical at 480 volts.

H. Configuration: Units front mounting only, accessible from the front only.

I. Enclosure Per ANSI/NEMA ICS6, Type1.

J. Finish: Manufacturer's standard gray enamel.

K. Control Transformer: Provide control transformer in motor control center to provide 120-volt control source for all motor starters in control center

L. Seismic Requirements: Per ANSI/IEEE 344, Class 1. All seismic bracing shall be reviewed and approved by a structural engineer registered in the State of California.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify surfaces are ready to receive work.

B. Verify field measurements are as shown on drawings.

3.2 PREPARATION:

A. Install motor control equipment in accordance with manufacturer's instructions.

B. Select and install heater elements in motor starters to match installed motor characteristics.

C. Motor Data: Provide neatly typed label inside each motor starter enclosure identifying motor served, nameplated horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

* END OF SECTION 26 29 00 *

SECTION 26 51 00

LIGHTING

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS:

A. Refer to Drawings, General Conditions, Supplementary Conditions, and Division 01 General Requirements

1.2 DESCRIPTIONS

A. Work included in this Section:

1. Lighting fixtures and installation.

B. Related work included in other Sections:

1. Basic Construction Materials and Methods: Section 26 05 33.
2. Grounding: Section 26 05 26.

1.3 RELATED WORK

A. Section 26 00 10, Electric General Requirements, applies to all work in this Section.

1.4 SUBMITTALS:

A. Shop drawings and/or manufacturer's literature describing product components, sizes, shapes, finishes, methods of attachment to structure, electrical power requirements, cable assemblies, lamps.

B. Photometric test data by an independent testing laboratory when requested.

C. Layout drawings showing locations of tee-bar ceiling mounted fixtures and locations of cable assemblies and sizes and numbers of cable assemblies.

PART 2 - PRODUCTS

2.1 GENERAL

A. Fixtures shall be complete, including lamp and ready for service and shall bear the label of Underwriters' Laboratories, Inc. Fixtures shall be wired in accordance with the manufacturer's recommendations and Owner requirements and shall be hung earthquake-resistant in accordance with the State of California Title 24, Basic Electrical Regulations.

B. Incandescent lamps shall be energy saving wattage rating and rated at 130 volts line voltage.

C. Fluorescent ballasts shall be electronic with high power factor and an average light output rating of 95% or greater and 20% (or less) total harmonic current generation and zero audible sound output. "A" or better sound rating. Ballast output current frequency shall be 25 KH to 50 KH and bear the CBM emblem or approval indicating CMB certification of performance by ETL, and shall be labeled by Underwriters' Laboratories, Inc. and conform with ANSI C82.11-1993, Motorola or equal.

D. All fluorescent lamps shall be energy saving type, 3500K, CRI 75 wattages as given in fixture sequence.

E. Fluorescent fixtures shall be designed for 40^0 ambient.

F. Recessed fixtures in suspended ceilings shall be supported from structure by wires at diagonal corners and on four foot centers along row of fixtures, and two diagonal wires at 45^0 on four foot centers for lateral bracing. Wire shall be same size as ceiling support, #12 gauge minimum.

G. Exact location of fixtures shall be coordinated with the Architect during construction.

H. Lighting fixtures shall comply with National Electrical Code, Article 410.

I. Recessed fixtures mounted in gypsum board ceilings shall be equipped with plaster rings and gaskets as required. Check room finish schedule on Architectural Drawings.

J. Fixtures which are exposed to weather shall be weatherproof and shall have 0^0 ballasts when applicable.

K. Flexible conduit connections between J-boxes and recessed fluorescent fixtures in T-bar ceiling areas shall be not greater than six feet long.

L. Locate lighting fixtures in mechanical rooms to clear all duct work, piping, etc.

M. Each lighting fixture shall be grounded with a green insulated copper wire which extends from the panel ground bus to fixture body via branch circuit raceways and fixture channels. Ground wire shall be sized in accordance with Code, minimum size #12. This ground wire may not be shown on the Plans.

N. Recessed fixtures shall be complete with appropriate mounting devices and trim. Check room finish schedule on Architectural Drawings for exact details prior to ordering fixtures.

O. In areas which require fire rated ceilings or walls, the Contractor shall provide continuous fire rating construction behind all recessed fixtures.

P. Fluorescent fixtures shall be aligned and bolted together with two (2) ¼" bolts.

Q. Where a fixture containing a ballast is to be surface mounted on combustible low-density cellulose fiberboard, it shall:

1. Be approved for this condition, OR
2. Be installed as detailed on the Drawings, with sheetrock backing, or spacers as directed.

R. Fluorescent fixtures wired for step switching shall be pre-wired by the manufacturer. Four (4) lamp fixtures for 50% and 100% step switching shall be wired with the two (2) center lamps on one ballast and the two (2) outer lamps on the other ballast. Three (3) lamp fixtures for 33%, 66% and 100% step switching shall be wired with the center lamp on one ballast and the outer two (2) lamps on the other ballast.

S. Where two 1-lamp or two 3-lamp fluorescent fixtures are located in the same room, they shall be Tandem wired so that one ballast operates one lamp in one fixture and one lamp in the adjacent fixture. Where Tandem wiring is indicated on the Drawings, a master and slave fixture shall be provided. For 3-lamp fixtures, the master fixture shall contain two-two lamp ballasts and the slave fixture shall contain one-two lamp ballast. Tandem master/slave wired fixtures shall be interconnected by a flexible conduit/wire assembly with required conductors. Each end of the flexible conduit shall be provided with a plug and each fixture shall be provided with a receptacle. The flexible conduit with conductors and plug shall be provided by the wiring system manufacturer and shall be U.L. listed.

T. Open tube fluorescent lighting fixtures shall be provided with lamp retaining clips to secure lamps in place. Clips shall be McGill Cat. No. 175, 176 or 180 as required, or approved equal. (MCGill Mfg. Co., Inc. Electrical Division, Valparaiso, Indiana 46383. Phone: (219) 465-2279).

U. The exact location, height and/or stem length of fixtures shall be determined finally by the Structural and Mechanical limitations of the building. The Contractor shall work with the Architect to avoid obstructions and to insure that proper illumination results.

V. Type and finish of fixtures shall be submitted to and approved by the Electrical Engineer/Owner and Architect prior to being ordered.

2.2 HIGH DENSITY DISCHARGE (HID) BALLAST

A. Description: ANSI C82.4, metal halide lamp ballast.

B. Provide ballast suitable for lamp specified.

C. Voltage: Match luminaire voltage.

2.3 LAMPS

A. Reflector Lamp Beam Patterns: ANSI C78.379

B. High Density Discharge (HID) Lamps:

1. General
   a. Refer to the Fixture Schedule for type, size and finish of HID lamps as required.
   b. Use the same manufacturer for all HID lamps.
   c. Use self-extinguishing type HID lamps in open bottom downlight fixtures.
2. Metal Halide:
   a. Color correlated temperature: 3200 degree K.
   b. . Minimum CRI: 70.
3. High Pressure Sodium: General Electrical “Lucalox” or equivalent.

PART 3 - EXECUTION

3.1 FIXTURE INSTALLATION

A. Mount outlets to be readily accessible and at positions and heights to clear ductwork, piping, etc.

1. Coordinate with work of all other trades.

B. Fixture Structural Support:

1. Set true, free of light leaks, warps, dents or other irregulations.
2. Adjust length of stems of suspended luminaries as required to hang all adjacent luminaries level and in same horizontal plane.
3. Mount fixtures at heights shown on Drawings.
4. Obtain structural Engineer's design for support of all lighting fixtures weighing 50 lbs. or more and conform with UBC requirement for Earthquakes (seismic analysis).
5. Conform with UBC Standards, Section 47.1813.

C. Cleaning: Leave fixtures clean, free of fingerprints, exterior labels, etc., especially on lenses and reflectors at owner's occupancy.

D. Wiring:

1. Protect wiring with tape or tubing at all points where abrasion is likely to occur.
2. Install branch circuit wiring only in fluorescent fixtures UL approved for use as raceways.

E. Lay in ceiling fixtures in suspended ceilings shall be independently supported by UBC Standard Section 47.1813. Do not use suspended ceiling support wires. Contractor shall use 72 inch flexible wiring from J-box (mounted to structure above ceiling) to lay in fixtures.

3.2 LAMPS

A. Provide all new lamps delivered to project in original manufacturer's cartons. Factory prelamped fluorescent fixtures are approved for use. Clean fixtures and replace damaged faulty lamps and equipment to provide proper operation not less than 21 days prior to substantial completion. Lamps shall be subjected to 21 day continuous burn-in at not less than 21 on/off cycles.

3.3 FIXTURES MOUNTED ADJACENT TO INSULATION

A. Provide barrier to prevent insulation from coming in contact with fixture, unless fixture is approved for installation in contact with such insulation. Option: Coordinate with General Contractor for provision of barriers by others.

3.4 FIRE RATED STRUCTURE

A. Coordinate with installer of suspended ceiling, fire rated wall, etc., such that electrical work does not compromise the fire rating. Provide "tents" over light fixtures in ceilings unless these are provided by ceiling installer.

3.5 SPACERS

A. Provide as required by code and as recommended by manufacturer.

3.6 EMERGENCY (PATHWAY) AND NIGHT LIGHTS CIRCUITRY

A. Provide unswitched (or switch accessible to authorized staff as indicated on Drawing) circuit.

3.7 FLUORESCENT EMERGENCY BALLASTS

A. Provide/fluorescent emergency ballasts in all fixtures on emergency circuits and fixtures on split normal/emergency circuits. Exceptions as notes on Drawings.

* END OF SECTION 26 51 00 *

SECTION 27 05 28

REQUIREMENTS FOR OTHER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. General: Provide electrical labor and materials for other equipment, complete, and fully operational for the following:

1. Telephone outlets
2. Data outlets
3. Mechanical systems
4. Energy Management Systems (EMS)

B. Reference University of California CDS Standards Division 16-6 through 16-9.

C. Obtain and verify electrical requirements and location of specified equipment prior to installation of related electrical work.

1.2 RELATED WORK

A. The requirements of Section 26 00 10 Electrical General Provisions apply to all work in this section.

B. The requirements of Section 26 05 33 Basic Electrical Materials and Methods apply to all work in this section.

PART 2 - PRODUCTS

2.1 TELECOM OUTLETS:

A. Per UCB – CDS Standards

2.2 DATA OUTLETS:

A. Per UCB – CDS Standards

PART 3 - EXECUTION

3.1 TELEPHONE OUTLETS

A. Provide pull strings, outlet boxes, with rings, and other material as required, ready for installation of conductors, instruments, and connector.

B. Conductors, instruments, coverplates, and connectors are not a requirement of these Specifications.

C. Conduit System: 1.25" conduit stub to accessible ceiling only

1. Maximum of two 90-degree bends in conduit between outlet or pull boxes. Provide additional pull boxes as required.
2. Pull chord: provide in all empty conduits (where required).

D. Plywood backboards as shown to be provided by the General Contractor : Use exterior grade. Mount ¾" fire retardant, knot free, AC grade plywood sheets with stamp on A side. Mount between 6" AFF to a minimum of 8'-6" above floor. Provide an additional 2 feet of plywood starting at 8'-6" if cable management equipment is braced by the wall above 8'-6" wall line. Mask fire rating stamps before painting. Paint plywood backboards with two coats of low-gloss white fire retardant paint.

E. Outlet boxes: Minimum 5 inch square 2-7/8 inch deep double gang box with single gang plaster flange for gypsum wall installation.

3.2 DATA OUTLETS:

A. Provide pull strings, outlet boxes, switch rings, and other material as required, ready for installation of conductors, instruments and connectors.

B. Conductors, instruments, coverplates, and connectors are not a requirement of these Specifications.

C. Conduit System: 1.25" conduit stub to accessible ceiling only

1. Maximum of two 90-degree bends in conduit between outlet or pull boxes. Provide additional pull boxes as required.
2. Pull chord: provide in all empty conduits (where required).

D. Plywood backboards as shown to be provided by the General Contractor : Use exterior grade. Mount ¾" fire retardant, knot free, AC grade plywood sheets with stamp on A side. Mount between 6" AFF to a minimum of 8'-6" above floor. Provide an additional 2 feet of plywood starting at 8'-6" if cable management equipment is braced by the wall above 8'-6" wall line. Mask fire rating stamps before painting. Paint plywood backboards with two coats of low-gloss white fire retardant paint.

E. Outlet boxes: Minimum 5 inch square 2-7/8 inch deep double gang box with single gang plaster flange for gypsum wall installation.

3.3 MECHANICAL SYSTEMS

A. Provide disconnect switches, and control voltage sources where not supplied as part of packaged unit as noted on electrical plans (furnished by mechanical).

B. Provide branch circuit conduit and wiring complete.

C. Provide 120 volt power to all control panels.

D. Sprinkler system:

1. Install and connect fire alarm wiring to flow and tamper switches.
2. Install and connect pre-action panels.

E. Duct Detectors:

1. Installed by Division 25.
2. Wiring and connections by this Division.

* END OF SECTION 27 05 28 *

SECTION 31 00 00
EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED WORK

A. Consult all other Specification sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete operational installation:

1. Waterproofing: 07 1355 and 07 2316
2. Storm Drainage: 33 4000
3. Trenching Excavation and Backfilling: 31 2333

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. C33: Concrete Aggregates.

B. California Administrative Code, Title 24, Part 2 - Basic Building Regulations, Chapter 24 - Excavations, Foundations, and Retaining Walls.

C. California Department of Transportation (CDT):

1. Standard Specifications: Sections 17 and 19, 26 and 68.

E. Geotechnical Report:

1. Geotechnical Investigation report (Draft), prepared by A3GEO. Dated August 30, 2013.

D. CAL/OSHA, Title 8.

1.4 SITE CONDITIONS

A. General:

1. The Contractor shall so conduct his operations and schedule his cleanup so as to cause the least possible obstruction and inconvenience to public traffic, pedestrians, and adjacent landowners.
2. Protect open excavations, trenches, and the like with fences, covers, and railings as required to maintain safe pedestrian and vehicular traffic passage.

3. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

4. The Contractor shall protect existing trees not designated for removal from injury or damage during grading operations by use of fences or other protective measures as required per Section 31 1100: Clearing and Grubbing.

5. Fill material shall be temporarily stockpiled in an orderly and safe manner in a location approved by the Owner.

6. All bench marks, monuments, signs, and other reference points shall be maintained; if disturbed or destroyed, they shall be replaced by the Contractor as directed by the Construction Manager or the Engineer.

7. Earthwork operations shall be conducted so as to prevent windblown dust and dirt from interfering with the surrounding normal operations. Contractor shall assume liability for all claims related to windblown dust and dirt. Water shall be applied in conformance with applicable provisions of Section 17 of the CDT Standard Specifications and with Section 1590 (e) of CAL/OSHA, Title 8.

8. Existing irrigation lines to be abandoned shall be capped as directed by the Construction Manager. All hose bibs, valves and sprinkler heads removed from the project area prior to commencement of construction shall be salvaged in accordance with Section 31 1100: Clearing and Grubbing.

9. In the event irrigation lines are discovered passing through project area to other areas of the campus, lines shall be rerouted and maintained in operations during construction as directed by the Construction Manager.

B. Environmental Requirements: When unfavorable weather conditions necessitate interrupting filling and grading operations, areas shall be prepared by compaction of surface and grading to avoid collection of water. Adequate temporary drainage shall be provided to prevent erosion. After interruption, compaction specified in last layer shall be reestablished before resuming work.

1.5 SUBMITTAL

A. Imported Materials: Samples of all proposed imported materials, minimum 40 pounds, tagged with source location and supplier shall be submitted to the Geotechnical Engineer of Record at least 15 days prior to import. Materials shall not be imported to jobsite without written approval by the Geotechnical Engineer of Record.

PART 2- PRODUCTS

2.1 FILL AND BACKFILL MATERIALS

A. General Fill: General fill should have an organic content of less than 3 percent by volume and should not contain environmental contaminants or rocks or lumps larger than 6 inches in the greatest direction. On-site materials may be used if they meet or can be processed (by sorting and/or crushing) to meet the above requirements. General fill may be used anywhere except where non-expansive fill is required.

B. Non-Expansive Fill: Non-Expansive Fill should conform to the requirements of General Fill, have a Plasticity Index no greater than 15 and Liquid Limit no greater than 40. Non-Expansive Fill should be used under concrete slabs and grade beams less than 36 inches below grade. Caltrans Class 2 aggregate base meets the requirements of Non-Expansive Fill.

C. Imported Fill: Imported Fill should conform to the requirements for Non-Expansive Fill and should be evaluated by the Geotechnical Engineer of Record and the project environmental consultant prior to its importation to the site.

D. Backfill Material Requirements-Retaining Walls: Backfill material for use behind building walls shall be either Class II Aggregate base per Section 26 of Caltrans Standard Specifications or non-expansive soil as defined in this section if a prefabricated drainage panel and a perforated pipe collector is used.(see section 33 4000 storm drainage for perforated pipe spec.) As an alternative to the drainage panel, a 12 inch wide section of open graded drain rock encapsulated in filter fabric shall be placed against the wall extending from the bottom of the wall to within 2 feet of the final subgrade. The perforated collector pipe will also be used with the permeable base material.

2.2 GEOTEXTILE FABRIC

A. Geotextile fabric used for soil stabilization shall be Mirafi 140N or approved equal.

2.3 SOIL STERILANT

A. Soil Sterilant shall be non-migrating with Treflan E.C. or equal.

PART 3- EXECUTION

3.1 PREPARATION

A. Paved Areas: Existing pavement shall be wedgecut (5-foot minimum width) at pavement conforms.

3.2 EXCAVATION

A. General:

1. All supports, shoring, and sheet piling required for the sides of excavations or for protection of adjacent existing improvements shall be provided and maintained by the Contractor. The adequacy of such systems shall be the complete responsibility of the Contractor.

2. Earth and rock, regardless of character and subsurface conditions, shall be excavated to depths shown on drawings and to the neat dimensions of the footings wherever practicable, to permit pouring of footings and grade beams without use of sideforms, except at slab perimeters.

3. Large rocks, pieces of concrete or other obstructions, if encountered during the excavationscarifying operations, shall be removed and disposed of as specified under Section 31 11 00: Clearing and Grubbing.

4. Where footing excavation is too deep, backfill shall be lean concrete. Where footing are overdug laterally, sideforms shall be employed for backfill with approved soil or lean concrete backfill shall be used (Contractor's option).

5. Where forming is required, only that excavation necessary to permit placing and removal of forms shall be done.

6. Bottoms of all footings and foundation trenches shall be subject to review by the Geotechnical Engineer of Record before rebar placement and again immediately prior to concrete placement. Refer to page 6-1 of our Geotechnical Report. Corrective measures as directed by the Geotechnical Engineer of Record shall be executed promptly.

B. Building Wall Excavation: Side slope angle of repose shall not exceed a 1:1.5 vertical-to-horizontal ratio or shall be shored vertically unless approved by the Geotechnical Engineer of Record.

C. Removal of Excess Excavated Material: Excess material shall be removed by the Contractor to an off-campus site in a legal manner.

D. Dewatering:

1. Dewatering equipment necessary to drain and keep excavations free of water under all circumstances shall be provided, operated, and removed by the Contractor.

2. Contractor shall obtain Geotechnical Engineer of Record 's approval of proposed method of dewatering.

3. Surface water shall be prevented from flowing into excavation. Accumulated water shall be promptly removed.

4. Dewatering system shall be maintained in place until construction work below groundwater is completed.

3.3 GRADING

A. General:

1. All areas covered by the project, including excavated and filled areas and adjacent transition areas, shall be uniformly graded so that finished surfaces are at the elevations established by the plans. Planter areas to receive future topsoil shall be graded to 6" below finished grade to allow for such material.

2. Finished surfaces and surfaces to receive paving and aggregate base shall be smooth, compacted, and free from irregular surface drainage and shall not vary more than 0.10' from the established grade.

3. Ditches, gutters, and swales shall be finished to permit proper surface drainage.

3.4 SOIL STERILIZATION

A. General: Soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base as recommended by the manufacturer. Sterilant shall be applied uniformly at the rate recommended by the manufacturer to all areas beneath asphalt concrete pavement, brick pavement, concrete pavement, or on-grade concrete slabs including sidewalks, curbs, and gutters. In addition to ground areas treated, sterilant shall be applied below expansion or control joints, and at all areas where pipe, ducts, or other features penetrate slabs.

3.5 SUBGRADE PREPARATION

A. Subgrade preparation is required under all paved areas, curbs, gutters, walks or structures (5 ft. minimum beyond building footprint.

B. The surface shall be plowed or scarified to a depth of at least 6" below the final subgrade elevation except

where bedrock is exposed. The earth shall be brought to a finely divided condition by harrowing, dry rolling and breaking clods. All boulders, hard ribs or solid rock encountered shall be removed. The earth shall be uniform for a full depth and width of subgrade. The subgrade material shall be moisture conditioned to near optimum moisture content and compacted to a minimum of 90% relative compaction (ASTM D1557) per the geotechnical report.

C. If stabilization of the subgrade is required, then the recommendations of the geotechnical engineer shall be followed.

3.6 FILLING

A. General:

1. The placement of fills shall be done under the supervision of the Geotechnical Engineer of Record.

2. Jetting shall not be permitted.

3. All areas to receive fills shall be scarified to a depth of 6" and uniformly moisture conditioned as required to obtain the required compaction. Where slopes exceed 1 vertical to 4 horizontal, subgrade shall be plowed, stepped, or benched in such a manner that fills will bond with base material.

4. Fill material shall be spread in uniform lifts of not more than 8" in uncompacted thickness. Prior to commencing compaction, fills shall be brought to a uniform water content that will permit proper compaction by either aerating the material if it is too wet, or spraying the material with water if it is too dry. Each lift shall be thoroughly mixed before compaction to assure uniform distribution of water content. All fills shall be brought to suitable elevations above grade to provide for anticipated settlement and shrinkage thereof. Moisture conditioning and compaction (per ASTM Test Methods) is as follows:

   - General fill that is predominantly cohesive, >15% passing #200 sieve, should be moisture conditioned to be between 3%-5% over optimum moisture content and compacted to at least 90% relative compaction

   - General fill that is predominantly granular, <15% passing #200 sieve, should be moisture conditioned to be near optimum moisture content and compacted to at least 95% relative compaction

   - Select Non-expansive fill should be moisture conditioned to be near optimum moisture content and compacted to at least 95% relative compaction

5. Fill shall not be dropped on any structure. Backfill shall not be placed around, against, or upon any concrete or masonry structure until structure has attained sufficient strength to withstand the loads imposed and the horizontal structural system has been installed.

6. Within the exterior walls of buildings, utility trenches shall be backfilled using Caltrans Class 2 aggregate base complying with ASTM C33, installed in 6-inch lifts and mechanically tamped to achieve 95% relative compaction (ASTM D1557).

B. Building Walls Backfill:

1. Backfill shall not be placed against building walls until 28 days after slabs have been poured.

2. On the exterior, the top 2 feet of backfill shall be completed with approved silty-clayey (Cap) excavated material compacted to 95% relative compaction under paving and to 85% relative compaction at planting areas.

3. Wall backfill material shall be per 2.1.B of this specification. The material shall be placed in no greater than 8 inch lifts of uncompacted thickness, moisture-conditioned to near optimum moisture content of the material and compacted to 90% relative compaction (ASTM 1557)."

C. Slab-on-Grade Subgrade:

1. The slab subgrade shall bear on firm native soil or engineered fill or clean weathered rock. Remove all loose material. Prepare subgrade per 3.5 Subgrade Preparation, per this specification section

2. Waterproof Impervious Membrane shall be in accordance with Section 07 1300.

3.7 COMPACTION AND TESTING

A. General:

1. All compaction testing shall be in accordance with Section 31 23 33 Trenching and Backfilling.

2. Each layer of fill and scarified subgrade for all retaining walls, buildings and pavement areas shall be compacted to not less than 95% relative compaction (ASTM D1557). Compaction shall extend not less than 5' beyond building lines and pavement edges (including shoulders).

3. Where fill is required and no immediate or future construction is planned (such as planting areas), each layer of fill and scarified subgrade shall be compacted to not less than 85% maximum density.

4. All compaction shall be performed using compacting rollers, pneumatic or vibrator compactors, or other equipment and mechanical methods approved by the Geotechnical Engineer of Record.

3.8 FIELD QUALITY CONTROL

A. All excavation, filling, and compaction shall be performed under the direct observation of the Geotechnical Engineer of Record. The Contractor shall cooperate with the Geotechnical Engineer of Record in all aspects of the work. Any materials placed or improvements constructed in the absence of the Geotechnical Engineer of Record's approval to proceed shall be presumed to be defective and, at the discretion of the Geotechnical Engineer of Record shall be removed and replaced at no cost to the Owner. The Geotechnical Engineer of Record shall be notified at least 48 hours prior to required observation or testing.

B. Embankments shall be maintained to the grades shown on the plans until completion and acceptance of the Contract. Suitable allowance for shrinkage shall be provided for by the Contractor.

C. The Contractor shall be responsible for the stability of all constructed embankments, and shall replace any portion which, in the Geotechnical Engineer of Record's opinion, has been displaced due to the Contractor's negligence.

D. Finish soil grade tolerance at the completion of grading:

1. Building and paved areas: +0 to -0.10 feet.

2. Other areas: ±0.10 feet.

END OF SECTION 31 00 00

SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED WORK

A. Section 01 56 39 Plant Protection

B. Section 31 00 00 Earthwork

1.3 REFERENCES

A. California Department of Transportation (CDT):

1. Standard Specifications: Sections 16 and 52.

B. National Arborists Association:

1. Pruning Standards and Practices.

1.4 SITE CONDITIONS

A. General:

1. Clearing work shall not begin until temporary fences, barricades, warning signs and other pedestrian control devices are installed.

2. All trees, plants, utilities and existing improvements that are not to be removed shall be protected from injury or damage resulting from the Contractor's operation. The Contractor shall replace all damaged landscaping, improvements or utilities in kind. Such repair and/or replacement work shall be considered as included in other items of work, and no additional compensation will be allowed.

3. All excavation and grading on site requires prior authorization from PP-CS and the issuance of a digging permit, in writing, prior to excavation beginning.

B. Salvage: Contractor shall take care when removing salvageable material to avoid damaging the material itself or the adjacent or adjoining structures that are to remain.

C. Existing Subsurface Utilities:

1. Existing subsurface facilities are shown on the Plans to help the Contractor avoid damage to essential utilities which must remain in service. The accuracy or completeness of existing utility information cannot be guaranteed.

2. The Contractor shall ascertain the exact location of all underground facilities prior to doing work that may damage such facilities. If the Contractor discovers underground facilities not indicated on the Plans or in a location different from what is indicated on the Plans, the Contractor shall protect such facilities from damage and notify the Construction Manager immediately if a conflict exists.

3. Although irrigation lines smaller than 3" in diameter are typically not shown on the Plans, all landscaped areas are served by automatic irrigation systems. Unless otherwise indicated on the Plans, the Contractor shall relocate all irrigation lines, risers, heads, and control wires as required to resolve conflicts with proposed construction. Such repair and/or relocation work shall be considered as included in other items of work, and no additional compensation will be allowed.

D. Protection of Existing Trees:

1. All trees greater than or equal to 6 inches in diameter not specifically designated for removal are to remain and shall be protected. See section 02 805 Plant Protection for specific requirements

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION, STRIPPING, AND GRUBBING

A. Demolition:

1. Existing asphalt concrete paving, concrete curbs and walks shall be broken up and removed where shown on the plans for new construction. In addition, the baserock material underneath paved areas shall be removed.

2. Existing on-site underground utilities conflicting with construction shall be cut off and capped, removed entirely, or relocated as indicated on the plans.

3. Existing concrete structures or portions of structures extending below new structures shall be removed entirely. In all other areas, existing concrete structures or portions of structures below grade shall be removed to a depth of at least 3 feet below finished grade and broken in a manner that will prevent water entrapment.

4. Unless otherwise directed by the Construction Manager, salvageable material shall be delivered to the Owner's Representative. All adhering concrete shall be removed from signs, posts, barricades or other facilities to be salvaged or reconstructed.

5. Explosives shall not be used.

B. Stripping:

1. Existing topsoil shall be stripped to a depth of 6" (or deeper where directed by the Soils Engineer) as necessary to remove all vegetation, organic matter, or other objectionable material in those areas to be graded.

2. Topsoil not containing vegetation shall be stockpiled on-site for later use as topsoil backfill.

C. Grubbing and Trimming:

1. See Section 01 5639 Plant Protection

D. Excavation Around Trees:

1. See Section 01 5639 Plant Protection.

3.2 FILLING AND BACKFILLING

A. Pits or depressions resulting from the above operations shall be filled and compacted prior to performing any earthwork.

B. Material to be used for filling shall be select on-site or imported fill material approved by the Soils Engineer.

C. Fill material shall be compacted to 95% maximum density. Relative compaction will be tested in accordance with ASTM D 1557.

3.3 DISPOSAL

A. All debris, site strippings, and objectionable material shall be the property of the Contractor and shall be removed and disposed of in a legal manner off the Owner's property.

B. Disposal shall be performed as promptly as possible after removal of the material and shall not be left until the final clean-up period.

3.4 SURFACE STRUCTURES

A. All existing surface structures currently located in non-traffic areas which are also within the limits of proposed paving shall have traffic-rated (AASHTO H-20 loading) frames and grates or covers.

B. Grade Adjustments:

1. Frames, grates, and covers of all existing surface structures (manholes, vaults, valve boxes, drain inlets, monument boxes, etc.) shall be adjusted to proposed finished grade. Grade rings shall be supplied and installed as required.

2. Frames of new or adjusted surface structures shall be supported by concrete with minimum dimensions as follows: 6" wide by 6" deep for structures less than 18" in diameter or 6" wide by 9" deep for structures 18" or greater in diameter.

3. Structures Within Paved Areas:

a) A structure located in an area paved with asphalt concrete shall not be constructed to final grade until the adjacent pavement or surfacing has been compacted.

b) The contractor shall be responsible for referencing structures prior to paving and locating

them after paving operations are complete.

c) After asphalt concrete paving is complete, the asphalt shall be cut out 6" wider than the frames of all surface structures. Each frame shall then be raised to finished grade and supported by concrete as noted above. The concrete shall be left 1.5 inches lower than finished grade. This depressed area shall be paved to finished grade with hot-mix asphalt concrete, 1/2" maximum aggregate size. Cold-applied asphalt patching material will not be allowed.

4. When reconstruction or adjustment of a concrete drainage facility requires partial removal of concrete, sufficient concrete shall be removed to permit new reinforcing steel to be spliced to existing reinforcing steel as specified in CDT Standard Specifications Section 52-1.08, "Splicing." Existing reinforcement that is to be incorporated in new work shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in new concrete. Concrete removal shall be performed without damage to any portion that is to remain in place. All damage to the existing concrete, which is to remain in place, shall be repaired to a condition equal to that existing prior to the beginning of removal operations. The cost of repairing existing concrete damaged by the Contractor's operations shall be at his expense.

5. All manholes that are to be lowered shall be removed to an approximate depth of 3.5 feet below finished grade and shall then be reconstructed with the proper taper to finished grade.

6. When existing manholes or inlets are to be abandoned, all pipes entering the manhole or inlet shall be securely closed by tight fitting plug or wall of Class A or Class B concrete not less than 0.5-foot thick. The bases of manholes or inlets shall be broken in manner to prevent entrapment or water. The manhole or inlet shall be demolished to an elevation 3-feet below finished grade and backfilled in accordance with Paragraph 3.02 (above).

END OF SECTION 31 11 00

SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Work Specified Elsewhere:

1. Cutting and Patching: 01 7329

2. Earthwork: 31 00 00

3. Excavation and Backfilling for Underground Structures: 31 23 43

1.2 QUALITY ASSURANCE

A. Applicable Standards:

1. American Society for Testing and Materials (ASTM)

a) D1557 - Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using a 10.5-Pound (4.54-kg) Rammer and a 18-Inch (457mm) Drop

b) D1556 - Density of Soil In-Place by Sand Cone Method

c) D2049 - Relative Density of Cohesionless Soil

d) D2167 - Density of Soil In-Place by Rubber Balloon Method

e) D6938 - Density of Soil and Soil-Aggregate In-Place by Nuclear Method (Shallow Depth)

f) ASTM 1970, 5th Edition, Special Procedures for Testing Soil and Rock for Engineering Purposes, (STP 479), "Burmister Method"

PART 2 - PRODUCTS

2.1 TRENCH BACKFILL

A. Suitable fill materials per section 31 0000 and per the Soils Engineer’s recommendations.

B. Unsuitable materials include material that does not conform to the above or materials that are determined by the Owner’s Representative as too wet or otherwise unsuitable for providing a stable fill.

C. Compact with appropriate equipment to achieve a minimum of 95 percent of maximum density. Optimum moisture and maximum density shall be determined by ASTM D1557 (modified proctor).

D. Place fill material in six inch maximum layers (uncompacted depth) or as otherwise specified elsewhere in these specifications.

E. Perform any wetting or drying of the material as required to obtain the specified density when compacted and to maintain ±2% of optimum moisture content.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities,6 inches wide and 4-mil thick minimum, continuously inscribed with a description of the utility , with metallic core encased in a protective jacket for corrosion protection when tape is buried up to 2'-6" deep.

1. Tape colors: Provide color tape for identifying utilities as follows:

a) Yellow: Steam hues

b) Blue: Water system

c) Orange: Telephone, Electrical and common locations

B. When required for protection of workers, public safety, or as required by State Laws, substantial barricades shall be provided for areas where excavation, trenching, construction and demolition work is being performed. Safety barricades shall not be used in lieu of required guardrails on temporary bridge crossing trenches, excavations or other openings. For protection of the visually impaired, safety barricades shall be joined together with 3" yellow caution tape.

1. One strand of tape running continuously from barricade to barricade at 42 inches above grade or mounting level.

a) One strand of tape running continuously from barricade to barricade 4"-12 inches above grade or mounting height.

2. In addition, battery operated warning lights shall be maintained on such barricades whenever visibility is restricted and at night.

C. Provide temporary chain link fencing and 5' high plastic net fencing as required for safety or other reasons.

PART 3 - EXECUTION

3.1 GENERAL TRENCHING

A. Excavate all materials found within the specified limits for excavation.

B. Perform excavation by any recognized method of good practice to complete the job in the most expeditious manner in conformance with specified requirements.

C. Take precautions to ensure no damage to existing facilities or equipment, other work, or endangerment to life.

D. All materials encountered, regardless of type, character, composition, and condition thereof, shall be

considered "unclassified" for the purpose of payment.

E. Blasting is not permitted.

F. All trenching which exceeds a depth of four (4) feet requires shoring pursuant to a shoring plan in compliance with OSHA. Neither the Owner's Representative or Owner will review, accept, or have any liability for the adequacy of the Contractor's trench excavation system. The Contractor shall provide safe working conditions for Owner's personnel and their representatives.

3.2 TRENCH DEWATERING

A. Control grading around excavations to prevent surface water from flowing into excavation areas.

B. Drain or pump as required to continually maintain all excavations and trenches free of water or mud from any source, and discharge to approved drains or channels. Commence when water first appears and continue as required to keep excavation free of standing water during entire time excavation is open.

C. Use pumps of adequate capacity to ensure rapid drainage of area, and construct and use drainage channels and subdrains with sumps as required.

D. When water is found in the excavation due to Contractor negligence, remove unsuitable excessively wet subgrade materials and replace with approved compacted fill material as directed by the Owner's Representative and at no additional cost to Owner.

E. Contractor shall submit a dewatering plan prior to beginning excavation.

3.3 TRENCH SIDEWALLS

A. Make vertical or slope within specified trench width limitations below a horizontal plane 12 inches above top of underground utilities.

B. Make vertical or nearly vertical above a horizontal plane 12 inches above top of underground utilities. Only under special circumstances, and with the Owner's Representatives prior written approval, may stepping occur. Trench width will be limited to the required width to accommodate trenching coffin or shoring required by OSHA and WISHA.

C. Excavate without undercutting.

D. The Contractor shall provide support systems for exposed building foundations, tunnels, and other structures designed and stamped by a Civil Engineer licensed to practice in the State of California.

3.4 TRENCH DEPTH

A. Depth shall be sufficient to provide the minimum bedding requirements for the underground utilities being placed.

B. Do not exceed that indicated where conditions of trench bottom are satisfactory.

C. Increase depth as necessary to remove unsuitable supporting materials. Unsuitable materials shall be defined as mud, muck, and material that is not free of debris, roots, organic matter, refuse, ashes, and cinders.

3.5 TRENCH BOTTOM

A. Protect and maintain when suitable native materials are encountered, as determined by the Geotechnical Engineer.

B. Restoring over-excavation

1. Restore over-excavation of trench with imported granular fill or concrete per the direction of the Owner's Representative.

2. Correct at no extra cost to Owner when trench is over-excavated without authority or to stabilize bottom rendered unsuitable through negligence or improper operations.

3.6 TRENCH WIDTH

A. Excavate trenches to a width that will permit satisfactory jointing of the pipe and thorough tamping of the bedding, and construction of the concrete encased duct banks.

B. Maximum trench width limitations shall apply beginning four feet from manhole, handhole, steam tunnel or structure walls.

C. Maximum width shall be as near the minimum specified as can controlled by construction equipment and methods utilized.

D. Correct when overexcavated at no additional cost to Owner.

E. Excavate only the length of trench which can be completed and backfilled the following day. Trenches not filled in any given day shall be surrounded by protective fencing.

3.7 GENERAL TRENCH FILL

A. For all sewer piping, complete placement promptly after piping installation and authorization by owner's representative to proceed.

B. Use mechanical methods acceptable to the Owner's Representative.

C. Until compacted depth over conduit exceeds three feet, do not drop fill material over five feet. Then distance may be increased two feet for each additional foot of cover.

3.8 COMPACTION TESTING

A. The University shall be responsible for all compaction testing. The Owner's Representative shall coordinate compaction testing. All results shall be submitted to the Owner's Representative.

B. The method of in-place compaction testing shall be as follows:

1. Cohesive materials: ASTM D2167,OR ASTM D1556,

2. Granular pipe embedment: ASTM D6938

C. The minimum frequency of density tests will be as follows:

1. At least one test for every 8 inches of vertical depth and horizontal intervals of 20 to 30 feet

2. At least one test for every shift of compaction operations.

3. At least one test when Owner's Representative questions the quality of moisture control or

effectiveness of compaction

D. Fill failing to meet required densities shall be removed or scarified and recompacted as necessary to achieve specified results.

E. Removal of in-place material and replacement with new material will be required if scarifying and recompaction do not produce the required densities.

3.9 SURPLUS MATERIAL

A. Designated haul routes for the disposal of surplus material shall be approved and acceptable to the Owner's Representative. Where trucks move earth on campus streets all hauling will be limited to Class 1 and Class 6 vehicles, nothing to exceed a maximum gross load of 36,000 pounds. Truck speed limit on streets shall be a maximum of 20 miles per hour or less if so posted. Provide flagpersons or flaggers where trucks enter and leave main campus streets, unless such entry or exit is at an established intersection.

END OF SECTION 31 23 33

SECTION 31 23 43
EXCAVATION AND BACKFILLING FOR UNDERGROUND STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Work Specified Elsewhere:

Section 31 2333: Trenching Excavation and Backfilling
Concrete Sidewalks, Curbs and Gutters: Section 32 1613
Tree Protection: Section 01 5639
Flexible Paving: Section 32 1200

C. Blasting is prohibited.

1.2 QUALITY ASSURANCE

A. Applicable Standards

1. American Society for Testing and Materials (ASTM):

a) D1557 - Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using a 10.5-Pound (4.54kg) Rammer and a 18-Inch (457mm) Drop

b) D1556 - Density of Soil In-Place by Sand Cone Method

c) D2049 - Relative Density of Cohesionless Soils

d) D2167 - Density of Soil In-Place by Rubber Balloon

e) D6938 - Density of Soil and Soil-Aggregate In-Place by Nuclear Method (Shallow Depth)

f) ASTM 1970, 5th Edition, Special Procedures for Testing Soil and Rock for Engineering Purposes, (STP 479), "Burmister Method"

2. Cal-Trans Standard Specifications for Road, Bridge, and Municipal Construction 1992 edition.

PART 2 - PRODUCTS

2.1 CRUSHED ROCK BEDDING

A. Material shall be local crushed rock conforming to the following gradation:

Size	Percent Passing
5/8"	100
3/8"	95-100
1/4"	30-60
#50	2-20
#200	0-10

2.2 CONTROLLED DENSITY FILL (CDF)

A. See Section 32 16 13 -Concrete Sidewalks, Curbs and Gutters for CDF specification.

2.3 CLASS II AGGREGATE BASE MATERIAL BACKFILL

A. Backfill shall be class II aggregate base material per Section 26-1.02 A (¾ inch maximum gradation) of the Caltrans specifications.

PART 3 - EXECUTION

3.1 EXCAVATION

A. General

1. Excavate all materials found within the designated limits for excavation.

2. Perform excavation by any recognized method of good practice to complete the job in the most expeditious manner in conformance with specified requirements.

3. Take precautions to ensure that no damage is caused to existing facilities or equipment, or other work.

B. Make excavation area adequate to permit efficient erection and removal of forms or installation of precast structures and to provide minimum clearances for drain beds and backfilling.

C. See Section 01 5639 Tree Protection for work to be done within driplines of trees.

D. Excavate by hand in areas where space and access will not allow use of machines.

E. Restore over excavated areas with approved material. Perform at no extra cost to the Owner.

F. Blasting will not be permitted.

3.2 DEWATERING

A. Control grading around excavations to prevent surface water from flowing into excavation

areas.

B. Drain or pump as required to maintain all excavations and trenches free of water or mud from any source. Discharge water to approved drains or channels. Commence when water first appears and continue as required to keep excavation free of standing water during entire time excavation is open.

C. Use pumps of adequate capacity to ensure rapid drainage of area, and construct and use drainage channels and subdrains with sumps as required.

D. When water is found in the excavation due to Contractor negligence, remove unsuitable excessively wet subgrade materials and replace with approved compacted backfill material as directed by the Owner and at no additional cost to the Owner.

3.3 CRUSHED ROCK BEDDING

A. Place 6-inches minimum of compacted crushed rock bedding underneath all structures except where controlled density backfill is used.

B. Place class II agg. base material as backfill around the manholes and structures up to finish paving surface or landscape subgrade. Excavated material cannot be used for backfill.

C. Utility trench backfill shall be placed in layers not exceeding eight inches of loose layer thickness keeping the working surface of the entire area level.

D. Exercise care in the use of heavy equipment in areas adjacent to structures.

E. Compact bedding to 95 percent relative density as referenced to ASTM D1557 or Relative Density of Cohesionless Soils, Alt. Method, from Designation E-12 of USBR Earth Manual, 2nd Ed. or ASTM STP 479 - Burmister Method.

3.4 CDF USED FOR BACKFILL

A. Backfill in the form of Controlled Density Fill shall be used to backfill under existing utilities, tunnels, and other structures where compaction equipment cannot be used.

3.5 AGGREGATE BASE FOR FLEXIBLE PAVING

A. See Section 32 1200 Flexible Paving for final asphalt paving. Temporary cutback asphalt is not acceptable for surface paving unless approved in writing from the Owner's representative.

3.6 AGGREGATE BASE FOR SITE CONCRETE

A. See Section 32 1613 Concrete Sidewalks, Curbs and Gutters for concrete paving.

3.7 COMPACTION TESTING

Compaction Testing shall be performed under the direction and supervision of the Soils Engineer. See Geotechnical Report for details on compaction.

A. The method of in-place compaction testing shall be as follows:

1. Cohesive materials: ASTM D2167, or ASTM D1556

2. Cohesionless materials: ASTM D6938

B. The minimum frequency of density tests will be as follows:

1. At least one test for every 8 inches of vertical.

2. At least one test for every shift of compaction operations.

3. At least one test when the Owner questions the quality of moisture control or effectiveness of compaction.

C. Backfill failing to meet required densities shall be removed or scarified and recompacted as necessary to achieve specified results.

D. Removal of in-place material and replacement with approved new material will be required if scarifying and recompaction do not produce the required densities.

3.8 WASTE MATERIALS

A. Waste material includes all excavated native material.

B. Remove waste materials from work area as excavated.

C. Deposit waste materials off site in a legal dumpsite or landfill as required by law.

END OF SECTION 31 23 43

SECTION 32 0190

OPERATION AND MAINTENANCE OF PLANTING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Provide continuous Landscape Maintenance, complete as specified during progress of the work, after installation, and for a period of 90 days after Preliminary Acceptance.

B. Related Work:

1. Section 32 8400 - Planting Irrigation

2. Section 32 9113 - Soil Preparation

3. Section 32 9300 - Planting

1.02 REFERENCES

A. International Society of Arboriculture (ISA) Pruning Standards

B. "Arboriculture: Care of Trees, Shrubs and Vines in the Landscape" by Richard W. Harris, Prentice-Hall, Inc. 1983.

C. Western Chapter of International Society of Arboriculture Pruning Standards

D. ANSI A300 Pruning Standards

E. OMRI, Organic Materials Research Institute

F. USCC STA, United States Composting Council Seal of Testing Assurance

G. Bay-Friendly Landscape Guidelines, StopWaste.Org.

1.03 SUBMITTALS

A. Quality Control Submittals:

1. Schedule of maintenance operations and monthly status report including list of equipment, materials proposed for the job and watering schedule.

2. Licenses, permits and insurances required by the City and County of San Francisco, CA, the State or Federal government pertaining to maintenance work.

3. Monthly record of all herbicides, insecticides and disease control chemicals used for the project.

4. Documentation of existing planting and irrigation system. Note: Bay-Friendly Landscaping emphasizes the use of Integrated Pest Management. Chemical controls should only be applied when monitoring indicates that preventative and non-chemical methods are not keeping pests

below acceptable levels. When pesticides are required, the least toxic and the least persistent pesticide that will provide adequate pest control shall be applied.

B. Project Close-out Submittal: Include in a single, 3-ring binder a landscape maintenance manual containing an indexed collection of all schedules, records and permits listed above, as well as a documentation of accepted condition of planting and irrigation at Final Acceptance.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Experience: The landscape contractor or maintenance subcontractor shall have a full-time employee assigned to the job as foreman for the duration of the contract. He/she shall have a minimum of four (4) years experience in landscape maintenance supervision, with experience or training in turf management, entomology, pest control, integrated pest management, soils, fertilizers, plant identification, sustainable landscape maintenance practices and be familiar with the Bay-Friendly Landscape Guidelines.

2. Labor Force: The landscape maintenance labor force shall be thoroughly familiar with, and trained in, the work to be accomplished and shall perform the task in a competent, efficient manner acceptable to the Owner.

B. Requirements:

1. Supervision: The foreman shall directly supervise the work force at all times. Notify Owner of all changes in supervision.

2. Identification: Provide proper identification at all times for landscape maintenance firm's vehicles and labor force. Be uniformly dressed in a manner satisfactory to the Owner.

1.05 PROJECT/SITE CONDITIONS

A. Site Visit: At beginning of maintenance period, visit and walk the site with the Owner's representative to clarify scope of work and understand existing project/site conditions.

B. Documentation of Conditions: Document general condition of existing trees, shrubs, vines, and groundcovers recording all plant materials which are healthy, thriving, damaged, dead or dying.

C. Irrigation System: Document general condition of existing irrigation system, making sure that faulty electrical controllers, broken or inoperable sprinkler heads or emitters are reported. Verify that ET controller has been properly programmed for plant establishment and readjusted for optimal performance of plants.

1.06 SEQUENCING AND SCHEDULING

A. Perform all maintenance during hours mutually agreed upon between Owner and Contractor.

B. Work force shall be present at the project site at least once a week and as often as necessary to perform specified maintenance in accordance with the approved maintenance schedule.

1.07 WARRANTY

A. Specific Requirements: Refer to the following sections:

1. Section 32 9000 - Planting

2. Section 32 8400 - Planting Irrigation

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Use local products and suppliers (as defined by 150 mile radius from project) to the extent possible to minimize fuel consumption and emissions. Use salvaged and recycled-content products where possible. (such materials can be located at the following websites: www.ciwmb.ca.gov and www.stopwaste.org)

B. All materials and equipment, shall be provided by the Contractor, except as specified below.

1. Water: Clean, potable and fresh, as available from Owner

2. Fertilizers:
   a. Use only where prescribed by soil laboratory reports
   b. Use only locally organically produced compost in lieu of chemical fertilizers.
   c. Use compost tea.

3. Herbicides, Insecticides, and Fungicides:
   a. Use only where prescribed by IPM consultant

4. Replacement Tree Guys, Stakes, Ties and Wires: Match originally accepted existing materials on the site. Tree stakes to be removed after one year from the date of final approval.

2.02 EQUIPMENT

A. General: Use only the proper tool for each job. Maintain all tools in sharp, properly-functioning condition. Clean and sterilize pruning tools prior to usage.

B. Fuel conservation: Implement strategies in work operations to reduce fossil fuel consumption and emissions.

1. Use hand-powered equipment when possible.

2. Minimize use of gas-powered blowers, especially on planting beds.

3. Select smallest, most fuel efficient equipment to accomplish task.

4. Consider vehicles that operate on natural gas or biodiesel.

5. Maintain equipment properly and keep it well tuned.

6. Emphasize employee carpooling to project.

C. Repair equipment oil leaks immediately and at an alternate location from project site.

D. Insect/Disease Prevention: Take all measures to prevent introduction of insect or disease-laden materials onto the site. Planting - Section 32 9300.

PART 3 - EXECUTION

3.01 ESTABLISHING THE MAINTENANCE PERIOD

A. Preliminary Review: As soon as planting is substantially completed per documents, hold a preliminary review to determine the condition of the work.

B. Date of Review: Notify Landscape Architect at least five (5) workings days prior to anticipated date of review.

C. Beginning of the Maintenance Period: The date on which the Landscape Architect issues a letter of Preliminary Acceptance to the Contractor.

3.02 PREPARATION

A. Protection:

1. Protect all new planting areas from damage of all kinds from beginning of work until sufficiently established or until Final Acceptance.

2. Provide temporary protection fences, barriers and signs as required for protection.

B. Replacements:

1. Immediately treat or replace all plants which become damaged or injured as a result of Contractor's operations or negligence, as directed by Landscape Architect, at no cost to Owner.

2. Replacement plants shall match size, condition and variety of plants replaced.

3.03 PLANTING

A. Watering Basins:

1. Maintain all watering basins around plants so that enough water can be applied to establish moisture through major root zones.

2. For supplemental hand watering of watering basins, use a water wand to break the water force. Do not permit use of "jet" type watering equipment. Do not permit crown roots to become exposed to air through dislodging of soil and mulch.

3. Maintain originally called for depth of mulch to reduce evaporation and frequency of watering.

4. In rainy season, open basins to allow surface drainage away from the root crown where excess water may accumulate. Restore watering basins at end of rainy season.

5. At end of rainy season, form watering basins at trees as specified in drawings

B. Resetting: Reset plants to proper grades and upright position.

C. Weed Control:

1. All areas between plants, including watering basins, shall be weed free at all times.

2. Hand weed whenever possible.

3. Avoid frequent soil cultivation that destroys shallow roots and breaks the seal of pre-emergent herbicides.

D. Pruning:

1. Prune trees to select and develop permanent scaffold branches that are smaller in diameter than the trunk or branch to which they are attached, and which support the natural growth pattern of each tree species.

2. Prune trees to eliminate diseased or damaged growth, and narrow V-shaped branch forks that lack strength. Where necessary, reduce toppling and wind damage by tip pruning as required. Do not thin out crowns.

3. Prune trees to maintain growth within space limitations, maintaining a natural appearance.

4. No stripping of lower branches of young trees will be permitted.

5. Retain lower branches in a "tipped back" or pinched condition to promote trunk caliper growth. Do not cut back to fewer than six buds or leaves on such branches. Only cut lower branches flush with the trunk after the tree is able to stand erect without staking or other support.

6. Tip prune and shape evergreen trees when necessary to prevent wind and storm damage. Do primary pruning of deciduous trees during the dormant season. Do not permit any pruning of trees prone to excessive "bleeding" during growth season.

7. Prune damaged trees or those that constitute health or safety hazards at any time of year as required.

8. Make all cuts clean and close to the trunk, without cutting into the branch collar. "Stubbing" will not be permitted. Cut smaller branches flush with trunk or lateral branch. Make larger cuts (1 in. in diameter or larger) parallel to shoulder rings, with the top edge of the cut at the trunk or lateral branch.

9. Branches too heavy to handle shall be precut in three stages to prevent splitting or peeling of bark. Make the first two cuts 18 in. or more from the trunk to remove the branch. Make the third cut at the trunk to remove the resulting stub.

10. Selectively prune shrubs as necessary to enhance natural shape. Do not prune or clip shrubs into balled or boxed forms unless specifically called for by design. Do not shear shrubs.

11. Take extreme care to avoid transmitting disease from one infected plant to another. Properly sterilize pruning tools before going from one infected plant to all other plants.

E. Staking and Guying of Trees:

1. See drawings for staking details.

2. Inspect stakes and guys at least once a month to check for rubbing that causes bark wounds.

3. Conform to the recommended procedures of staking and guying as outlined in the University of California Publication AXT-311, "Staking Landscape Trees."

3.04 GENERAL LANDSCAPE PLANTINGS

A. Watering:

1. Check for moisture penetration throughout the root zone at least twice a month.

2. Water as frequently as necessary to maintain healthy growth of groundcovers through establishment and adjust irrigation to a regular cycle after establishment.

B. Weed Control:

1. Control weeds, preferably with flaming or hand pulling; use pre-emergent herbicides and selective systemic herbicides only with analysis of invasive species lifecycle.

2. Do not hoe weeds.

C. Fertilization:

1. Use compost or compost tea if plants show transplant shock. Do not use fertilizers unless soil test shows specific nutrient deficiencies.

D. Mowing and Edging:

1. Edge groundcovers to keep in bounds. Trim top growth as necessary to achieve an overall even appearance.

E. Replacements:

1. Replace dead and missing plants after obtaining Owner's agreement to pay for replacement.

2. Damages due to Contractor's negligence shall be paid for without charge to Owner.

3.05 CONTAINER PLANTINGS

A. Watering:

1. Hand-water all pre-fabricated pots and planters without an automatic irrigation system.

2. Species, sizes of plants, container sizes and orientation shall dictate frequency of watering. Submit to Owner a watering schedule for different seasonal requirements.

B. Weed Control: All planters shall be weed-free at all times.

C. Pruning:

1. Limit pruning to removal of damaged or dead twigs and foliage.

2. Remove spent flowers on a weekly basis.

D. Replacements of Perennials:

1. Replace perennials when materials exhibit a "spent" condition.

2. Thoroughly cultivate soil after removal of "spent" or "dead" plants prior to planting new materials.

E. Fertilization:

1. Use compost or compost tea if soil or leaf tests show deficiencies.

3.06 INTEGRATED PEST MANAGEMENT

A. Insects and diseases

1. Key Plant: key pests- Contractor shall identify primary plant species and cultivars in the landscape (key plants) and the pests that commonly cause significant harm to plant health and appearance (key pests).

2. Monitoring: Contractor shall monitor landscape areas to identify presence of beneficial insects and pests, determine populations, life stage, and degree of damage to plants. Key plants: key pests will be monitored closely during normal periods of pest activity. This information will be the basis on which pest control methods are initiated. Records of monitoring activity shall be kept.

3. Controls: Control pests without harming non-target organisms, or negatively affecting air and water quality and public health. Use practices of IPM and only resort to chemical methods when non-chemical methods are not keeping pests below acceptable levels. When pesticides are required, use the least toxic and least persistent pesticide that will provide adequate pest control. Do not apply pesticides on a prescheduled basis.
   a. Cultural/mechanical/physical methods:
      1) Adjust pruning or fertilizing timing to make the environment unfavorable to pest reproduction, movement, or survival.
      2) Foster healthy soil, judiciously fertilize when needed and manage irrigation appropriately.
      3) Prune to remove infected or infested branches and shoots. Time pruning to avoid periods of insect infestation.
      4) Remove fallen twigs, leaves, and fruit that contain disease inoculum.
      5) Mulch soil surface to reduce weeds and to reduce the splashing of mud that would protects spores deposited on plant surfaces.
      6) Trap insects using sticky surfaces (use also for monitoring). Trap rodents with mechanical traps.
      7) Bring to attention of agency plants that are disease or insect prone and suggest resistant replacements or species better suited for site and microclimate.
   b. Biological methods: pesticides of natural origin that have limited or no adverse effects on the environment or beneficial organisms. It is critical to determine the effective biological control and proper timing of application. When cultural/mechanical/physical methods are not adequate, consider the following control methods to lower pest populations to target levels:
      1) Bacillus thuringiensis
      2) Parasitic nematodes
      3) Pheromone traps

4) Beneficial insect release and conservation

c. Pesticides: Insecticides, fungicides, and other substances used to control pests. When Cultural/mechanical/physical and Biological methods have provided inadequate pest control, the Contractor may apply an appropriate least-toxic pesticide as a last resort. Application must be timed to the appropriate life stage of the pest. Examples as follows:
   1) Insecticidal soaps
   2) Horticultural soaps
   3) Herbicidal soaps
   4) Neem
   5) Pyriproxyfen insect growth regulator (e.g. Distance IGR)

d. Do not use pesticides that have been prohibited by Organic Materials Research Institute (OMRI) in its generic materials list. Restricted chemicals:
   1) Organophosphate-containing pesticides. Examples as follows:
      a) Diazinon, trade names Spectracide, Knox-out
      b) Chlorpyrifos, trade names Dursban, Pageant
      c) Malathion and carbaryl, trade names Sevin
   2) Pyrethroids and pyrethrins containing piperonyl butoxide (PBO)
   3) Any pesticide of Toxicity category I or II
   4) Any pesticide containing a chemical known to the State to cause cancer or reproductive toxicity pursuant to the California Safe Drinking Water and Toxic Enforcement Act of 1986.
   5) Any pesticide classified as a human carcinogen, probable human carcinogen or possible human carcinogen by the United States Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances.

4. Notice of pesticide use: Signs shall be posted at least three days before application and remain posted four days following the application of pesticide(s).

5. Recordkeeping and reporting
   a. Contractor shall maintain records of all pest management activities. Submit the pest management report to the Owner on a monthly basis. Each record shall include the following:
      1) Target pest
      2) Type and quantity of pesticide used
      3) Site of the pesticide application
      4) Date the pesticide was used
      5) Name of the pesticide applicator
      6) Application equipment used
      7) Prevention and other non-chemical methods of control used

B. Weed Management

1. Identify key weeds present and design weed manage program to target those species.

2. Invasive plants may have been present on-site prior to landscape installation or inadvertently included in planting. Seedlings and/or suckers shall be removed by contractor.

3. Controls
   a. Cultural/mechanical/physical methods shall be used as the first choice in weed management.
      1) Monitor planting areas frequently to identify and eradicate weeds early in the growth stage prior to their setting seed.
      2) Cut or pull weeds using hand operated equipment where possible.

3) Mulches shall be maintained at all times over soil surface that is not covered by vegetation. Apply through sheet mulching technique when possible.
4) Propane-fueled flamers may be used in winter and spring with required permits and approval by Fire Marshall to kill early-season weeds by heating the cells until they burst. The week quickly wilts and dies.

b. Least toxic herbicides may be employed by Contractor as a last resort. Examples are as follows:
1) Fatty acid potassium salts (herbicidal soaps e.g. Safer's Superfast Weed and Grass Killer, Dr. Bronner's Peppermint Anti-Bacterial Soap)
2) Acetic and citric acids (e.g. Nature's Glory Weed and Grass Killer)
3) Clove, citrus, mint, and thyme oils
4) Corn gluten
5) Low-toxic, low-residual herbicide (e.g. Round-up)

c. Do not use herbicides that have been prohibited by Organic Materials Research Institute (OMRI) in its generic materials list. The following herbicides are restricted and may not be used (identified as contaminants of either water or compost)
1) Atrazine (Aatrex)
2) Simazine (Princep)
3) Bromacil (Hyvar, Krovar)
4) Prometon (Pramitol)
5) Bentazon (Basagran)
6) Norflurazon (Solicam, Predict, Zorial)
7) Picloram
8) Clopyralid

3.07 WASTE MANAGEMENT

A. General: minimize waste production, use plant debris generated on-site as much as possible, recycle plant debris and discarded materials to the maximum extent feasible.

B. Retain natural leaf litter and other organic material in shrub beds. Where leaf litter detracts from landscape appearance it is preferable that leaves be chopped and returned to the landscape. Remove diseased leaves that would provide inoculum for plant infection.

C. Plant debris: All plant debris (including cut or chipped woody prunings) less than 4 inches shall be re-incorporated into the mulch layer of landscape areas.

D. Produce mulch from site generated untreated and unpainted wood and plant debris.

E. Produce compost from site generated plant debris to the extent possible. All excess plant debris must be separated from other refuse and take to a facility where it will be used to produce compost or mulch.

F. Recycle waste

3.08 IRRIGATION SYSTEM

A. General:

1. Repair without additional charge to Owner all damages to system caused by Contractor's operations. Perform all repairs within one (1) watering period.

2. Report promptly to Owner all accidental damage not resulting from Contractor's negligence or operations.

3. Set and program automatic ET controller with proper soil information, water needs of plants, orientation of irrigation zones, and adjust throughout establishment period and final growth period after establishment.

4. Twice a month, use a probe or other acceptable tool to check the rootball moisture of representative plants as well as the surrounding soil.

B. Cleaning and Monitoring the System:

1. Continually monitor the irrigation systems to verify that they are functioning properly as designed. Make program adjustments required by changing field conditions.

2. Clean pump filter and strainer at least once a year and as often as necessary to keep the irrigation systems free of sand and other debris.

3. Prevent spraying on windows, building walls, and play areas by balancing the throttle control on the remote control valves and the adjustment screws on the sprinkler heads. Do not allow water to atomize and drift.

3.09 TERMINATION OF THE MAINTENANCE PERIOD

A. Final Acceptance Procedure:

1. Work will be accepted by the Landscape Architect upon satisfactory completion of all work, including maintenance period, but exclusive of replacement of materials under the Warranty Period.

2. Submit a written request to Landscape Architect for review for Final Acceptance at least five (5) working days prior to anticipated Final Review date, which is at the end of the Maintenance Period.

B. Corrective Work:

1. Work requiring corrective action or replacement shall be performed within ten (10) calendar days after the Final Review.

2. Perform corrective work and materials replacement in accordance with the Drawings and Specifications, and shall be made by the Contractor at no cost to the Owner.

3. After corrective work is completed, the Contractor shall again request a Final Review for Final Acceptance as outlined above.

4. Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted.

C. Conditions for Acceptance of Work at End of Maintenance Period:

1. Each plant shall be alive and thriving, showing signs of growth and no signs of stress, disease, or any other weaknesses.

2. Replace all plants not meeting these conditions. An additional Warranty Period equal in length to the original shall be commenced for all such plants and planted areas.

D. Final Acceptance Date: The date on which the Landscape Architect issues a Letter of Final Acceptance. Upon Final Acceptance, the Owner will assume responsibility for maintenance of the work.

3.010 CLEANING

A. Dispose of all pruned materials, sweep all walkways. Avoid walking in planting areas where possible.

B. Remove from the site all containers and evidence of maintenance activities.

3.011 CLOSE OUT

A. Landscape Maintenance Record: Submit binder to Owner with all documentation and records required and utilized during the maintenance period.

B. Keys and Identification: Return all keys and identification materials supplied by Owner for the purpose of site access.

END OF SECTION

SECTION 32 12 00
ASPHALT PAVING

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section

B. Section includes furnishing and installing:

1. Minimum 3-inch asphalt over 12-inch: aggregate base for all pavement area where existing pavement is removed for installation of utilities. If the existing pavement section is greater than 3-inch AC/12-inch AB match existing section.

1.2 SUBMITTALS

A. General: Submit in accordance with conditions of contract and Division 1 specifications sections:

B. Product Data: Submit manufacturer's product data for the following:

1. Asphalt.

2. Aggregate base.

C. Owner certifications shall be signed by the material producer and Contractor, certifying that each material product item complies with or exceeds the specification requirements.

1.3 QUALITY ASSURANCE

A. Testing Agency Services:

1. Contractor will engage a testing agency to conduct tests and perform other services specified for quality control during construction.

2. If re-testing is required due to failure by the Contractor, then the costs for the re-testing shall be borne by the Contractor.

B. Qualifications of asphalt producer: Use only materials which are furnished by a bulk asphalt Concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.

C. Paving Quality Requirements:

1. General: In addition to either specified condition, comply with the following minimum requirements:

a) Testing in-place asphalt concrete courses for compliance with the requirements for density thickness and surface smoothness.

b) Provide final surfaces of uniform texture conforming to required grades and cross sections.

2. Density:

a) Compare the density of in-place material against laboratory specimen of same asphalt concrete mixture, when subjected to 50 blows of a standard Marshall Hammer on each side of the specimen.

b) Minimum acceptable density in-place course material is 95 percent of the recommended laboratory specimen density.

1.4 RELATED DOCUMENTS

A. American Society for Testing and Materials (ASTM)

B. American Association of State Highway and Transportation Officials (AASHTO)

C. American Concrete Institute (ACI)

D. Concrete Reinforcing Steel Institute (CRSI)

E. Caltrans Standard Specification, Section 39, 1992

1.5 SITE CONDITIONS

A. Weather limitations: Apply prime and tack coats for asphalt concrete when ambient temperature is above 50 degrees F (10 degrees C) and when the temperature has not been below 35 degrees F (1 degree C) for 12 hours immediately prior to application.

1. Do not apply when base is wet or contains excessive moisture.

B. Construct hot-mixed asphalt concrete surface course when atmospheric temperature is above 40 degrees F (4 degrees C) and when the base is dry.

1. Base course may be placed when air temperature is above 30 degrees f (-1 degree C) and rising.

PART 2 - PRODUCTS

2.1 ASPHALT CONCRETE PAVING

A. General: Use locally available materials and gradations that exhibit a satisfactory record of previous installation: Refer to Caltrans standard specification, Section 39, 1992.

B. Aggregate base: ¾-inch maximum aggregate size (Section 39-2.02)

C. Asphalt: PG 64-10 five percent (5%) to seven percent (7%) 85/100 penetration asphalt, mineral aggregate (Section 39-2.01)

D. Asphalt Aggregate: ½-inch maximum aggregate size (Section 39-2.02).

E. Prime Coat: Liquid asphalt, type SC-70, (Section 39-4.02).

F. Paint Binder (tack coat): Emulsified asphalt, type SS-1 (Section 39-4.02).

G. Portioning and Mixing: Section 39-3.03

H. Spreading Equipment: Section 39-5.01

2.2 EDGE RESTRAINT

A. General: Permaloc AsphaltEdge shall be installed per manufacturer's instructions.

B. Permaloc AsphaltEdge: 4" aluminum asphalt edge restraint, 0.210-inches (5.33 mm) thick.

C. Fasteners: 10-inch long, 3/8-inch spiral steel spikes

D. Finish: Milled aluminum, natural finish (ML).

PART 3 - EXECUTION

3.1 PLACING AGGREGATE BASE

A. Construct aggregate base with minimum 6-inch compacted thickness in compliance with the requirements of Section 39-5.00.

B. Spreading: Section 39-5.01.

C. Compaction: To 95% compaction and in accordance with Section 39-5.02.

D. Grading Tolerance: 0.05 foot (±) above or below proper grade, and such surface shall contain no ridges, valleys or sharp breaks.

3.2 PLACING ASPHALTIC CONCRETE

A. Remove loose material from compacted base course immediately before applying prime coat.

B. Prime Coat: Apply at a rate of 0.20 to 0.50 gallons per square yard, over compacted base course at a temperature of 105 degrees F to 175 degrees F.

1. Apply material to penetrate and seal, but not to flood surface.

2. Cure and dry as long as necessary to attain penetration and evaporation of volatile.

3. Additional asphalt shall be applied to any spots where color or other signs indicate that more asphalt is required to prevent breaking or raveling.

C. Tack Coat: Apply at a rate of 0.10 gallon per square yard of surface covered.

1. Apply to all vertical surfaces of existing building, concrete structures and construction joints against which asphalt concrete is to be placed.

2. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged and smeared surfaces.

D. Place hot-mix asphalt mixture on prepared surfaces, spread and strike off.

1. Construct asphaltic concrete with 3-inch minimum compacted thickness.

2. Spreading shall conform to Section 39-6.02.

a) Place areas in accessible to equipment by hand.

b) Place each course to required grade, cross section and compacted thickness.

E. Compaction shall conform to Section 39-6.03.

1. Immediately correct surface irregularities in finish course behind paver.

2. Remove excess material forming high spots with shovel or lute.

F. Joints: Make joints between successive days' work to ensure continuous bond between adjoining work.

1. Construction joints shall have the same density and smoothness as other sections of hot-mixed asphalt course.

2. Clean contact surfaces and apply tack coat.

3.3 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: Contractor shall obtain an independent testing laboratory to test in-place hot-mixed asphalt courses for compliance with requirements for thickness and surface smoothness.

1. Repair or remove and replace unacceptable paving as directed by the Owner's Representative.

B. Thickness: In-place compacted thickness tested in accordance with ASTM D 3549 will not be acceptable if exceeding following variations:

1. Surface Course: ± ¼-inch.

C. Surface Smoothness: Test finished surface of each hot-mixed asphalt course for smoothness, using 10-foot straightedge applied parallel with and at right angles to center line of paved area.

1. Surface shall not be acceptable if exceeding 3/16-inch tolerances for smoothness.

D. Check surface areas at intervals as directed by Owner's Representative.

3.4 OPENING PAVEMENTS TO TRAFFIC

A. Do not allow traffic, including construction traffic, on pavements until authorized.

END OF SECTION 32 12 00

SECTION 32 16 13
SITE CONCRETE

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS

A. U. S. Department of Commerce Standard

1. PS1 Construction and Industrial Plywood

B. American Concrete Institute (ACI) Publications

1. ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete
2. ACI 305 R Hot Weather Concreting
3. ACI 315 Details and Detailing of Concrete Reinforcement
4. ACI 318 Building Code Requirements for Reinforced Concrete
5. ACI 347 Recommended Practice for Concrete Formwork

C. American Society for Testing and Materials (ASTM) Publications

1. A 615 Deformed and Plain Billet-steel Bars for Concrete Reinforcement
2. A 706 Low-Alloy Steel Deformed Bars for Concrete Reinforcement
3. C 31 Making and Curing Concrete Test Specimens in the Field
4. C 33 Concrete Aggregates
5. C 38 Compressive Strength of Cylindrical Concrete Specimens
6. C 94 Ready-mixed Concrete
7. C 143 Slump of Portland Cement Concrete
8. C 150 Portland Cement
9. C 171 Sheet Materials for Curing Concrete
10. C 172 Sampling Freshly Mixed Concrete
11. C 309 Liquid Membrane-forming Compounds for Curing Concrete
12. C 618 Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

1.2 SUBMITTALS

A. Mix Design: In lieu of a design by a testing laboratory, mix design based on current materials previously evaluated by the concrete producer whose established methods of statistical quality control is in conformance with ACI 214 , will be acceptable. The mix designs together with certified test reports showing the results of the test specified for the various materials, and the results of the 28 day compressive strength tests of the concrete shall be submitted.

1.3 STORAGE OF REINFORCEMENT

A. Reinforcement: Store reinforcement in a manner that will avoid excessive rusting or coating with grease, oil, dirt, and other objectionable materials. Storage shall be in separated piles or racks so as to avoid confusion or loss of identification after bundles are broken.

1.4 CONCRETE

A. Contractor-furnished Mix Design

B. For permanent concrete facilities, design structural concrete in accordance with ACI 318.

C. Concrete: For structures, provide concrete having a minimum compressive strength of 4000 psi at 28 days and maximum aggregate size of 1 inch. Slump shall be 3 inches maximum. For flat work concrete, thrust blocks and encasements provide concrete having a minimum compressive strength of 3000 psi at 28 days and maximum aggregate size of 1 inch. Slump shall be 4 inches maximum.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: Cement shall be Type I or II conforming to ASTM C 150. All cement for exposed concrete surfaces shall be of the same type from the same manufacturing plant. Mix designs using Type I cement shall include 15 to 20 percent type C or type D fly ash conforming to ASTM C618. Mix designs using Type II cement may include 15 to 20 percent type C or type D fly ash conforming to ASTM C618 at Contractors option.

1. Owner’s representative may at his discretion, direct the Contractor to add lampblack to more closely match adjacent concrete.

B. Water: Water for mixing and curing, including free moisture and water in the aggregates shall be fresh, clean and potable.

C. Aggregates: Fine aggregates shall conform to specification ASTM C 33. Grading of coarse aggregates shall be in accordance with ASTM C 33, Table 2, size number 57.

D. Reinforcement: Reinforcing bars shall conform to ASTM A 615, Grade 60 or ASTM A 706.

E. Materials for Curing Concrete

1. Waterproof Paper: Conform to ASTM C 171, regular color.

2. Liquid Membrane-forming Compound: Conform to ASTM C 309, white pigmented, Type 2, Class B, and be free of paraffin or petroleum.

F. Anchorage: Items for anchoring work of other trades to concrete shall be of standard manufacture and of types to engage with anchors provided and installed under other sections.

G. Form Ties: Plastic or metal, factory fabricated removable or snap off types shall be used.

H. Grout and Dry Pack:

1. Cement grout shall consist of one part Portland cement, two parts sand, proportioned by volume, and sufficient water to form a workable mix.

I. Controlled Density Fill (CDF): CDF consists of a fluid, workable mixture of aggregate, Portland cement, and water. The aggregate for CDF should meet the following gradation requirements:

Sieve Size	Percentage Passing(by weight)
1/2”	100
3/8”	70-100
No. 200	0-12

The 28-day compressive strength shall be minimum 150 psi as per geotechnical recommendations. The actual CDF mix proportion and slump should be determined by the Contractor to meet the requirements of the method used to install and backfill the structure.

2.2 FORMS

A. General Requirements: Forms shall be provided for all concrete not indicated or specified otherwise. Set forms true to line and grade and maintain so as to insure completed work within the allowable tolerances specified, and mortar-tight. The Contractors shall be responsible for the adequacy of forms and form supports. Arrange bolts and rods used for internal ties so that when the forms are removed, all metal will be not less than 1-1/2 inches from any surface for concrete which will be exposed to weathering or for water-tight concrete, and not less than one inch for unexposed concrete.

B. Materials for Forms: Forms shall be of wood, plywood, or steel. Forms for concrete pavements shall be metal. Wood forms for surface exposed to view in the finished structure and requiring a smooth form finish, shall be plywood. For unexposed surfaces, undressed square-edged lumber may be used. Plywood, other than for lining, shall be concrete-form plywood not less than 5/8-inch thick and shall conform with Department of Commerce product standard PSI, BB concrete form grade, Class II, free of raised grain, torn surfaces, worn edges, patches, or other surface defects which would impair the texture of the concrete surface. Surfaces of steel forms shall be free from irregularities, dents, and sags.

C. Coating: Before placing the concrete, coat the contact surfaces of forms with a non-staining form release compound. For surfaces not exposed to view in the finished structure and when the temperature is above 45 degree F, sheathing may be wetted thoroughly with clean water. Remove all excess coating by wiping with cloths. Reused forms shall have the contact surfaces cleaned thoroughly; those which have been coated shall be given an additional application of the coating.

D. Tolerances and Variances: The Contractor shall set and maintain concrete forms to ensure that, after removal of the forms and prior to patching and finishing, no portion of the concrete work will exceed any of the tolerances specified. Tolerances shall conform to ACI 347.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Mixing: Mix all concrete in accordance with ASTM C 94. In emergencies, concrete may be mixed at the site of work if so authorized by the Owner's Representative.

B. Reinforcement; Provide all reinforcement bars, and other reinforcing materials as indicated together with all necessary wire ties, chairs, spacer, supports, and other devices necessary to install and secure the reinforcement properly. All Reinforcement, when placed, shall be free from loose rust, scale, oil, grease, clay and other coatings and foreign substances that would reduce or destroy the bond.

1. Splicing of Reinforcement: Splicing of reinforcement shall be in accordance with ACI 318, except as indicated otherwise or modified herein. Sides and ends of welded wire fabric shall be overlapped not less than one mesh.

C. Setting Miscellaneous materials: Anchors and bolts, including but not limited to those for machine and equipment bases, frames or edgings, hangers and inserts, pipe supports, pipe sleeves, metal ties, conduits, drains and all other materials in connection with concrete construction; shall, where practicable be placed and secured in position when the concrete is placed. Set anchor bolts for machines to templates, plumb carefully and check for location and elevation with an instrument, and hold in position rigidly to prevent displacement while concrete is being placed.

D. Concrete Control: No concrete shall be placed after there is evidence of initial set. Concrete placement will be permitted only when weather conditions allow proper placement and consolidation. Consolidation of concrete shall be with internal concrete vibrators supplemented by hand spading, rodding, and tamping. Vibrating equipment shall be adequate to thoroughly compact the concrete.

3.2 CONVEYING AND PLACING CONCRETE

A. Conveying: Deposit concrete as nearly as practicable in its final position in the forms. At any point in the conveying and before concrete is deposited in the forms, the free vertical drop of the concrete shall not exceed 4 feet. Clean conveying equipment thoroughly before each run. Concrete which has segregated in conveying shall be removed and disposed of as directed by the Owner's representative.

B. Placing: The placement of concrete in uncovered areas during periods of precipitation will not be allowed. Placing concrete in water will not be allowed. Subgrades of earth or other material shall be properly prepared and, if necessary, covered with heavy building paper or other suitable material to prevent the concrete from becoming contaminated. Before placing concrete on porous subgrades, they shall be dampened as required to prevent water of hydration from being absorbed into the subgrade. Forms shall be clean of dirt, construction debris, water, snow and ice. The method of depositing concrete shall be such as to avoid overworking, which may result in segregation. Water which accumulates on the surface of the concrete during placing shall be removed by absorption with porous materials in a manner that prevents removal of cement. Pumping of concrete through aluminum pipe will not be permitted.

C. Vibration: Compact all concrete, with the exception of concrete slabs 4 inches or less in depth, with high frequency, internal, mechanical vibration equipment supplemented by hand spading. Consolidate concrete slabs 4 inches or less in depth by spading and settling with a heavy leveling straight edge.

D. Embedded Items: Place all sleeves, inserts, anchors and embedded items required for adjoining work or for its support prior to concreting. All subcontractors, whose work is related to the concrete or must be

supported by it, shall be given ample notice and opportunity to introduce or furnish embedded items before the concrete is placed. Galvanize all ferrous metal sleeves, inserts, anchors and other embedded ferrous metal items exposed to the weather or where rust would impair the appearance or finish of the structure. Embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids. Aluminum embedded in concrete shall be given a heavy brush coating of bitumastic.

E. Concrete in Hot Weather: Follow the recommended practices in ACI 305. Take extra care in hot weather to reduce the temperature of the concrete being placed, and to prevent rapid drying of newly placed concrete. When the outdoor ambient temperature is more than 90 degrees F, the temperature of the concrete as placed shall not exceed 90 degrees F; shade the fresh concrete as soon as possible after placing; and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit curing without damage.

F. Joints:

1. Construction Joints: Locate and install construction joints as indicated, or if not indicated, locate so as not to impair strength and appearance of the structure. Match adjacent joints to continue patterns. Provide keyways at least 1-1/2 inches deep in construction joints in walls and between walls and adjacent slabs. Continue reinforcing across construction joints unless otherwise indicated.

3.3 FINISHES

A. Concrete Slab Finishes: Slab finishes shall be true planes with no deviation exceeding 1/8-inch when tested with a 10 foot long straightedge. Surfaces shall be pitched to drains. Surfaces shall be screeded and floated to the required finish level with no coarse aggregate visible before finishing as specified below.

1. Give a monolithic finish to slabs unless otherwise specified.

3.4 CURING AND PROTECTION

A. Slabs: Cure finished slab surfaces adequately as specified hereinafter.

1. Curing with Water: Moist or wet-curing with water or by complete covering with waterproof paper shall be continuous for 7 days at temperatures of 60 degrees F and above, and for longer periods at lower temperatures, as necessary.

B. Curing General: Protect concrete adequately from injurious action by sun, rain, flowing water, frost, and mechanical injury, and do not allow to dry out from the time it is placed until the completion of the curing period. Accomplish curing by application of liquid membrane curing compound, except as specified otherwise herein. Do not use membrane-forming compound on surfaces where its appearance would be objectionable, on formed surfaces for which special finish is specified, on any surface to be painted, waterproofed, tiled, roofed, of where coverings are to be bonded. Initiate curing immediately following the removal of forms. Maintain the temperature of the air next to the concrete at not less than 40 degrees F for the full curing period.

1. Moist Curing: The entire exposed surface shall be wetted thoroughly with a fine spray of water and then covered with waterproofed paper as specified elsewhere herein. Lay sheets directly on the concrete surface and overlap 12 inches when a continuous sheet is not used. The curing medium shall be not less than 18 inches wider than the concrete surface to be cured, and shall be

weighted down on the edges just outside the forms and over the transverse laps to form closed joints. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

2. Liquid Membrane-forming Compound Curing: Accomplish liquid membrane-forming compound curing by applying a white-pigmented liquid compound, free of paraffin or petroleum, over the concrete surface to restrict evaporation of the mixing water. Seal all joint openings except sawed joints at the top by inserting moistened paper or fiber rope, or covering with strips of waterproof material, prior to application of the curing compound, in a manner to prevent the curing compound from entering the joint. Seven days following the placing of the liquid membrane-forming compound shall be considered as the end of the curing period and the basis for determining when joint sealing material will be placed in joints.

3. Application of Curing Compound: Apply the compound immediately after the surface loses its water sheen and has a dull appearance and before joints are sawed. Agitate curing compound thoroughly by mechanical means during use and apply uniformly in a 2 coat continuous operation by suitable power-spraying equipment.

3.5 FIELD SAMPLING AND TESTING

A. Sampling and Testing: Owner will provide for the services testing laboratory to make and test concrete cylinders. Contractor shall cooperate and assist the Owner or testing agency as required in taking concrete samples from concrete furnished for this project. If the cylinders fail to meet the minimum specifed strength requirements, the Contractor shall pay for the cost of any additional testing to verify complience with the Specifications. If the concrete still fails the additional testing, the Contractor shall pay the costs to remove and replace the concrete in question.

3.6 CLEANUP

A. Equipment washdown is not permitted anywhere on the campus.

B. Remove all concrete material from surfaces upon which it may have splattered during construction work.

C. Remove all excess concrete material from the site. No bits, chips, blobs, or chunks are to be left or disposed of in landscape areas. Clean all Construction debris from landscape areas.

END OF SECTION 32 16 13

SECTION 32 1800

CONCRETE FLATWORK AND SITEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Provide site concrete for pedestrian pavements, walls, curbs, and footings, complete, as shown and as specified in landscape drawings, including but not limited to:

1. Concrete pavement on grade and on structure.
2. Concrete curbs.
3. Concrete walls (planter).
4. Concrete wall (with stone cap)
5. Concrete footings.

B. Related Work:

1. Section 03 0000 - Cast In Place Concrete
2. Division 07 - Waterproofing
3. Section 12 9300 - Site Furnishings and Features
4. Section 32 8400 - Planting Irrigation

1.02 REFERENCES

A. State of California, Business and Transportation Agency, Department of Transportation's (CalTrans) "Standard Specifications" (CSS).

B. ASTM - American Society for Testing and Materials

C. ACI - American Concrete Institute, Manual of Concrete Practice, including but not limited to:

1. ACI 301, "Specifications for Structural Concrete for Buildings."
2. ACI 304: "Recommended Practice for Measuring, Mixing, and Placing Concrete."
3. ACI 308: "Standard Practice for Curing Concrete.'
4. ACI 318, "Building Code Requirements for Reinforced Concrete."

D. CB Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

E. CBC – California Building Code

F. LEED – LEED-BD+C Reference Guide 2009

1.03 DEFINITIONS

A. Percent Compaction: ASTM D1557, percentage of the maximum in-place dry density of the same material as determined by Soils Engineer.

1.04 SUBMITTALS

A. Product Data: Manufacturers' current catalog cuts and specifications for the following:

1. Expansion joint filler, sealant, backer rod and bond breaker.

2. Air-entrainment.

3. Curing Compound.

4. Joint Sealant

B. Samples. Contractor shall provide samples until color and finish have been approved by the Landscape Architect. Furnish samples of the following:

1. Coarse Aggregate

2. Color additive sample chips indicating pigment numbers and required dosage rates.

3. Joint Sealant: Color chart.

C. Certificates:

1. Reinforcing Steel: Certificate of compliance

2. Concrete Mix Design: Ticket for each batch delivered showing the following:
   a. Mix identification.
   b. Weight of cement, aggregate, water, and admixtures, aggregate sizes/proportion, and air entrainment.

1.05 QUALITY ASSURANCE

A. Field-Constructed Mock-up: Prior to installation of concrete work, erect mock-ups for each type of work required to verify selections made under sample submittals. Build mock-ups to comply with the following requirements, using materials and same base construction including special features for expansion joints and contiguous work as indicated for final unit of work.

1. Locate mock-ups on site where indicated or as directed by the Owner or Landscape Architect.

2. Provide a separate 4 ft. x 4 ft. full depth pavement panel, and a full height x 3 ft long, full width planter wall panel, for each finish to serve as standard of quality for all work. Mock-up shall include all jointing and edge conditions.

3. No concrete work shall begin until the samples and mockups have been approved by the Landscape Architect and becomes the standard of comparison for all respective work.

4. Retain mock-ups during construction. Do not alter, move or destroy section until the work is completed. When directed, demolish mock-ups and remove from site.

5. Mock-ups may be incorporated as part of Work if conforming to specified requirements, and if accepted by the Landscape Architect.

B. Contractor shall arrange and pay for concrete tests to be made by an independent testing laboratory acceptable to the Landscape Architect. Laboratory shall take, prepare, and cure samples, and do all field and laboratory testing. Promptly submit five copies of test reports to the Landscape Architect. Testing shall comply with ASTM C94-90.

1. Strength Tests: Strength tests shall be made from each 100 cubic yards of concrete or fraction thereof each day. For each test, three cylinders shall be molded, one to be used for a 7-day test.

2. Air Content and Slump Tests: At the time samples are taken for strength tests, the laboratory shall make slump and air content tests.

3. Coefficient of Friction: Friction tests shall be made from samples that have been approved for color, joints and finish.

4. Should tests show that concrete is below specified strength or coefficient of friction, Contractor shall remove all such concrete off the site. Full costs of removal of rejected concrete, its replacement with concrete of specified strength, and retesting shall be borne by the Contractor.

C. Lines and Levels: To be established by a licensed Surveyor or registered Civil Engineer.

D. Design of Concrete Mix: Employ approved commercial testing laboratory to design concrete mixes as follows:

1. Minimum Compressive Strength at 28 Days:
   a. Slabs on structure: 2,500 psi
   b. Slabs on Grade: 2,500 psi
   c. Subbase Headers and Curbs: 3,000 psi
   d. Walls, Footings and Foundations: 4,500 psi
   e. Concrete Slump:
      1) Minimum: Two (2) inches
      2) Maximum: Four (4) inches
   f. Maximum Water-Cement Ratio:
      1) Slabs On-grade: 8.75 gallons per sack of cement
      2) Foundations: 6.75 gallons per sack of cement

E. Slip Resistance: All cast-in-place concrete to meet a slip resistance coefficient of 0.5 for flat surfaces and 0.8 for ramps

F. Colored Concrete: Achieve color by integrally mixing coloring agent with concrete. Match color of existing concrete where adjacencies occur.

G. All landscape retaining walls shall be waterproofed to conform with requirements set forth in relevant sections of Project Specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging and Labeling: Furnish materials in manufacturer's unopened, original packaging, bearing original labels showing quantity, description and name of manufacturer. Verify that all materials and components are adequately padded and securely bound in such a manner that no damage occurs to the product during delivery and unloading at the site.

B. Do not deliver items until site conditions are adequate to receive the work. Protect items from weather while in transit, and against moisture and abrasion after delivery.

C. Storage: Protect materials from weather. Store materials a minimum of 6 inches above ground on framework or blocking and protect with waterproof covering allowing for adequate air circulation and ventilation. Do not store materials in damp portions of building.

D. Delivered Mixes: Coordinate delivery so that mixes may be immediately poured upon arrival at site.

E. Components and Accessories:

1. Fittings and Reinforcements: Protect from rust, soil and oil contamination at all times. Store on pallets above ground.

2. Templates: Protect from damage. Test accuracy prior to each use.

1.07 PROJECT/SITE CONDITIONS

A. Existing Conditions: Protect all existing waterproofing during formwork and concrete pours on top and adjacent to walls, structural slabs and other improvements.

B. Water and Dust Control: Maintain control of concrete dust and water at all times. Do not permit adjacent planting areas to be contaminated. Clean up all debris resulting from this work at the end of each day's work.

1.08 SEQUENCING AND SCHEDULING

A. Coordination: Coordinate all items of other trades to be furnished and set in place. Coordinate proper installation of all accessories embedded in the concrete and for the provision of holes, openings, etc., necessary to the execution of the work of the trades in ample time that progress of the work is not delayed.

B. Cutting/Patching: Perform as necessary to comply with above injunction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C150, Type I or II Portland Cement. Use only one brand and type for entire job.

B. Coarse Aggregate:

1. Description: ASTM C33, hard, durable, uncoated, washed, graded, cleaned and screened crushed rock or gravel aggregate for regular weight concrete. Do not use crusher-run stone or bank-run gravel. Select dark gray color aggregate to match building metal panels.

2. Grading: Do not use aggregate which has a maximum size exceeding 1/5 of the narrowest dimension between sides of forms of the member for which the concrete is to be used, nor larger than 3/4 of the minimum clear spacing between reinforcing bars. Do not use coarse aggregate which exceeds 3/4 in. for paving.

C. Fine Aggregate:

1. Description: ASTM C33, clean, hard and durable sand. Do not use sand coated

2. Grading Requirements:

Sieve Size	Percent Passing
No. 16 (1.19 mm)	45 - 70
No. 50 (0.297 mm)	15 - 30
No. 100 (0.149 mm)	3 - 8

D. Water: Clean, potable concrete mixing water free from injurious amounts of salts, oils, acids, alkalis, organic materials or other deleterious matter. As available from Owner. Transport as required.

2.02 ADMIXTURE COMPONENTS

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

2.03 INTEGRAL COLOR ADDITIVE

A. Concrete pavement shall have integral colored concrete by LM Scofield or Davis colors. Dark grey to match building metal panel color.

B. Pigments shall contain pure, concentrated mineral pigments specifically processed for mixing into concrete and complying with ASTM C 979.

C. If pigments are to be added to mix at Project Site, furnish pigments in pre-measured Mix-Ready disintegrating bags. Field sample will be required for determining the exact amount of additive.

D. Use additive and sealers as recommended by manufacturer.

E. Other admixtures complying with ASTM C494-86 or ASTM C618-89a may be used with approval of Landscape Architect. No chlorides will be permitted.

2.04 AGGREGATE BASE

A. Aggregate base shall be hard, durable particles of stone, gravel or other finely divided mineral matter to produce a dense, compacted base.

B. Base course aggregate shall be uniformly graded from coarse to fine and shall be as per CALTrans Class 2 aggregate and the following:

Screen Size	Percent Passing by Weight
1" (25 mm)	100
3/4" (19 mm)	90 – 100
No. 4 (4.75 mm)	35 – 60
No. 30 (0.595 mm)	10 – 30
No. 200 (0.074 mm)	2 – 9

2.05 ACCESSORIES

A. Reinforcements:

1. Reinforcing Bars: ASTM A615 Grade 40, or 60 deformed billet-steel bars, clean and free from rust, scale, or coating that will reduce bond.

2. Smooth Dowels for Expansion Joints: ASTM A615, Grade 40 smooth, billet-steel bars, shop painted with iron-oxide zinc-chromate primer.

3. Tie Wires: 18 ga. min. black annealed.

4. Snap Ties: Snap-off metal of fixed length capable of leaving no metal within 1 1/2 in. of surface nor causing fractures, spall or other defects larger than one (1) in. diameter.

B. Expansion Joint Materials:

1. Premolded Joint Filler: ASTM D1751, non-extruding and bituminous type resilient filler, compatible with sealant, and having a "guide strip" removable depth gauge.

2. Joint Sealant: Integrally colored, ASTM C290, as per "Sonolastic SL2" by Sonneborn, (www.buildingsystems.basf.com, 800.433.9517); BASF (www.buildingsystems.basf.com, 800.433.9517); W.R. Meadows (www.wrmeadows.com, 800.342.5976); Sherwin Williams (www.sherwin-williams.com, 800.474.3794). Color to match adjacent paving.

3. Bond Breaker: Pressure-sensitive tape as recommended by sealant manufacturer to suit application.

C. Forms:

1. Steel or wood of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.

2. Use forms that are straight and free of distortions and defects.

3. Use flexible spring forms or laminated boards to form radius bends as required.

4. Finish (for walls) as indicated on Drawings.

D. Form Release Agent: Colorless non-staining, free from oils. Chemical agent shall not impair bonding of paint or other proposed coatings

E. Form-Facing Materials:

1. All Surfaces: Of sufficient strength to hold concrete properly in place and prevent leakage of water from forms.

2. Exposed Vertical Surfaces: A-Matte, Two-step MDO plywood made for concrete forming. No wood-textured finish will be permitted on exposed concrete unless specified as such.

F. Curing Compound: ASTM C309, Type I-D, Class A.

G. Dampproofing: ASTM C836-81, Fluid-V single component, bitumen-modified, moisture-curing polyurethane Tremproof 250 GC by Tremco, (800) 321-7906. Alternates: Concrete Sealer X-3 by Stone Technologies (423) 503-4490; Deco 20 by Deco Products, (717) 484.6131

H. Waterproofing: as specified elsewhere, Division 07 Waterproofing. All on-structure walls, footings, anchorages, and embedments shall be waterproofed compatibly and seamlessly with the building waterproofing system. Waterproofing shall conform with the applicable Sections of the building specifications including type, coverage and warranty.

I. Chamfer Strips: Rigid PVC, size per drawings, in maximum possible lengths.

J. Slip Sheet: 40 mil PVC sheet

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Verify that subgrade preparation for concrete paving has been completed including base course prior to commencement of work.

2. Verify that the waterproofing, drain board, protection board, and structural slab drains have been installed by others and accepted by Architect.

B. Surface Drainage:

1. Report in writing conflicts discovered on the site or prior work done by others, which would prevent positive drainage.

2. Do not permit finished paving surfaces to vary more than 1/4 in. measured with a 10 ft. metal straightedge, except at grade changes. No "birdbaths" or other surface irregularities will be permitted. Properly correct irregularities.

3.02 PREPARATION

A. Templates: Use templates for all anchor plates, bolts, inserts and other items embedded in concrete. Accurately secure so that they will not be displaced during placing of concrete.

B. Piping and Conduit: Do not embed piping, other than electrical conduit, in structural concrete. Locate conduit to maintain strength of structures at maximum. Verify size, length and location of electrical conduit.

C. Coordinate the installation of on-structure concrete work with the installation of embeds in the structural slab and the related waterproofing and drainage systems.

D. Aggregate Base Course: Compact base course to thicknesses shown on Drawings to 95% compaction.

3.03 INSTALLATION

A. Formwork:

1. Footings:
   a. Prepare subgrades per conditions identified in drawings.
   b. Coordinate work with other trades.
   c. Verify all grades and subgrades and work by others.
   d. Verify all steel reinforcing have met steel schedule and spacing per drawings and local codes.

2. Construct forms accurately to dimensions, plumb and true to line and grade. Brace and tie as required to maintain position and shape during placing of reinforcing and concrete.

3. Wavy surfaces and bulged walls or slab surfaces in finished work will be rejected.

4. Extend wood forms for all exposed concrete at least 6 in. below finish grade.

5. Do not disturb earth at bottoms of excavations for footings or foundations. Maintain these areas free of water, properly cleaned and leveled off.

6. Assemble forms so that all construction joints appear only as shown on Drawings and as accepted by Landscape Architect. Incorporate all formwork joints into required reveal and expansion joints. No exposed form joints will be permitted.

7. Install form liners/facings as required.

8. Use PVC chamfer strips to form chamfers at all exposed edges as shown on Drawings.

9. Thoroughly clean all formwork prior to pouring concrete. Where no form coating is used, wet down all wood.

B. Reinforcements:

1. Placement: Clean, bend and place reinforcements per ACI Manual of Concrete Practice. Do not extend bars through expansion joints.

2. Supports: Accurately and securely fasten or support reinforcements to prevent displacement before or during pouring. Hang footing bars from forms. Support wire mesh with suitable metal cradles.

3. Reinforcement Splices: Reinforcing bars - 24 bar diameter minimum, except as otherwise noted.
   a. Notify Landscape Architect 48 hours prior to pour.
   b. Place concrete in conformance to the ACI Manual of Concrete Practice.

C. Placing:

1. Concrete placement shall conform to Section 03 3000 Cast-In-Place Concrete.

2. Concrete slabs for pavement shall be formed, placed, vibrated, and finished by hand using conventional methods. Concrete curbs shall be constructed in the same manner.

3. Place concrete on moistened subgrade monolithically between construction joints. Deposit to full depth in one operation. Consolidate immediately. After depositing concrete, screed and darby or bullfloat.

D. Removal of Forms:

1. Form removal shall conform to Section 03 3000 Cast-In-Place Concrete.

2. Remove no sooner than at seven (7) days after each pour.

E. Cleaning:

1. Removal: Remove all projecting fins, bolts, wire, nails, etc., not necessary for the work, or cut them back 1 in. from the surface and patch in an inconspicuous manner.

2. Snap Ties: Immediately after removal of forms, cut off snap ties extending from the face of concrete to at least 1 in. deep in the concrete. Fill or plug as detailed in Drawings.

3. Voids: Fill holes with a 1:3 cement/sand mortar with the same color as the adjoining concrete. Mix and place the mortar as dry as possible and finish flush with the adjacent surface.

F. Patching of Walls:

1. Corrective Patching: Correct all defects in concrete work. Chip all voids to a depth of at least 1 in. with the edges perpendicular to the surface and parallel to form markings. Fill all voids, surface irregularities, or honeycombing by patching or rubbing. Insure that all concrete surfaces so repaired duplicate the appearance of the unpatched work.

2. Finishings: Work finish surface texture as specified below.

G. Defective Work: Remove in its entirety and replace all defective concrete work which after corrective patching, rubbing, etc., fails to duplicate the appearance of unpatched work and/or conform to the standards set forth in these Specifications.

3.04 FINISHES

A. Finishes, General:

1. Comply with ACI 302.1R for screeding, re-straightening and finishing operations for concrete surfaces. Do not wet concrete surfaces.

2. Screed level all surfaces with a wood float.
   a. Do not screed surfaces until the surfaces have become stiff enough to withstand the pull without cracking.
   b. Use hand methods only where mechanical floating is not possible.
   c. Adjust floating to compact surface and produce a uniform texture.

3. After floating, test flatwork surface for trueness with a 10-foot straight-edge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

4. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to one-half inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

5. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing as per the Drawings and reviewed mock-ups:

B. Sand-Blast Finish:

1. Time Restriction: Perform sand blasting no sooner than 21 days after pouring each section of concrete.

2. Continuity: Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish.

3. Depth of Cut: Use an abrasive grit of the proper type and gradation to expose the aggregate and surrounding matrix surfaces to match reviewed mockups.

4. Backup Boards: Using backup boards to maintain a uniform corner or edge line.

5. Uniformity: Use same nozzle, nozzle pressure and blasting technique as used for sample panel.

6. Control: Maintain control of abrasive grit and concrete dust in each area of blasting.

7. Clean Up: Remove all expended abrasive grit, concrete dust and debris at the end of each day of blasting operations.

C. Broom Finish:

1. Obtain by drawing a stiff bristled broom across a floated finish.

2. Direction of brooming to be perpendicular to direction of paving, or as shown on Drawings.

3.05 JOINTS (FLATWORK)

A. Expansion Joints:

1. Locations: Provide joints at locations and intervals shown on the Drawings, and where concrete paving abuts buildings, curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

2. Placement: Place joint materials with top edge 1/2 in. below the paved surface to full width and depth of joint. Securein place to prevent movement. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint

3. Forming: Form joints and other edges in the fresh concrete using an edging tool to provide a smooth uniform impression. Strike all edges before and after brooming.

4. Sealing: After the curing period, carefully clean expansion joints and fill with joint compound to 1/4 in. below adjacent paved surface. Do not permit spillage on paved surfaces or overflow from joint.

B. Score Joints, hand tooled:

1. Form in fresh concrete using a jointer to cut the groove so that a smooth uniform impression is obtained. Strike all joints before and after finishing.

2. Perform in a continuous manner, avoiding misalignment. Redo all crooked or misaligned joints at no cost to Owner.

3.06 DAMPPROOFING

A. Conform with relevant architectural specifications for dampproofing

B. Preparation of Surfaces:

1. Clean all surfaces to be dampproofed. Remove all dirt, grease, and other foreign matter which might interfere with adhesion and penetration. Allow surfaces to dry thoroughly.

2. Carefully repair all cracks, holes, voids, open areas and other defects in concrete surfaces to be dampproofed. Use Portland Cement mortar; strike flush and permit to dry.

3. Thoroughly clean all excess mortar from concrete surfaces after drying.

C. Application of Dampproofing Compound:

1. Cover entire retaining surface of backside of walls from top of footing to finished grade with two brush coats of specified dampproofing. Apply according to manufacturer's current printed instructions.

2. Apply first coat at minimum rate of 80 square feet per gallon of material. Brush into surface thoroughly making sure that coverage is uniform.

3. Allow first coat to dry for 24 hours and apply second coat at minimum rate of 150 square feet per gallon of material. Brush second coat at right angles to first coat to assure thorough coverage of entire surface. Apply dampproofing in a clean line conforming to finished ground grade.

4. Provide a completed dampproofing coating which is a continuous, uniform, unbroken, impervious film, free from pinholes and other surface breaks.

3.07 WATERPROOFING

A. Conform with relevant architectural specifications for waterproofing.

3.08 PROTECTION AND CURING

A. Protection:

1. Protect concrete against rapid drying and damage by rain (frost).

2. Keep concrete moist for at least 7 days. Protect with liquid curing compound, or a covering that will not stain or discolor finished concrete surfaces. Obtain acceptance of proposed method prior to use.

B. Spraying: Spray concrete during the curing period as frequently as drying conditions may require.

C. Curing: Cure concrete in accordance with the ACI Manual of Concrete Practice. During curing period, maintain concrete above 70 degrees F. for at least 3 days or above 50 degrees F. for at least 5 days.

D. Damage and Defacement: Protect all concrete work against damage and defacement during subsequent construction operations until final acceptance.

3.09 FIELD QUALITY CONTROL

A. Samples: Owner will select a qualified testing laboratory to take samples for testing during the course of the work as considered necessary.

B. Cost of Testing: Paid for by the Owner.

C. Rejected Materials: Remove off the site all concrete below specified strength.

D. Cost of Removal and Retesting: Pay for full costs of removal of rejected concrete and its replacement with concrete of specified strength and retesting.

END OF SECTION 32 1800

SECTION 32 8400
IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. Work Included: Order and furnish all labor, materials, supplies, tools and transportation and perform all operations in connection with and reasonably incidental to complete installation of the irrigation system as indicated in the Contract Documents. Items hereinafter are included as an aid to pricing, and are not necessarily a complete list of work items.

1. Trenching, stockpiling, excavation, backfill materials and refilling trenches.

2. Furnishing materials and installation for complete system including piping, backflow prevention assembly, valves, fittings, tree bubbler heads, subsurface drip system, automatic controls and final adjustment of system to insure complete and uniform coverage.

3. Line voltage connections to the irrigation controllers and low voltage control wiring from controllers to remote control valves.

4. Replacement of unsatisfactory materials.

5. Clean-up

6. All work of every description mentioned in the specification and/or addenda thereto, and all other labor, and materials reasonably incidental to the satisfactory completion of the work, including clean up of the site, as directed by the Owner's Agent.

7. Tests.

8. Record drawings.

9. Maintenance and Warranty Period

B. Work Not Included:

1. Water stubout from building domestic water.

2. 120 volt A.C. electrical and wired ethernet/LAN stub-out to controller location.

3. Electrical conduit through/under building

C. Related Sections:

1. Section 02935 – Establishment Maintenance

3. Section 02930 – Plants

4. Section 02920 – Turf and Grasses

5. Section 02910 – Planting Preparation

1.2 GENERAL REQUIREMENTS

A. OSHA Compliance: All articles and services covered by this specification shall meet or exceed the safety standards established by Cal/OSHA, together with all amendments in effect as of the date of this specification.

B. Codes and Standards: Comply with all applicable codes and standards.

1. All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; the Uniform Plumbing Code, published by Western Plumbing Officials Association; and other State or local laws or regulations. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes.

2. When the specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the specifications shall take precedence over the requirements of the said rules and regulations.

3. The Contractor shall furnish, without any extra charge, any additional material and labor when required by the compliance with these rules and regulations, though the work be not mentioned in these particular specifications or shown on the drawings.

4. The Contractor shall erect and maintain barricades, guards, warning signs and lights as necessary or required by Cal/OSHA regulations for the protection of the public or workmen.

5. Any existing buildings, equipment, piping, pipe covering sewers, sidewalks, landscaping, etc., damaged by the Contractor during the course of this work shall be replaced or repaired by the Contractor in a manner satisfactory to Owner's Agent and at Contractor's expense, and before final payment is made. The Contractor shall be responsible for damage caused by leaks in the piping systems being installed or having been installed by him. He shall repair, at his own expense, all damage so caused, in a manner satisfactory to Owner's Agent.

1.3 SUPERVISION AND WORKMANSHIP

A. The Contractor, personally or through an authorized and competent representative, shall supervise the work constantly, and shall as far as possible keep the same foreman and workmen on the job from commencement to completion. The workmanship of the entire job must in every way be first class, and only experienced and competent workmen will be allowed on the job.

1.4 LAYOUT OF WORK

A. The Contractor shall stake out the irrigation system as shown on the drawings. These areas shall be checked by the Contractor and Owner's Agent before construction is started. Any changes, deletions or additions shall be determined at this check.

1.5 INSTRUCTION

A. After the system has been installed and approved, the Contractor shall instruct the Owner's Agent in complete operation and maintenance of the irrigation system.

1.6 SUBMITTALS

A. Substitutions: Submit 6 copies of catalogue information on materials that are to be proposed for substitution. No substitution will be permitted without prior written approval by the Owner's Agent.

Complete material list shall be submitted prior to performing any work.

1.7 MAINTENANCE PERIOD

A. Contractor shall provide maintenance for the irrigation system installed under this Contract from beginning of work until end of Maintenance and Warranty Period.

B. Maintenance of system includes, but is not limited to: flushing system and adjusting heads, providing optimum amounts of water to plants, replacing lost, stolen or damaged equipment, reprogramming controller, and hand watering as required for plant establishment.

1.8 WATER AUDIT

A. See Section 02935 "ESTABLISHMENT MAINTENANCE" for performance of water audits.

1.9 WARRANTY PERIOD

A. Contractor shall provide a one-year guarantee for Work of this Section. On Contractor's letterhead:

1. Warrant that irrigation system has been installed according to Drawings and specifications, and that system will be free of defects in products and installation for 1 year from Final Acceptance. Manufacturer's warranties shall only supplement this warranty.

2. Agree to repair or replace defective work, or adjacent work that is damaged by such defects, with the exception of ordinary wear and tear**,** abuse or neglect. This includes damage to site improvements caused by settlement of improperly compacted trench backfill. When the specifications call for materials or construction of a better quality or larger size than required by the abovementioned rules and regulations, the provision of the specifications shall take precedence over the requirements of the said rules and regulations.

3. Owner reserves the right to make temporary repairs as required.

PART 2 - MATERIALS

2.1 PIPE AND FITTINGS

A. Main lines (constant pressure) shall be 1120 Schedule 40 PVC plastic pipe. All main lines shall be connected with Schedule 40, Type I, Grade I, PVC solvent weld fittings.

1. PVC main lines shall conform to the specifications of ASTM designation D 1785, ANSI NSF 14, SDR 21.0.

2. Fittings for main lines shall be Schedule 40 PVC, conforming to the specifications of ASTM designation D 2466, ASTM designation D 2467, standard weight, as manufactured by "Dura," "Lasco," or accepted substitute.

B. Main lines (unsleeved under paving, constant pressure) shall be copper type K, soft annealed tubing.

1. Copper tubing shall conform to ASTM B88 - 09 standard specification for seamless copper water tube.

2. Fittings shall be wrought copper solder joint fittings, conforming to ANSI/ASME standard B16.22.

3. Joints shall be soldered in compliance with specifications of ASTM B828-02 standards.

4. Coat all copper tubing with coal tar epoxy and wrap with 50-mil polyethylene tape to 6" beyond connection to PVC pipes.

B. Risers and fittings for backflow prevention device shall be composition bronze, 125 pound class.

1. Bronze pipe and fittings shall conform to ASTM B62 - 09 standard specification for composition bronze castings.

2. Coat all below grade bronze pipe and fittings with coal tar epoxy and wrap with 50-mil polyethylene tape to 6" above finish grade.

C. Lateral lines (non-pressure) shall be 1120 Schedule 40 PVC plastic pipe. All main lines shall be connected with Schedule 40, Type I, Grade I, PVC solvent weld fittings.

1. PVC lateral lines shall conform to the specifications of ASTM designation D 1785, ANSI NSF 14, SDR 21.0.

2. Fittings for main lines shall be Schedule 40 PVC, conforming to the specifications of ASTM designation D 2466, ASTM designation D 2467, standard weight, as manufactured by "Dura," "Lasco," or accepted substitute.

D. Connections between main lines and Remote Control Valves shall as detailed on Drawings.

E. Risers shall be as detailed on Drawings.

F. Sleeves: All PVC piping running under a driveway or sidewalk shall be installed in 1120 Schedule 40 PVC Plastic Pipe. All sleeves shall be two sizes larger than the irrigation piping. Length of sleeve shall overhang a minimum of 6 inches on each side of the crossing.

2.2 QUICK COUPLING VALVES

A. Quick coupling valves shall be as listed on the drawings.

2.3 CONTROLLERS

A. Controller, and controller enclosure, shall be as listed on the drawings.

2.4 REMOTE CONTROL VALVES

A. Remote control valves shall be as listed on the drawings. Sizes of remote control valves shall be as indicated on drawings.

2.6 GATE VALVES

A. 3" and smaller gate valves shall be class 200 bronze construction with operating wheel, non-rising stem and screwed connections.

1. Install in 10" diameter plastic valve box as detailed.

2.7 CONTROL WIRE

A. Control wire shall be copper with U.L. approval for direct burial in ground.

Common ground wire shall have white insulating jacket size #12-1; control

wire shall have insulating jacket of color other than white size #14-1.

Splices shall be made with 3M DBR/Y-6 waterproof connectors, Rainbird DB series, Hunter DBRY-6, or accepted substitute.

2.8 DETECTION WIRE

A. Single conductor, copper, type PE, #12 or greater with yellow insulating jacket.

2.9 RECTANGULAR VALVE BOXES AND LIDS

A. Rainbird model VB-STD-B/VB-STDBKL/VB-LOCK-H, NDS Pro Series Plus, Carson Truss T series, or accepted substitute.

2.10 ROUND VALVE BOXES AND LIDS

A. Rainbird model VB-10RND-B/VB-10RNDBKL/VB-LOCK-H, NDS Pro Series Plus, Carson Truss T series, or accepted substitute.

2.11 TREE BUBBLER HEADS

A. All tree bubbler heads shall be as listed on the drawings.

2.12 SUBSURFACE DRIP SYSTEM

A. Subsurface drip system shall be as listed on the drawings.

2.13 BACKFLOW PREVENTION DEVICE

A. Backflow prevention device shall be the reduced pressure type with ball valves, check valves, test cocks, reduced pressure chamber and air vent in metal enclosure specified on the drawings. Install as detailed and according to applicable plumbing codes.

2.14 CHECK VALVE

A. Adjustable PVC check valve with 18-8 stainless steel spring and valve stems with EPDM seals. Preset at 5 PSI**.** 150 PSI working pressure.

2.15 MISCELLANEOUS INSTALLATION MATERIALS

A. Solvent cement and primer for solvent weld joints shall be of make and type approved by manufacturer of pipe and fittings. Cement shall be maintained at proper consistency throughout use. Solvent cement shall meet the requirements of ASTM D 2564, NSF/ANSI 14, NSF/ANSI 61. Performance shall be same as WELD-ON 711 PVC. Primer shall meet requirements of ASTM F 656, NSF/ANSI 14, NSF/ANSI 61. Performance shall be same as WELD-ON P70.

B. Pipe joint compound shall be non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Performance shall be same as Permatex No.51.

2.15 MISCELLANEOUS EQUIPMENT

A. Provide to the Owner, at completion of the maintenance period, three (3) each of all operating and servicing keys and wrenches required for complete maintenance and operation of all heads and valves. Include all wrenches necessary for complete disassembly of all heads and valves.

PART 3 - INSTALLATION

3.1 PREPARATION

A. Schedule and coordinate placement of materials and equipment in a manner to effect the earliest completion of work in conformance with construction and progress schedule.

3.2 HANDLING AND STORAGE

A. Protect work and materials from damage during construction and storage.

B. Handle plastic pipe carefully; protect from prolonged exposure to sunlight from vendor to job site.

3.3 LAYOUT

A. Layout work as accurately as possible in accordance with diagrammatic drawings.

B. Where site conditions do not permit location of piping, valves and heads where shown, notify Owner's Agent immediately and determine relocation in joint conference.

C. Run pipelines and automatic control wiring in common trenches wherever practical.

3.4 EXCAVATION AND TRENCHING

A. Excavation shall be in all cases ample in size to permit the pipes to be laid at the elevations intended and to permit ample space for joining.

B. Make trenches for pipelines deep enough to provide minimum cover from finish grade as follows:

1. 24" minimum cover over main lines to control valves and quick coupling valves. Install detectable water warning tape 6” above all mainlines.

2. 24" minimum cover over control wires from controller to valves.

3. 14" minimum cover over RCV controlled lateral lines.

C. Restore surfaces, existing underground installations, etc., damaged or cut as a result of excavations, to original conditions in a manner approved by Owner's Agent.

D. Where other utilities interfere with irrigation trenching and pipe work, adjust the trench depth as instructed by Owner's Agent.

3.5 ASSEMBLING PIPELINES

A. All pipe shall be assembled free from dirt and pipe scale. Field cut ends shall be reamed only to full pipe diameter with rough edges and burrs removed.

B. Solvent Weld Joint:

1. Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe and fitting of dirt, dust and moisture.

2. Dry-insert pipe into fitting to check for incorrect sizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.

3. Coat the inside socket surface of the fitting and the male end of the pipe with primer. Then without delay, apply cement liberally to the male end of the pipe and also apply cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe

end.

4. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Pipe and fitting shall be aligned properly without strain to either.

5. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the outside of the pipe and fitting.

6. Cure joint a minimum of thirty (30) minutes before handling and at least six (6) hours before allowing water in the pipe.

C. Threaded Joint:

1. Field threading of plastic pipe or fittings is not permitted. Factory-formed threads only will be permitted.

2. Factory made nipples shall be used wherever possible. Field cut threads in metallic pipe will be permitted only where absolutely necessary. When field threading, cut threads accurately on axis with sharp dies.

3. All threaded joints shall be made up with joint compound. Apply compound to male threads only.

4. Where assembling metallic pipe to metallic fitting or valve, not more than three (3) full threads shall show when joint is made up.

5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.

6. Where assembling soft metal (brass or copper) or plastic pipe, use strap type friction wrench only; do not use metal-jawed wrench.

D. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstructions. Remove caps or plugs only when necessary to continue assembly.

E. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.

3.6 REMOTE CONTROL VALVES

A. Install where shown on drawings and group together where practical. Limit one remote control valve per box. No exceptions.

B. Provide 12" between valve boxes where valves are grouped together.

C. Thoroughly flush main line before installing valve.

D Fill bottom of valve box with ¾” pea gravel

E. Use aluminum tag to label and number each valve.

3.7 AUTOMATIC CONTROL WIRE

A. Run lines along mains wherever practical. Tie wires in bundles with pipe wrapping tape at 10' intervals and allow slack for contraction between strappings.

B. Loop a minimum of two (2) feet of extra wire in each valve box; both control wire and ground wire.

C. Connections shall be made by crimping bare wires with brass connectors and sealing with specified waterproof connectors.

D. Splicing will be permitted only on runs exceeding 2500'. Locate all splices at valve locations within valve boxes.

E. Where control lines pass under paving, they shall pass through Schedule 40 electrical PVC conduit.

F. Provide minimum one spare wire.

3.8 DETECTION WIRE

A. Install detection wire on top of the main supply line for the purpose of future mine detection search.

3.9 AUTOMATIC CONTROLLER

A. Provide and install automatic irrigation controller in metal enclosure in approximate location shown on drawings. The exact location will be determined on the site by the Owner's Agent. Provide conduit and wire and connect to 120 volt switch accessible to controller for ease of maintenance.

B. Connect control lines to controller in sequential arrangement according to assigned identification number on valve. Each control line wire shall be labeled at controller with a permanent non-fading label indicating station number of valve controlled. Attach label to control wire.

3.10 FLUSHING OF LINES

A. Thoroughly flush lines before installing Remote Control Valves, bubblers, Quick Coupling Valves and subsurface drip systems.

3.11 TESTING

A. Perform test as specified below. Remake any faulty joints with all new materials. Use of cement or caulking to seal leaks is absolutely prohibited.

The Contractor shall:

1. Notify Owner's Agent at least three (3) days in advance of testing.

2. Perform testing at his own expense.

3. Center load piping with small amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered.

4. Apply the following tests after welded plastic pipe joints have cured at least 24 hours.

a. Test live (constant pressure) lines hydrostatically at 125 PSI minimum. Lines will be approved if test pressure is maintained for six (6) hours. The lines shall be restored to the original test pressure and the amount of water required to do so shall be measured. Approved tables of allowable loss will be consulted, and the line will be approved or not approved as such results may indicate. The Contractor shall make tests and repairs as necessary until test conditions are met.

b. Test lateral lines with water at line pressure and visually inspect for leaks. Retest

after correcting defects.

3.12 BACKFILLING

A. Backfill only after piping has been tested, inspected and approved.

B. Backfill per requirements of specification Section 02225.

C. All pipe under paving shall be backfilled with 4" of clean sand on all sides of pipe.

D. Dress off areas to finish grades and remove excess soil, rocks or debris remaining after backfill is completed.

E. If settlement occurs along trenches, and adjustments in pipes, valves and sprinkler heads, soil, sod or paving are necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, then the Contractor, as part of the work under this contract, shall make all adjustments without extra cost to the Owner.

3.13 CLEAN-UP

A. When work of this section has been completed and at such other times as may be directed, remove all trash, debris, surplus materials and equipment from site.

3.14 INSPECTIONS, WARRANTY PERIOD AND FINAL ACCEPTANCE

A. At the completion of all irrigation work under this contract, and before the beginning of the one (1) year Maintenance and Warranty Period, an Irrigation Inspection shall be performed to establish the beginning of the ninety (90) day Establishment Period. Refer to Section 02935-Establishment Maintenance.

B. Contractor shall request the Irrigation Inspection in writing to the Owner's Agent ten (10) days prior to anticipated inspection date.

C. The Owner's Agent, contractor and such others as the Owner's Agent may designate shall be present at the Irrigation Inspection.

D If, after the inspection, the Owner's Agent is of the opinion that all work has been performed in accordance with the Contract documents and that the irrigation system is in satisfactory working condition, then the Owner's Agent will issue the contractor written notice of acceptance of the irrigation portions of the Work and commencement of the Establishment Period.

E. Work requiring corrective action in the judgement of the Owner's Agent shall be performed within ten days after the Irrigation Inspection. Corrective work and materials replacement shall be in accordance with the contract documents and shall be made by the contractor at no cost to the Owner.

3.15 ACCEPTANCE INSPECTION FOR END OF ESTABLISHMENT PERIOD AND BEGINNING OF WARRANTY AND MAINTENANCE PERIOD

A. At the completion of the ninety (90) day Establishment Period, the Final Acceptance Inspection shall be performed. If the Final Acceptance of the project is later than the end of the Warranty Period, then the Warranty Period shall be extended until Final Acceptance at no additional cost to the Owner.

B. The contractor shall request the inspection in writing to the Owner's Agent ten (10) working days

before the completion of the Establishment Period or ten (10) working days prior to the date of the Final Inspection, whichever occurs later.

C. The Owner's Agent, Contractor, and such others as the Owner's Agent may designate, shall be present at the inspection.

D. If, after the inspection, the Owner's Agent is of the opinion that all work has been performed in accordance with the Contract Documents, and that the irrigation system is in operating order, then the Owner's Agent will issue written notice of Final Acceptance, the beginning of the Maintenance and Warranty Period.

E. Work requiring corrective action in the judgement of the Owner's Agent shall be performed within ten days after the Final Inspection. Corrective work and materials replacement shall be in accordance with the contract documents and shall be made by the contractor at no cost to the Owner.

F. Contractor shall submit as-built drawings, operation manual, water audit and irrigation records to the owner.

G No partial approvals will be given.

END OF SECTION 02810

SECTION 32 91 13

SOIL PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Provide all soil and soil amendment products, including all imported topsoil as required to make up deficiencies in quantity of soil available on site, including light weight soils for on structure planting, special planting mix (sand filter media) for bioretention planters and structural soil (alternate). Execute all labor to achieve soil preparation, complete, as shown and as specified.

B. Related Work:

1. Section 32 0190 - Operation and Maintenance of Planting
2. Section 32 1800 - Concrete Flatwork and Sitework
3. Section 32 8400 - Planting Irrigation
4. Section 32 9119 - Finished Grading
5. Section 32 9300 - Planting

1.02 DEFINITIONS

A. Subgrade: Soil level resulting from the rough grading work under another Section. Cultivation of all subgrade areas prior to amending is included in this section.

B. Lightweight Soil: Lightweight soil mix for all on-structure planting areas.

C. Structural Soil (alternate):

1. A two-part soil system comprised of a rigid stone “lattice” to meet engineering requirements for a load-bearing soil, and a quantity of soil, to meet tree requirements for root growth. The lattice of load-bearing stones provides stability as well as interconnected voids for root penetration, air and water movement.
2. Mixture of crushed gravel and soil with a small amount of hydrogel to prevent the soil and stone from separating during the mixing and installation process.

D. Subgrade: Soil level resulting from the rough grading work under another Section. Cultivation of all subgrade areas prior to amending is included in this section.

1.03 SUBMITTALS

A. Product Data: Manufacturer's current catalog cuts and specifications of the following:

1. Nitrogen-treated sawdust
2. Ground redwood bark

3. Organic compost

4. Compost tea.

5. Filter Fabric

6. Herbicides

7. Fertilizers (organic and inorganic)

B. Quality Control Submittals:

1. Testing Agency:
   a. Soil and Plant Laboratory, Inc., 352 Matthew Street (P.O. Box 153), Santa Clara, CA 95052, Tel. (408) 727-0330; or
   b. Root Zones Associates, P.O. Box 18911, San Jose, CA 95118, Tel. (408) 264-7024 or Wallace Laboratories, 365 Coral Circle, El Segundo, CA 90245 (310) 615-0116

2. Test Reports:
   a. Nitrogen-treated Sawdust: Test for physical and chemical properties.
   b. Stockpiled Topsoil: Test for parasitic nematodes and herbicide contamination. Acceptability will be determined by soils testing laboratory.
   c. Particle size, and chemical / nutrient analyses for:
      1) Topsoil (import, stockpiled, and existing)
      2) Soil mixes (lightweight soil, bioretention soil, structural soil)
   d. Other tests as noted herein in this specification section.
      1) Compost and sand components for bioretention soil
      2) Clay loam and gravel components for structural soil

3. Certificates: Certify strict compliance with accepted soil mixes and amendments, including rate of application.

4. Testing: Test Stockpiled Topsoil for agricultural suitability, contaminants and required amendments. Test amended soil after mixing with amendments.

C. Samples:

1. Two one-quart representative sample of each soil type.

1.04 PROJECT/SITE CONDITIONS

A. Existing Conditions:

1. If planting area has been treated with lime, remove all lime treated soils from site.

2. Through study of all Contact Documents and by careful examination of the site, become informed as to the nature and location of the Work, the nature of surface and subsurface soil conditions, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work.

3. Conform to all governmental regulations in regard to the transportation of materials to, from, and at the job site, and secure in advance such permits as may be necessary

4. Should the Contractor, in the course of Work, find any discrepancies between Contract Documents and physical conditions or any omissions or errors in the Drawings it shall be the Contractor's duty to inform the Landscape Architect immediately in writing for clarification. Work done after such discovery, unless authorized by the Landscape Architect, shall be done at the Contractor's risk.

B. Perform both off site mixing and on-site soil work only during suitable weather conditions. Do not disc, rototill, or work soil when frozen, excessively wet, or in otherwise unsatisfactory condition. Soil mixes shall not be handled, hauled, or placed during rain or wet weather or when wet near or above field capacity.

1.05 SEQUENCING AND SCHEDULING:

A. Do not install on-structure drainage materials and soil mix prior to acceptance of waterproofing in another section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Planting Backfill Mixture:

1. Existing site soil including topsoil and material excavated from planting pits may be used as a component of the planting backfill mixture if approved by the Landscape Architect.
   a. Soil shall be free from weeds, roots, sod, clods, and stones larger than 1 inch, toxic substances, litter or other deleterious material.
   b. Contractor is responsible for soil testing to determine the suitability of on-site or imported soil and for appropriate amendments to correct any deficiencies.
   c. Contractor shall provide Landscape Architect with test results at least 14 working days prior to work (soil installation).

2. Imported topsoil shall be provided if an insufficient quantity of native soil is verified. Quantity of topsoil to complete the work shall be calculated by the Contractor.
   a. Imported topsoil shall match or exceed in quality accepted native stockpiled topsoil, as determined by analysis similar to that described above. Stockpile on site as directed by Owner.
   b. Landscape Architect reserves the right to take samples of the imported topsoil delivered to the site for conformance to the Specifications. Immediately remove rejected topsoil off the site at Contractor's expense.

3. Imported fill, where required, shall be a non-expansive and predominantly granular soil or soil-rock mixture which is free from organic matter and deleterious substances, and which does not contain materials over 4" in greatest dimension. Material having a dimension greater than 2" shall not be used in the upper 6" of fill.

B. Lightweight Soil Mix (for on-structure planters)

Amount per Cubic Yard	
1/2 cu. yd	Fine Sand
1.4 cu. yd	Compost
1/4 cu. yd	Expanded shale or lava rock (1/4" to 1/2")
1 lb.	Calcium Nitrate
3 lbs	Single Superphosphate

3/4 lbs	Potassium Sulfate
9 lbs	Dolomite Lime

C. Bioretention Soil Mix (Sand Filter Media)

1. Bioretention Soil shall be a mixture fine sand and compost, measured on a volume basis:
   a. 60% - 70% Sand
   b. 30% - 40% Compost

2. Sand shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be non-plastic.
   a. Sand for Bioretention Soils shall be analyzed by an accredited lab using #200, #100, #40, #30, #16, #8, #4, and 3/8 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight)	
	Min	Max
3/8 in	100	100
No. 4	90	100
No. 8	70	100
No. 16	40	95
No. 30	15	70
No. 40	5	55
No. 100	0	15
No. 200	0	5

Note: All sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements.

3. Composted material for bioretention soil.
   a. General - Compost shall be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids meeting the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program.
   b. Compost Quality Analysis - Before delivery of the soil, the supplier shall submit a copy of lab analysis performed by a laboratory that is enrolled in the US Composting Council's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Evaluation of Composting and Compost (TMECC). The lab report shall verify:
      1) Feedstock Materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
      2) Organic Matter Content: 35% - 75% by dry wt.
      3) Carbon and Nitrogen Ratio: C:N < 25:1 and C:N >15:1
      4) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable. In addition any one of the following is required to indicate stability:
         a) Oxygen Test < 1.3 O2 /unit TS /hr
         b) Specific oxy. Test < 1.5 O2 / unit BVS /
         c) Respiration test < 8 C / unit VS / day
         d) Dewar test < 20 Temp. rise (°C) e.
         e) Solvita® > 5 Index value
      5) Toxicity: any one of the following measures is sufficient to indicate non-toxicity.

a) NO3-N < 3
b) Ammonium < 500 ppm, dry basis
c) Seed Germination > 80% of control
d) Plant Trials > 80% of control
e) Solvita® > 5 Index value

6) Nutrient Content: provide analysis detailing nutrient content including N P K, Ca, Na, Mg, S, and B.
   a) Total Nitrogen content 0.9% or above preferred.
   b) Boron: Total shall be <80 ppm; Soluble shall be <2.5
7) Salinity: Must be reported; < 6.0 mmhos/cm
8) pH shall be between 6.5 and 8. May vary with plant species.

c. Compost for Bioretention Soil Texture: Compost for Bioretention Soils shall be analyzed by an accredited lab using #200, 1/4 inch, 1/2 inch, and 1 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight)	
	Min	Max
1 inch	99	100
½ inch	90	100
¼ inch	40	90
No. 200	2	10

d. Bulk density: shall be between 500 and 1100 dry lbs/cubic yard
e. Moisture Content shall be between 30% - 55% of dry solids.
f. Inerts: compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 1% by weight or volume.
g. Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.
h. Select Pathogens: Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
i. Trace Contaminants Metals (Lead, Mercury, Etc.) Product must meet US EPA, 40 CFR 503 regulations.
j. Compost Testing - The compost supplier will test all compost products within 120 calendar days prior to application. Samples will be taken using the STA sample collection protocol. (The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org). The sample shall be sent to an independent STA Program approved lab. The compost supplier will pay for the test.

2.02 ORGANIC AMENDMENTS:

A. Organic Compost

1. A minimum of 3 cubic yards of compost per thousand square feet of landscaped area must be used as the soil amendment in all landscaping in place of synthetic fertilizers including tablets and granules. In stormwater treatment landscapes, pesticides are also not allowed.

2. Type: Dark, rich, microbially active premium quality compost made from recycled yard trimmings vegetal food waste, forest or agricultural products, dairy manure, chicken manure, worm castings, bat guano, kelp meal or oyster shell. Containing no sludge or bio-solids.

B. Compost tea

1. Compost tea is produced by soaking healthy compost in water using some method of aeration. Compost tea is brewed from compost and a microbial food source additive, such as molasses, kelp, rock dust, and humic-fulvic acids.

C. Ground redwood bark.

D. Nitrogen-Treated Sawdust:

1. Type: Derived from redwood, fir or cedar wood sawdust.

2. Physical Properties:

Sieve Size	Percent Passing
1/4" (6.35 mm)	95 - 100
No. 8 (2.38 mm)	80 - 100
No. 35, 32 (500 micron)	0 - 30

3. Organic Content (dry weight basis): 94 percent minimum as determined by ash analysis.

4. Chemical Properties:
   a. Nitrogen content (dry weight basis):
      1) Wood of Redwood 0.4 - 0.6%
      2) Wood of Fir/Cedar 0.56 - 0.84%
      3) Fir/Pine Bark 0.80% minimum
   b. Iron content (dry weight basis): 0.08% iron as metallic, minimum.
   c. Salinity/Soluble salts: Maximum 3.5 millimhos/cm 25 degrees C. as determined by saturation extract method.
   d. Ash (dry weight basis): 0 - 6.0 percent maximum.
   e. pH: 6.5 - 7.5
   f. Wettability:
      1) When applied to a cup or small beaker of water @ 70 degrees F. in the amount of 1 teaspoon, the air-dry product shall become completely wet in a period not exceeding 2 minutes.
      2) All wetting agents to be non-phytotoxic at rate used.

E. Treating Nitrogen Process: Thoroughly bulk-blend any of the following available sawdust types with the amendment specified:

1. Urea Formaldehyde

2.

Sawdust	Per Cubic Yard
a. Hardwood	4 lbs.
b. Redwood	2 lbs.
c. Fir or Cedar	4-1/2 lbs.

F. Manure:

1. Type: Well-rotted cow, horse or sheep manure, free from sawdust, shavings or refuse.

2. Straw Content: Maximum 25% straw by volume.

2.03 INORGANIC AMENDMENTS:

A. Consult soils report for recommended amendments and rates, which may include the following:

1. Ground Limestone: Agricultural limestone containing not less than 85% of total carbonates, ground to such fineness that 50% will pass #100 sieve and 90% will pass #20 sieve

2. Dolomite Lime: Agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing #65 sieve. "Kaiser Dolomite 65 AG" by Kaiser, Inc. Mineral Products Department, or acceptable equivalent.

3. Gypsum: Agricultural grade product containing 80% minimum calcium sulphate.

4. Iron Sulfate: Granulated ferrous sulfate containing 20% to 30% iron and 35% to 40% sulfur. Provide as recommended by soil testing results.

5. Sulphate of Potash: Agricultural grade containing 50% to 53% of water-soluble potash.

6. Single Superphosphate: Commercial product containing 20% to 25% available phosphoric acid.

7. Ammonium Sulphate: Commercial product containing approximately 21% ammonia.

8. Ammonium Nitrate: Commercial product containing approximately 34% ammonia.

9. Calcium Nitrate: Agricultural grade containing 15-1/2% nitrogen.

10. Urea Formaldehyde: Granular commercial product containing 38% nitrogen.

11. I.B.D.U. (Iso Butyldiene Diurea): Commercial product containing 31% nitrogen.

12. Soil Sulfur: Agricultural grade sulfur containing a minimum of 96% sulfur..

B. Fine Sand:

1. Physical Properties (by dry weight basis):

Sieve Size	Percent Passing
No. 4 (4.76 mm)	100
No. 18,16 (xx mm)	95 -100
No. 35, 32 (500 micron)	65 - 100

No. 60 (250 micron)	0 – 50
No. 140, 150 (150 micron)	0 – 20
No. 270 (53 micron)	0 - 5

2. Chemical Properties: (by Saturation Extract Method):
   a. Soluble Salts/Salinity: Maximum conductivity of 3.0 millimhos/cm at 25 degrees C.
   b. Boron: Maximum concentration of 1.0 ppm.
   c. Sodium Absorption Ratio (SAR): Maximum 6.0.

C. Water: Clean, fresh and potable, as available from Owner. Transport as required.

2.04 HERBICIDES:

A. For possible use if there is seed germination on-site after sub-grade placement prior to planting mix installation or after subsequent plant mix installation. Under no circumstances are materials to be applied without specific instruction from the Contracting Officer's Representative and the Landscape Architect.

B. Herbicides shall be approved before use for type and rate of application by the Contracting Officer's Representative, the Landscape Architect and local and State agencies with jurisdiction.

1. Pre-emergent herbicide shall be an organic granulated or liquid herbicide which includes 10% nitrogen fertilizer and formulated to prevent germination of weeds in landscape areas, as available from Bioscape, Inc (www.bioscape.com, 877.246.7227); Aribico Organics (www.arbico-organics.com, 800.827.2847); Earth Easy (www.eartheasy.com, 888.451.6752) or an acceptable equivalent.

2. Post-emergent herbicide shall be an organic contact, non-selective, broad spectrum foliar-applied herbicide that controls actively growing emerged green vegetation, "Matron 2" as available from Bioscape, Inc (www.bioscape.com, 877.246.7227); Avenger Organics (www.avengerorganics.com, 866.906.9333); Aribico Organics (www.arbico-organics.com, 800.827.2847); or an acceptable equivalent.

2.05 STRUCTURAL SOIL MATERIALS (ALTERNATE)

A. Clay Loam

1. Clay Loam / Loam shall be a "loam to clay loam" based on the USDA classification system as determined by mechanical analysis (ASTM D-422) and it shall be of uniform composition, without admxture of subsoil. It shall be free of stones greater than one-half inch, lumps, plants and their roots, debris and other extraneous matter over one inch in diameter or excess of smaller pieces of the same materials as determined by the Engineer. It shall not contain toxic substances harmful to plant growth. It shall be obtained from areas which have never been stripped of top soil before and have a history of satisfactory vegetative growth. Clay Loam shall contain not less than 2% nor more than 5% organic matter as determined by the loss on ignition of oven-dried samples.

2. Mechanical analysis for a Loam *I* Clay Loam shall be as follows:

Textural Class	% of total weight
Gravel	less than 5%
Sand	20 – 45%
Silt	20 – 50%
Clay	20 – 40%

3. Chemical analysis: Meet or be amended to meet the following criteria.
   a. pH between 6.0 to 7.6
   b. Percent organic matter 2 -5% by dry weight
   c. Nutrient levels as required by the testing laboratory recommendations for the type of plants to be grown in the soil.
   d. Toxic elements and compounds below the United States Environmental Protection Agency Standards for Exceptional Quality sludge or local standard; whichever is more stringent.
   e. Soluble salt less than 1.0 Millimho per cm.
   f. Cation Exchange Capacity (CEC) greater than 10.
   g. Carbon/Nitrogen Ratio less than 33:1.

B. Crushed Stone / Gravel

1. Crushed Stone shall be a DOT certified crushed stone. Granite and limestone have been successfully used in this application. Ninety-100 percent of the stone should pass the 1.5 inch sieve, 20-55 percent should pass the 1.0 inch sieve and 10 percent should pass the 0.75 inch sieve. A ratio of nominal maximum to nominal minimum particle size of 2 is required.

2. Acceptable aggregate dimensions will not exceed 2.5:1 .0 for any two dimensions chosen.

3. Minimum 90 percent with one fractured face, minimum 75 percent with two or more fractured faces.

4. Results of Aggregate Soundness Loss test shall not exceed 18 percent. Losses from LA Abrasion tests shall not exceed 40%.

C. Hydrogel

1. Hydrogel shall be a potassium propenoate-propenamide copolymer Hydrogel such as that which is manufactured under the name Gelscape by Amereq Corporation. (800) 832-8788, or acceptable equivalent.

2.06 STRUCTURAL SOIL MIX (ALTERNATE)

A. A uniformly blended mixture of Crushed Stone, Clay Loam and Hydrogel, "CU-Structural Soil" as available from TMT Enterprises (408.432.9429) or acceptable equivalent; mixed to the following proportion:

MATERIAL	UNIT OF WEIGHT
Crushed Stone	80 units dry weight
Loam (screened)	as determined by the test of the mix (Approx. 20 units dry weight)

Hydrogel	0.03 units dry weight l 100units
Total moisture	(AASHTO T-99 optimum moisture)

B. The initial mix design for testing shall be determined by adjusting the ratio between the Crushed Stone and the Clay loam. Adjust final mix dry weight mixing proportion to decrease soil in mixture if CBR test results fail to meet acceptance (CBR > 50).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces, substrates and conditions for compliance with requirements of other sections in which that related work is specified, and determine if surfaces, substrates and conditions affecting performance of the work of this Section are satisfactory.

B. Any soils that have been compacted due to the construction shall be ripped prior to the placement of any soil mixes. The Contractor shall request an inspection by the Landscape Architect prior to the placement of any soil mixes.

C. Do not proceed with work of this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Starting installation constitutes acceptance of surfaces, substrates and conditions.

3.02 PREPARATION

A. After fine grading operations have been completed and prior to beginning soil preparation, take a minimum of three (3) horticultural soil samples where soil conditions or plant types vary, i.e. turf, shrub, slopes, etc.

1. Soil samples are to be collected and tested by a qualified soil testing laboratory (current member of the California Association of Agricultural Labs) and a written report prepared which includes recommendations for soil amendments, fertilization, planting backfill mixes and maintenance.

2. Submit a copy of the report to the Owner's Authorized Representative.

B. Soil Moisture Content: Do not work soil when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily.

1. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and planting.

2. Range: Maintain within 2 percent above or below optimum moisture content at all times during the work.

C. Cultivation of Subgrade: Rip or cultivate subgrade in planting areas to a depth of 24 in. immediately prior to spreading topsoil.

1. Verify that subgrades for installation of topsoil have been established under rough grading. Do not spread topsoil prior to acceptance of subgrade work.

2. Depth: Verify that subgrades are 12 in. minimum below finished grades. Report all variations.

3.03 SPREADING OF IMPORTED TOPSOIL

A. Coordinate soil placement with installation of drainage and irrigation systems. Protect drainage and irrigation during placement of soil. Damage to irrigation or drainage facilities during placement of soil shall be repaired at the Contractor's expense.

B. Spread imported topsoil over accepted subgrade prior to incorporating amendments.

C. Do not commence spreading of imported topsoil prior to acceptance of soil cultivation above. Do not place topsoil under muddy (or frozen) conditions.

D. Topsoil Depth: Minimum depth of 24-inches after natural settlement and light rolling conforming to finished grades shown on Drawings.

3.04 SOIL AMENDMENTS

A. Amending Existing Soil:

1. Preparation: Do not commence amending of existing soil prior to acceptance of soil cultivation above. Do not work soils under muddy or (frozen) conditions.

2. Soil Amendments per 1,000 Square Feet: Incorporate additives per soils report, if any, thoroughly with top six (6) in. of all existing planting and lawn areas:

B. Amending Imported Topsoil:

1. Soil Amendments per 1,000 square feet: Incorporate thoroughly with top six (6) in.:
   a. 6 cu. yd. Nitrogen-treated Sawdust/organic compost

2. Intent: The above amendments and quantities are approximate and are for bidding purposes only. Following a soil analysis by Testing Agency, composition of amendments may change. Contract Price will be adjusted accordingly.

C. Amending Lightweight Planter Mix: Per the recommendations of Soils test results.

1. Soil Amendments per 1,000 square feet: Incorporate thoroughly with top six (6) in.:
   a. 6 cu.yd. Nitrogen-treated Sawdust
   b. 30 lbs. 6-20-20 Commercial Fertilizer
   c. 50 lbs. Dolomite Lime
   d. 10 lbs. Iron Sulfate

2. Intent: The above amendments and quantities are approximate and are for bidding purposes only. Following a soil analysis by Testing Agency, composition of amendments may change. Contract Price will be adjusted accordingly.

3.05 PRE-EMERGENT HERBICIDE

A. Apply pre-emergent weed control to all (on-grade) areas to receive woody, non-lawn ornamental planting after incorporating soil amendments.

B. Apply strictly according to manufacturer's current printed specifications.

3.06 BLENDING OF SOIL MIXES

A. Stockpiled existing or imported soils:

1. Blending: Thoroughly bulk-blend materials uniformly in stockpiles.

2. Testing: Retain a Testing Agency to certify conformance of materials to Specifications and to prepare one laboratory control sample of planting soil mix in accordance with the Specifications.

B. On-Structure Planting Mix: Blend with bulk-blended materials prior to delivery on site. Material to be tested upon arrival at site for verification.

3.07 PLACEMENT OF DRAINAGE MATERIAL FOR BIORETENTION PLANTING AREAS

A. Install perforated drain pipes, planter and area drains, drainage aggregate, filter and geotextile fabric and irrigation system as per Drawings prior to placement of soil mix.

B. Protect drainage and irrigation during placement of soil. Damage to irrigation or drainage facilities during placement of soil shall be repaired at the Contractor's expense.

C. Bioretention Soil Mix: Compact initial placement of soil mix by thoroughly watering or jetting the entire planter to a maximum of 85% compaction. Fill planters beyond finish grade to allow for settlement.

3.08 SPREADING OF BACKFILL MIXTURE

A. Coordinate planter mix placement with installation of drainage and irrigation systems. Protect drainage and irrigation during placement of soil. Damage to irrigation or drainage facilities during placement of soil shall be repaired at the Contractor's expense.

B. Spread amended backfill mixture or topsoil over accepted subgrade prior to incorporating amendments.

C. Do not commence spreading of amended backfill mixture or topsoil prior to acceptance of soil cultivation above. Do not place amended backfill mixture or topsoil under muddy (or frozen) conditions.

D. Depth: Minimum depth of 12 in. after natural settlement and light rolling conforming to finished grades shown on Drawings.

3.09 SPREADING OF BIORETENTION SOIL

A. Bioretention Soil shall be placed in lifts of 8-10 inches.

B. Compact initial placement of soil mix by thoroughly watering or jetting the entire planting area to a maximum of 85% compaction. Fill planters beyond finish grade to allow for settlement.

C. Soil Depth: Full depth of planters to within finish grades as per Drawings.

3.010 STRUCTURAL SOIL (ALTERNATE)

A. All Structural Soil mixing shall be performed at the Contractor's yard using appropriate soil measuring, mixing and shredding equipment of sufficient capacity and capability to assure proper quality control and consistent mix ratios. No mixing of Structural Soil at the project site shall be permitted.

B. The Contractor shall mix sufficient material in advance of the time needed at the job site to allow adequate time for final quality control testing as required by the progress of the work. Structural Soil shall be stored in piles of approximately 500 cubic yards and each pile shall be numbered for identification and quality control purposes. Storage piles shall be protected from rain and erosion by covering with plastic sheeting.

C. Structural soil shall not be placed any closer than 3 feet to the outer face of Electrical and Water Meter vaults to avoid pipes or conduit sweeps entering vaults, with the exception at PG&E vaults where 60" Conduit Sweeps are specified. At these PG&E vaults, the structural soil shall not be placed within 5' of the outer face of the vault.

D. Structural Soil Installation

1. Install Structural Soil in six (6) inch lifts and compact each lift.

2. Compact all materials to not less than 95% of peak dry density from a standard AASHTO compaction curve (AASHTO T 99). No compaction shall occur when moisture content exceeds maximum as listed herein. Delay compaction 24 hours if moisture content exceeds maximum allowable and protect Structural Soil during delays in compaction with plastic or plywood as directed by the Landscape Architect.

3. Bring Structural Soils to finished grades as shown on the Drawings. Immediately protect the Structural Soil material from contamination by toxic materials, trash , debris, water containing cement, clay, silt or materials that will alter the particle size distribution of the mix with plastic or plywood as directed by the Landscape Architect..

3.011 FIELD QUALITY CONTROL

A. Tests: Right is reserved to take samples of soil mixes and/or prepared soil for testing for conformity to Specifications.

B. Rejected Materials: Remove off site at Contractor's cost. Pay cost of testing of materials, not meeting Specifications.

C. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the drawings or specifications, obstructions on the site, or prior work done by another party, which contractor feels precludes establishing proper drainage shall be brought to the attention of the Landscape Architect in writing.

3.012 DISPOSAL AND CLEAN-UP

A. Maintain the site in an orderly condition during the progress of the Work. Continuously and promptly remove waste materials; keep walks and roads clear.

B. Promptly remove equipment, surplus materials, refuse and debris resulting from Work upon completion. Leave the site in a neat, orderly "broom clean" condition.

C. Dispose of all refuse and debris offsite legally. Do not dump or burn materials on site.

END OF SECTION

SECTION 32 9119

FINISH GRADING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Execute finish grades complete, as shown on drawings and as specified.

B. Related Work:

1. Section 32 9113 - Soil Preparation

2. Section 32 9300 - Planting

1.02 SEQUENCING AND SCHEDULING

A. Complete all finish grading prior to installation of drip irrigation systems in each area graded. Coordinate all work with finished grades of adjacent pavement, curbs, walls and other built improvements.

B. Re-grade as required to finish grades established by Landscape Architect once the irrigation system is installed.

C. Dust Nuisance: Assume full responsibility for alleviation or prevention of dust as a result of grading work.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Contractor shall provide equipment and machinery sufficient for proper execution of Work.

B. Do not use mechanical compactor to compact soils on structure

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that the following items have been completed prior to commencement of finish grading:

1. Installation of all waterproofing and drainage.

2. Preparation of subgrade, including the removal of debris.

3. Incorporation of soil amendments.

4. Installation of planting soil mix.

3.02 INSTALLATION

A. Finish Grading:

1. Provide all grades for natural runoff of water without low spots or pockets. Accurately set flow line grades at 2 percent minimum gradient unless otherwise noted in Drawings.

2. Finish grades shall be smooth, even and on a uniform plane with no abrupt changes of surface. Slope uniformly between given spot elevations.

3. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given, or between points established by walks, paving, curbs or catch basins.

4. Tops and toes of all slopes shall be rounded to produce a gradual and natural-appearing transition between relatively level areas and slopes.

B. Tolerances:

1. All planting areas, including lawn areas, shall be true to grade within 1 in. when tested with a 10 ft. straightedge.

2. Hold finished grades below top of adjacent pavement, headers, curbs, or walls as follows:
   a. Tree, Shrub, Annual and Groundcover Areas: 1-1/2 inches.

END OF SECTION

SECTION 32 93 00

PLANTING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Provide planting complete, as shown and as specified. Plantings shall meet the Bay-Friendly Landscape Guidelines.

1. Maintenance Period

2. Warranty

B. Related Work:

1. Section 12 9300 - Site Furnishings and Features

2. Section 32 0190 - Operation and Maintenance of Planting

3. Section 32 1800 - Concrete Flatwork and Sitework

4. Section 32 8400 - Planting Irrigation

5. Section 32 9113 - Soil Preparation

1.02 REFERENCES

A. "An Annotated Checklist of Woody Ornamental Plants of California, Oregon and Washington, (Number 4091)", McClintock and Leiser, Division of Agricultural Sciences, University of California, 1979.

B. Western Chapter of International Society of Arboriculture Pruning Standards

C. ANSI A300 Pruning Standards

D. OMRI, Organic Materials Research Institute

E. USCC STA, United States Composting Council Seal of Testing Assurance

F. "American Standard for Nursery Stock", current Edition, American Association of Nurserymen, Inc.

G. "Hortus III", 1976 Edition, Bailey Hortorium, Cornell University.

H. Bay Friendly Landscape Guidelines, Stopwaste.org

1.03 DEFINITIONS

A. The “Owner’s Representative” is the person, appointed by the Owner, to represent their interests. The Owner’s Representative will be on site frequently and regularly during construction. Where needed, the

Owner's Representative will identify the need for field visits by the Owner's Representative or other consultants.

B. "Integrated Pest Management" (IPM) is a holistic approach to mitigating insects, plant diseases, weeds, and other pests. It involves the use of many strategies for managing, but not eliminating pests. IPM uses cultural, mechanical, physical, and biological control methods before using pesticides to control pests and diseases in the landscape. Chemical controls are applied only when monitoring indicates that preventative and non-chemical methods are not keeping pests below acceptable levels. When pesticides are required, the least toxic and the least persistent pesticide that will provide adequate pest control is applied.

C. The "Organic Materials Research Institute" (OMRI) is a national nonprofit organization founded in 1997 to support the organic community. OMRI reviews products to determine their suitability for producing, processing and handling organic food and fiber under the USDA National Organic Program Rule (OMRI General Materials List).

1.04 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. Plant material must meet or exceed applicable reference standards.

B. Landscape work shall be by a state licensed Landscape Contractor with a minimum of ten years of professional experience which has successfully completed work similar in quality and extent to that indicated for this project.

1. Installer shall be a member in good standing of the American Nursery and Landscape Association with no less than 4 years experience in landscape installation work similar in quality and extent to that indicated for this project.

2. Installer shall maintain an experienced full-time supervisor on Project site when work is in progress.

3. Herbicide Applicator: Licensed in California for commercial applications.

C. An independent laboratory shall have the experience and capability to conduct the testing indicated and specializes in types of tests to be performed.

D. Source Quality Control

1. Review: Submit a written request for review of plants and quantity at place of growth at least thirty (30) calendar days prior to shipment to site. Right is reserved to refuse review at this time if, in his/her judgment, a sufficient quantity of plants is not available.

2. Transportation: Contractor shall accompany Landscape Architect to all reviews of plants at the nursery. Landscape Architect will review and tag plants at place of growth and upon delivery for conformity to specifications.

3. Distant Material: Submit photographs with a person adjacent to each plant type for preliminary review. Such review shall not impair the right of review and rejection during progress of the work.

4. Unavailable Material: If proof is submitted that a specified plant is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than 30 days after award of contract.

5. Special Conditions: The above provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

E. Conduct a pre-installation conference at Project site.

1. Person(s) responsible for the Work of this Section shall attend a Pre-construction Conference with the Architect, Landscape Architect, General Contractor, the Installer and the Installer's field foreman.

2. To review the proposed schedule, the coordination with work of other trades, the source of plants, the consideration of substitutions, and a general review of the specifications and planting procedures.

3. Contractor shall coordinate the meeting and inform all parties in writing five (5) business days in advance of the scheduled meeting.

1.05 SUBMITTALS

A. Within 30 days of Notice to Proceed, document with receipts or invoices that all plants have been located and secured for the work by ordering, paying deposits, or as required. Provide name and location of nursery, contact person, and telephone number.

B. Within 30 days prior to commencement of work submit the test reports, samples, cut sheets and product data listed below.

C. Include all submittals in a single package for a single review.

D. Ensure that each sample, cut sheet, product data and test is clearly marked or labeled to correlate it to its specification, identifying the product, manufacturer and source.

E. Product Data:

1. Supply product data for all proprietary products specified herein. Furnish manufacturer's literature or laboratory analytical data. Include EPA approved product label, MSDS (Material Safety Data Sheet) and manufacturer's application instructions specific to the Project.

2. Submit manufacturer's literature for each type of factory fabricated products and accessories required including, but not limited to:
   a. Mulches
   b. Tree stakes and ties.
   c. Metal edging
   d. Root Barrier
   e. Drainage Board

f. Termination Bar
g. Fertilizers

F. Samples:

1. Stone Mulch: One (1) pint, each type.

2. Drainage Rock and Gravel Leveling Course: One (1) pint, each type.

3. Organic Compost: One (1) pint, each type.

4. Metal edging: Two twelve (12) inch lengths.

5. Root Barrier: Two 12" square pieces.

6. Drainage Board: Two 12" square pieces of each type.

7. Termination Bar: Two 12" long pieces.

8. Fertilizers: Two one-half (1/2) pint containers, each type.

G. Plant Material:

1. Submit quantities, sizes, quality, and sources for plant materials. Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project.
   a. Take photographs from an angle depicting true size and condition of the typical plant to be furnished.
   b. Include a scale rod or other measuring device in each photograph.
   c. For species where more than 20 plants are required, include a minimum of 3 photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished.
   d. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

2. Upon approval of plant materials, submit nursery invoices for all plant material for this project.

H. Notice of Shipment: At time of delivery, submit notice from nursery containing the following: Name and location of shipper; date of shipment; name of commodity; quantity; certificate that material complies with the specifications; size; statement of root pruning, including dates; and statement that plants are acclimated and have been growing outside.

I. Submit certificates of conformance for mulches. Furnish a certificate with each delivery to the site of material in containers, or in bulk. Certificate to state source, quantity or weight, type and analysis, and date of delivery. Deliver all certificates to Owner's Representative.

J. Certificates of Inspection: As required by law for transportation of each shipment of plants along with invoice.

K. Submit typed recommended procedures to be established by Owner for maintenance of planting for one full year. Submit prior to expiration of required maintenance period.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Notify the Landscape Architect of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant and landscape materials from the job site immediately.

B. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Keep seed and other packaged materials in dry storage away from contaminants.

C. Delivery: Do not deliver to the site disease-infected plant materials. . Cover plants transported on open vehicles with a protective covering to prevent wind burn.

D. Labeling: Furnish standard products in manufacturer's standard containers bearing original labels legibly showing quantity, analysis, genus/species and name of manufacturer/grower.

E. Storage: Protect metal containers from sun during summer months with temperatures above 80 degrees F. Keep plants that cannot be planted immediately upon delivery in the shade, well-protected and well-watered.

F. Handling: Do not lift or handle plants by tops, stems or trunks at any time. Do not bind or handle plants with wire or rope at any time except wrapped rootball of field dug material.

G. Anti-Desiccant: do not use spray anti-dessicants

H. Digging: Dig B & B plants with firm, natural balls of earth of diameter not less than that recommended by USDA Standard for Nursery Stock, and of sufficient depth to include the fibrous and feeding roots. Wrap and tie as required to prevent all cracking or loss of soil from rootball.

1.07 PROJECT/SITE CONDITIONS

A. Protection of Existing Plants to Remain: See Section 01 56 39.

B. Replacement of Damaged Plants:

1. Replace existing plants to remain which are damaged by Contractor during construction with accepted plants of the same species and size as those damaged at no additional cost to Owner.

2. Landscape Architect will determine extent of damage and value of damaged plants.

1.08 SEQUENCING AND SCHEDULING

A. Acceptance: Do not install plant materials prior to acceptance of finish grades and main line trenching/installation of irrigation system.

B. Coordination: Coordinate with work of other sections to insure the following sequence of events:

1. General: Irrigation system to be installed and operable prior to installation of plant materials. Schedule hand watering of all plant materials installed prior to sprinkler irrigation system.

2. Plants in Raised Planters: Schedule delivery of plants to coincide with installation of pots as determined by Owner.

3. Headers: Install prior to installation of adjacent sprinkler irrigation system.

4. Trees in Paving or Decomposed Granite Paving: As necessary, install prior to installation of paving under another Section. See Drawings.

5. Pruning: Do not prune plant materials prior to installation and acceptance. Request review by Landscape Architect prior to pruning.

1.09 WARRANTY

A. Warrant that all plants planted under this Contract will be healthy and in flourishing condition of active growth one (1) year from date of Final Acceptance. Similarly warrant (annuals), groundcover for a period of six (6) months from date of Final Acceptance.

B. Correct Species: Warrant that all plant materials are true to species and variety.

C. Delays: Delays caused by the Contractor in completing planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

D. Condition of Plants: Plants shall be free of dead or dying branches and branch tips, with foliage of normal density, size and color.

E. Replacements: As soon as weather conditions permit, replace, without cost to Owner all dead plants and all plants not in a vigorous, thriving condition, as determined by Landscape Architect during and at the end of Warranty Period.

F. Exclusions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, and acts of God, during Warranty Period. Report such conditions.

1.010 MAINTENANCE PERIOD AND FINAL ACCEPTANCE:

A. See Section 32 01 90 Operation and Maintenance of Planting

1.011 REPLACEMENTS

A. Failed Materials:

1. Repair and/or replace at no cost to the Owner all plant materials exhibiting conditions which are determined as unacceptable due to workmanship by the Contractor.

2. Closely match replacements to adjacent specimens of the same species. Apply requirements of this Specification to replacements.

3. Contractor shall be held responsible for a maximum of two (2) replacements for each failed tree, shrub and vine, and same area of groundcover planting after final acceptance during warranty period.

B. Incorrect Materials:

1. During Warranty Period, replace at no cost to Owner plants revealed as being untrue to name and species.

2. Provide replacements of a size and quality to match the planted materials at the time the mistake is discovered.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Plant Materials: Verify that all container stock (excluding annuals) has been grown in the containers in which delivered for at least one growing season, but not over two (2) years.

1. Growing Conditions: Plants shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least two years unless otherwise specifically authorized.

2. Appearance: Trees shall be exceptionally heavy, symmetrical, tightly knit, and so trained or favored in development and appearance as to be superior in form for their species, with regard to number of branches, compactness and symmetry.

3. Vigor: Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well-developed root systems. Plants shall be free from physical damage or adverse conditions which would prevent thriving growth.

B. Condition of Root System: Samples must prove to be completely free of circling, kinked or girdling trunk surface and center roots and show no evidence of a pot-bound condition. Upon inspection by Landscape Architect at the job site, if five (5) percent or more of the plants of each species are found to contain kinked, circling or girdling roots, all plants of that species will be rejected.

C. Measurements:

1. General: Take caliper measurement at a point on the trunk 6 in. above natural ground line for trees up to 4 in. in caliper and at a point 12 in. above the natural ground line for trees over 4 in. in caliper.
   a. Trunk diameter six inches above rootball within the diameter range shown below:

Container Size	Trunk Diameter
5 gallon	0.5 inch to 1 inch
15 gallon	1 inch to 2 inches
24-inch box	2 inches to 3 inches
36-inch box	3 inches to 5 inches

   b. Measure foliage across mean foliage dimension when branches are in their normal upright position. Foliage origin along main trunk shall be measured from soil line.
   c. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Properly trimmed plants shall measure the same in any direction. If a plant is unevenly grown, it shall be classified in the size category of the smallest dimension.

2. Size Range: If a range of size is given, do not use plant materials less than the minimum size. The measurements specified are the minimum size acceptable and are the measurements after

pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

D. Substitutions:

1. Substitutions must have written approval of Owner's Representative and equal the standard of products specified in the Construction Documents.

2. Substituted plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if accepted. Use of such plants shall not increase Contract price. If larger plants are accepted, increase the ball of earth in proportion to the size of the plant. Plants overgrown for their container size will be rejected.

3. Installation of approved substitution is Contractor's responsibility. Changes required for installation of approved substitution must be made to the satisfaction of Owner's Representative and without additional cost to the Owner.

4. Approval by Owner's Representative of substituted equipment does not waive these requirements.

E. Unacceptable Trees: Trees which have damaged or crooked leaders, will be rejected. Trees having a main leader shall not have been headed back. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 in. which have not completely callused, will be rejected. Temporary branches shall be present along the lower trunk and shall be no greater than 3/8" diameter.

F. Pruning: Do not prune plants before delivery. Consult Landscape Architect for pruning after installation.

2.02 MIXES

A. Backfill Mix for Plant Pits: See Soil Preparation - Section 32 9113.

B. Commercial Fertilizers:

1. Use local organically produced compost or Compost Tea

2.03 ACCESSORIES

A. Tree Staking:

1. Stakes: Painted steel with tapered driving point and capped top, color-black; 2 per tree.

2. Ties: Black corded rubber tie or other tie as accepted by Landscape Architect.

3. damaging bark.

B. Mulch

1. Wood Chip Mulch:
   a. Wood (Organic) mulch shall be Composted pine or fir (hardwood) bark, free of dirt, dust and other debris; 3/4" - 1-1/2"
   b. Basis of Design: "Small Fir Bark" as available from Lyngso Garden Materials (www.lyngsogarden.com, 650.364.1730) or acceptable equivalent.

2. Mineral Mulch:
   a. Gravel Mulch shall be as per Drawings
      1) Mulch at planters: As indicated on Drawings.
      2) Type A (at swale): As indicated on Drawings
      3) Type B (at band): As indicated on Drawings
   b. Decomposed Granite Mulch shall be hard and durable, decomposed, weathered granite fines, free from vegetable matter and other deleterious substances.
      1) Color: Gray
      2) Decomposed granite grading requirements:

Sieve Size	Percent Passing by Weight
3/8”	100
No. 4	95 - 100
No. 8	75 - 80
No. 16	55 - 65
No. 30	40 - 50
No. 50	25 - 35
No. 100	20 - 25
No. 200	5 - 15

C. Gravel leveling course

1. Gravel leveling course shall be crushed stone with 90% fractured faces, LA Abrasion < 40 per ASTM C 131, minimum CBR of 80% per ASTM D 1883.

2. Do not use rounded river gravel.

3. All stone materials shall be washed with less than 1% passing the No. 200 sieve.

4. Aggregate shall conform to ASTM D 448 gradation as follows:

ASTM No. 9 Grading Requirements

Sieve Size	Percent Passing
3/8” (9.5 mm)	100
No. 4 (4.75 mm)	85 - 100
No. 8 (2.36 mm)	10 – 40
No. 16 (1.16 mm)	0 – 10
No. 50 (0.3 mm)	0 - 5

D. Drainage rock layer

1. Drainage rock layer shall be hard, durable particles of stone, gravel or other finely divided mineral matter to produce a dense, compacted base.

2. Drainage rock shall be uniformly graded from coarse to fine and shall be as per CALTrans Class 2 permeable aggregate and the following:

Sieve Size	Percent Passing
1”	100
3/4”	90 - 100
3/8”	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. 30	5 - 15
No. 50	0 - 7
No. 200	0 - 3

E. Drainage Board (on-structure concrete planter):

1. Planter Bottom
   a. Basis of Design: “Gardendrain GR30” by American Hydrotech (www.hydrotechusa.com, 800.877.6125).
   b. Three-dimensional molded panels of recycled polyethylene with drainage channels top and bottom sides and water retention reservoirs top side.

2. Lightweight Expanded Aggregate Fill for Planter Bottom Drain Board (Gardendrain Composite)
   a. Basis of Design: “LiteTop Mineral Aggregate” by American Hydrotech (www.hydrotechusa.com, 800.877.6125).

3. Planter Sides Basis of Design: “Hydrodrain 400” by American Hydrotech (www.hydrotechusa.com, 800.877.6125).
   1) Three-dimensional, molded panels of recycled polyethylene with a non-woven needle punched filter fabric.

F. Termination Bar (for Drainage Board on concrete planter sides).

1. Termination Bar shall be as per the Drawings; designed to support vertical membrane systems at their termination point; ultraviolet resistant, non-corrosive; wtih pre-drilled holes for installation.

G. Filter Fabric

1. Basis of Design: A non-woven, polymeric, geotextile fabric per "Systemfilter", as manufactured by American Hydrotech (www.hydrotechusa.com, 800.877.6125).

2. Filter fabric (at pavers on grade) shall be a heavy duty non-woven geotextile fabric of polypropylene fibers.

H. Metal Edging.

1. Metal edging shall be heavy duty extruded aluminum (6063) with stakes specifically designed for landscape installations.

2. Basis of Design (At decomposed granite paving and tree wells on grade): "Pro-Slide", as manufactured by Permaloc (www.permaloc.com, 800.356.9660).
   a. Heavy duty corrugated straight profile aluminum edging and stakes with loops to receive stakes at approximately 3' on center;
   b. Size: 3/16" x 6", mill finish,.

I. Root Barrier:

1. Metal edging shall be 18" high x 24" wide (46 cm x 61 cm) 75% reprocessed injection molded polypropylene panels with integrated zipper joining mechanism for easy assembly;1/2" raised 90-degree molded root deflecting ribs; ground lock tabs to prevent lifting by tree, double top edge, and ultraviolet inhibitors. The 18" (46 cm) height is ideal for protection from invasive roots in sidewalk

2. Basis of Design: "UB 18-2" available from Deep Root (www.deeproot.com, 415.781.9700) .

J. Water:

1. Clean, fresh and potable, furnished and paid for by Owner.

2. Transport as required.

2.04 SOURCE QUALITY CONTROL

A. Review: Submit a written request for review of plant materials and quantity at place of growth at least (thirty (30) days after award of contract) (sixty (60) calendar days prior to shipment to site (digging). Right is reserved to refuse review at this time if, in his/her judgement, a sufficient quantity of plants is not available.

B. Transportation: Contractor shall accompany Landscape Architect to all review(s) of plant materials at the nursery. Landscape Architect will review and tag plants at place of growth and upon delivery for conformity to specifications.

C. Distant Material: Submit photographs with a person adjacent to each plant type for preliminary review. Such review shall not impair the right of review and rejection during progress of the work.

D. Unavailable Material: If proof is submitted that a specified plant is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than 30 days after award of contract.

E. Special Conditions: The above provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Finish Grades: Finish grades for planting areas shall have been established in another Section. Verify that all grades are within 1 in. plus or minus of required finish grade.

2. Soil Preparation: Do not commence planting work prior to completion and acceptance of soil preparation.

3. Irrigation: Verify that irrigation system has been installed and accepted.

B. Notify Owner's Representative at least 3 days prior to scheduling an observation meeting. Contractor to be present at observation meetings.

1. Call for an observation meeting at the following stages of work:
   a. After the finish grading is complete and plants have been delivered and spotted.
   b. At the completion of all work.

2. Perform remedial work directed by the Owner's Representative within 10 days after the observation meeting. Complete remedial work in accordance with the Contract Documents and at no additional cost to the Owner.

3.02 PREPARATION

A. Layout and Staking: Lay out plants at locations shown on Drawings. Use 3 -ft. lath, color-coded for each species of plant material. Stake each tree, not specifically located by dimension or alignment. Outline shrub and groundcover beds with lime.

B. Review: Locations of plants will be checked in the field and will be adjusted to exact position before planting begins. Right is reserved to refuse review at this time if, in the Landscape Architect's opinion, an insufficient quantity of plants is available.

C. Digging Plant Pits: Dig tree pits and scarify all sides of the tree pit after excavation - see below. Do not use an auger or tree spade.

D. Containerized Plant Pits: Excavate square plant pits as follows:

Width	Depth
Boxed Trees	Box + 24 in.

Canned Trees	Can + 18 in.
Canned Shrubs and Vines	Can + 12 in.

E. Install drain pipes, planter and area drains, drain collar, drainage board, filter fabric and irrigation system where applicable prior to placement of soil mixes in planters.

1. Install drainage board at planter bottom (Gardendrain Composite) per the manufacturer's recommendations and install lightweight expanded aggregate to fill the cups of the drainage board. Adjacent panels shall be butt together or overlapped approximately 1 inch (25 mm). Garden drainage composite shall be cut to fit around penetrations.

2. Cover the drainage board with filter fabric. Lap adjacent fabric rolls a minimum of 6 inches (150 mm). Enough material shall be left to be drawn up above the anticipated soil level. Any excess shall be trimmed down to the level of the soil.

3. Place specified soil mix over drainage system to depths indicated in plan and as recommended by the technical representative of the roofing installer/manufacturer.
    1) Place carefully to avoid damage or displacement of other materials such as walls, paving, drainage components, filter fabric, and roofing membrane.
    2) Conform with Section 32 9113 Soil Preparation.

F. Install soil mixes in planters per Drawings and Section 32 9113 - Soil Preparation.

3.03 DRAINAGE TEST OF PLANT PITS/OBSTRUCTIONS

A. Testing: Immediately after completion of excavation, test drainage of plant pits by filling with water twice in succession. Give written notification of conditions permitting the retention of water in plant pits for more than twenty-four (24) hours.

B. Correction: Submit for acceptance a written proposal and cost estimate for the correction of poor drainage conditions before proceeding with planting.

C. Obstructions: If rock, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits, acceptable alternate locations may be used at direction of Landscape Architect.

D. Percolation Test Pit:

1. Location: At tree planting at four (4) locations as determined by the Landscape Architect on site.

2. Restrictions: Do not perform test on a rainy day. Repeat all tests interrupted by rain or cold.

3. Procedure:
    a. Dig test pit of a size specified for the tree pits, a minimum of 4 ft. deep. Legibly calibrate a stake at 1 in. intervals and drive it firmly into the undisturbed soil at the bottom of the pit.
    b. Fill test pit with water to within 1 ft. of the finish grade. Immediately record water level on the stake.
    c. After 3 hours, record water level again. Repeat recording of water level once each hour for the succeeding five hours.

4. Documentation: Submit written documentation of all test pit results, dated and signed by the tester.

3.04 METAL EDGING:

A. Lay out locations of metal edging for review prior to final installation. Install per details in Drawings true to line and grade.

3.05 TREE AND SHRUB PLANTING

A. Handling and De-potting of Plant Materials:

1. Damage: Avoid damage to containers and rootballs. If rootball is cracked or broken during handling and de-potting, plant will be rejected. Do not remove plant from container prior to completion of plant pit preparation.

2. Canned Trees and Shrubs: Metal Containers: Cut can on two sides with accepted cutting tool. Do not use spade. Plastic Containers: Tip container to horizontal orientation and shake carefully to remove shrub. Support rootball during installation to prevent cracking or shedding of soil.

3. Boxed Trees: Lift from bottom with forklift or from sides with 2 in. x 4 in. rails nailed to each side of box. Do not remove box prior to settling tree in plant pit. Remove sides of box after acceptance by Landscape Architect and prior to backfilling. Bottom of box may be left in place.

B. Installation:

1. Do not plant when soil moisture is so great that excessive compaction will occur, nor when it is so dry that dust forms in the air or that clods will not break readily. Apply water if necessary to bring soil to optimum moisture content for tilling and planting.

2. Scarification:
   a. Plant Rootball: After removing plant from container, scarify the sides of the rootball to a depth of 1 in. at four to six equally-spaced locations around the perimeter of the ball or at 12 in. intervals on sides of boxed materials. Cut and remove circling roots over 3/8 in. diameter.
   b. Plant Pit: Scarify sides of plant pit, thoroughly breaking up surfaces and eliminating "glazed" areas.
   c. Compact soil at bottom of pit to support weight of rootball. In at-grade tree planting retain a pedestal of undisturbed native soil below rootball per Drawings.

3. Positioning: Backfill plant pit to allow setting crown of tree 2 in. above new finish grade and crown of shrub 1 in. above finish grade. Thoroughly foot tamp all backfill. Position plant in planting pit, maintaining plumb condition. Maintain throughout all planting operations.

4. Root Barrier; install per Drawings and manufacturer’s written specifications.

5. Backfilling:
   a. Use backfill mix to backfill (on-grade) plant pits as shown on Drawings. Brace each plant plumb and rigidly in position until planting soil has been tamped solidly around the ball and roots.
   b. When plant pits have been backfilled approximately 2/3 full, water thoroughly and saturate rootball, before installing remainder of the backfill mix to top of pit, eliminating all air pockets.

6. Staking and/or Guying: When required, stake or guy as specified below.

C. Watering Basin: Form saucer with 3 in. high berm centered around tree and shrub pits 12 in. wider than ball diameter. Do not form saucer around trees in lawn areas.

D. Watering: Immediately water all plants after completion of planting operations.

3.06 STAKING

A. General:

1. Trees shall be able to stand upright without support, and shall return to the vertical after their tops have been deflected horizontally and released. Stake or guy trees which do not meet this qualification.

2. Trees shall remain plumb and straight from installation through the warranty period.

3. Tree support, if required, shall be done as outlined on the following tables.

B. Staking: Stake all trees under 3-1/4 in. caliper in accordance with the following table at on-grade tree plantings only:

Tree Caliper @ 12 in. Above-Grade	# Stakes	Stake Size
To 1-3/4 in.	2	2 in. Diam. x 8 ft. min.
2 in. to 3 in.	2	2 in. Diam. x 10 ft. min.

1. Locate stakes as detailed in the Drawings, perpendicular to prevailing wind and as close to the main trunk as is practical, avoiding root injury. Drive stakes at least 36 in. into firm ground.

2. Remove nursery-supplied stake and tie trunk to new stakes using two tree ties. Find proper height for point of tree ties and attach as follows:
   a. Hold trunk in one hand, pull top to one side and release. Height at which trunk will snap back to upright position while hand-held is Base Height. Attach tree ties to trunk 6 in. above Base Height.
   b. Securely affix rubber ties mechanically to stakes. After total securement, cut off stakes to an even height determined by the Landscape Architect, and secure cap to stake.

3.07 PRUNING:

A. See Section 32 0190 – Operation and Maintenance of Planting.

3.08 MULCHING

A. Install a 4-in layer of decomposed granite mulch over street tree planting and a 3 in. deep layer of mulch over all shrub areas including tree and shrub watering basins.

B. Install stone and decomposed granite mulch as indicated on Drawings.

3.09 GROUNDCOVER PLANTING

A. Top-dress Fertilizer: Apply at the rate of 5 pounds per 1,000 square feet immediately after completion of planting.

B. Watering: Immediately water groundcover areas after fertilizer application to wash fertilizers from leaves of plants.

3.010 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

D. Erect temporary fencing or barricades and warning signs, as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

E. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

F. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION 33 0516
UTILITY STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE

1. Compliance: American Association of State Highways and Transportation Officials (AASHTO)

2. American Society for Testing and Materials (ASTM):

   a) A74 Cast Iron Soil Pipe and Fittings.

   b) A615 Deformed and Plain Billet-Steel Bars for Reinforcement.

   c) C150 Portland Cement

   d) C478 Precast Reinforced Concrete Manhole Sections.

   e) D3034 Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

   f) D2729 Perforated Drain Pipe

3. California Department of Transportation (CDT): Standard Specifications: Sections 51, 52, 55, 66, 70, 71, 72, 75 and 90.

PART 2 - PRODUCTS

2.1 UTILITY STRUCTURES

A. Manholes and Catch basins:
Precast drainage structures shall conform to Sections 70-1.02H and 71-1.07 of the CDT Standard Specifications and ASTM C478 and shall be of the size and shape shown on the drawings. Equivalent poured-in-place structures may be used at Contractor's option.
Frames and covers shall be cast iron conforming to Section 55-2.03 and 75-1.02 of the CDT Standard Specifications. Manhole covers shall have 24" clear opening with the words "STORM SEWER" or “SANITARY SEWER” in letters not less than 2" high cast into the cover (except where grated covers are shown on the drawings); Phoenix Iron Works P-1090 or equal.
Grates for catch basins shall have reticuline bars as shown on the plans suitable for use in areas with bicycle traffic.
Frames and grates for manholes and catch basins shall be match-marked in pairs before delivery to the job site. The grates shall fit into their frames without rocking.

B. Portland Concrete Cement:
Concrete shall be Class A concrete conforming to Section 90 of the CDT Standard Specifications. Cement shall be Type II cement conforming to ASTM Designation C150 as modified by Section 90 of the CDT Standard Specifications.

Aggregate shall be 3/4" maximum size conforming to Section 90 of the CDT Standard Specifications.
Water shall be clear and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.
Reinforcing bars shall conform to the requirements of ASTM A615 Grade 40 and deformed in accordance with Section 52 of the CDT Standard Specifications.
No admixtures will be allowed without prior approval of the Engineer.

C. Cleanouts
PVC Pipe: ASTM D3034, PVC cleanout threaded plug and threaded pipe hub.

D. Cleanout Boxes:
or approved equal. Valve risers shall be 6-inch PVC pipe or cast-iron pipe. Extension barrels shall be used as required.

PART 3 - EXECUTION

3.1 Valve Box Installation

A. Valve boxes shall be installed in accordance with NFPA 24. Valve boxes shall be set plumb and boxes shall be centered over valves. All foreign matter shall be removed from the interior valves before installation. Valves shall be inspected in the open and closed positions.

END OF SECTION 33 05 16

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 PROJECT INCLUDES

A. All labor, materials, tools, equipment, transportation, and temporary construction of any nature necessary for a complete operational installation of all work shown on the Plans and/or specified hereinafter.

1.2 RELATED WORK

A. Trenching and Backfill: 31 23 00

B. Earthwork: 31 00 00

1.3 QUALITY ASSURANCE

A. Compliance: American Association of State Highways and Transportation Officials (AASHTO)

B. American Society for Testing and Materials (ASTM):

1. A74 Cast Iron Soil Pipe and Fittings.
2. A564 Neoprene rubber compression gasket.
3. A615 Deformed and Plain Billet-Steel Bars for Reinforcement.
4. C150 Portland Cement
5. D3034 Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
6. D2729 Perforated Drain Pipe

C. California Department of Transportation (CDT):

1. Standard Specifications: Sections 51, 52, 55, 66, 70, 71, 72, 75 and 90.

PART 2 - PRODUCTS

2.1 REINFORCED CONCRETE PIPE(RCP)

A. Reinforced concrete pipe shall be per Cl. III ASTM C76.Joints shall be O-ring (nitrile) gasketed bell and spigot ,all concrete, with bell cast integrally with the pipe per ASTM C443. RCP pipe will be used for deep trench pipe outside footprint of the building.

2.2 CAST IRON PIPE (CIP)

A. Cast iron pipe and fittings shall conform to ASTM C74. Joints shall be rubber-gasketed bell and spigot type per ASTM C564.CIP will be used under the building.

2.3 POLYVINYL CHLORIDE (PVC) PIPE

A. Polyvinyl chloride pipe and fittings shall conform to ASTM D3034, SDR 26 with bell and spigot type rubber-gasketed joints.

2.4 PERFORATED PIPE/ FOUNDATION DRAIN

A. Polyvinyl chloride pipe and fittings shall conform to ASTM D2729, bell-and-spigot ends for loose joints.

2.5 HIGH DENSITY POLYETHYLENE (HDPE) PIPE, FUSION WELDED, DR 17

A. Pipe: HDPE pipe with Factory Mutual approvals for underground sewer and storm service. Pipe shall have a minimum DR rating of 17. Performance pipe or equal.

B. Fittings and couplings: Fusion welded, injection molded, ASTM D 2513. Butt fittings shall meet ASTM D 3261. Socket Fittings shall meet ASTM D2683.

C. Installers of HDPE pipe and fittings shall be in compliance with the regulations of the department of transportation, Materials Transportation Bureau, contained in the Code of Federal Regulations Title 49, part 192, Section 192-285.

2.6 PORTLAND CEMENT CONCRETE

A. Concrete shall be Class A concrete conforming to Section 90 of the CDT Standard Specifications.

B. Cement shall be Type II cement conforming to ASTM Designation C150 as modified by Section 90 of the CDT Standard Specifications.

C. Aggregate shall be 3/4" maximum size conforming to Section 90 of the CDT Standard Specifications.

D. Water shall be clear and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.

E. Reinforcing bars shall conform to the requirements of ASTM A615 Grade 40 and deformed in accordance with Section 52 of the CDT Standard Specifications.

F. No admixtures will be allowed without prior approval of the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cast iron pipe shall be installed where indicated on drawings and shall be installed per the manufacturer’s recommendations.

B. RCP shall be installed where indicated on the drawings and shall be installed per the manufacturer's recommendations.

3.2 PIPELINE TESTING

A. Prior to backfilling of the trench, the University inspector will inspect the trench bedding, pipe installation , and verify the slope of the alignment.

B. All new sections of sanitary sewer shall be air tested using the following procedures:

1. Test is conducted between two (2) consecutive manholes, or as directed by the Owner's designated representative.

2. The test section of the storm line is plugged at each end. One of the plugs used at the manhole must be tapped and equipped for the air inlet connection for filling the line from the air compressor.

3. All service laterals, stubs and fittings into the storm test section should be properly capped or plugged and carefully braced against the internal pressure to prevent air leakage by slippage and blowouts.

4. Connect air hose to tapped plug selected for the air inlet. Then connect the other end of the air hose to the portable air control equipment which consists of valves and pressure gages used to control the air entry rate to the sewer test section, and to monitor the air pressure in the pipe line. More specifically, the air control equipment includes a shut-off valve, pressure regulating valve, pressure reduction valve and a monitoring pressure gage having a pressure range from 0-5 psi. The gage shall have minimum divisions of .10 psi and an accuracy of ± .40 psi.

5. Connect another air hose between the air compressor (or other source of compressed air) and the air control equipment. This completes the test equipment set-up. Test operations may commence.

6. Supply air to the test section slowly, filling the pipe line until a constant pressure of 3.5 psig is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 5.0 psig.

7. When constant pressure of 3.5 psig is reached, throttle the air supply to maintain the internal pressure above 3.0 psig for at least 5 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

   During this stabilization period it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections. If leakage is detected at any cap or plug, release the pressure in the line and tighten all leaky caps and plugs. Then start the test operation again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, a new five-minute interval must be allowed after the pipe line has been refilled.

8. After the stabilization period, adjust the air pressure to 3.5 psig and shut-off or disconnect the air supply. Observe the gage until the air pressure reaches 3.0 psig. At 3.0 psig commence timing with a stop watch which is allowed to run until the line pressure drops to 2.5 psig at which time the stop watch is stopped. The time required, as shown on the stop watch, for a pressure loss of 0.5 psig is used to compute the air loss.

9. If the time, in minutes and seconds, for the air pressure to drop from 3.0 to 2.5 psig is greater than that shown in the following table for the designated pipe size, the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued at that time.

10. If the time, in minutes and seconds, for the 0.5 psig drop is less than that shown in the following table for the designated pipe size, the section of the pipe shall not have passed the test; therefore, adequate repairs must be made and the line retested.

Requirements for Air Testing

Pipe size (in inches)	Time Min.	Sec.
4	2	32
6	3	50
8	5	6
10	6	22
12	7	39
14	8	56
15	9	35
16	10	2
18	11	34
20	12	45
21	13	30

(For larger diameter pipe use the following: Minimum time in seconds = 462 x pipe diameter in feet)

11. For eight (8) inch and smaller pipe, only: if, during the five-minute saturation period, pressure drops less than 0.5 psig after the initial pressurization and air is not added, the pipe section undergoing test shall have passed.

12. Multi-pipe sizes: when the sewer line undergoing test is 8" or larger diameter pipe and includes 4" or 6" laterals, the figures in the table for uniform sewer main sizes will not give reliable or accurate criteria for the test. Where multi-pipe sizes are to undergo the air test, the Construction Administrator can compute the "average" size in inches which is then multiplied by 38.2 seconds. The results will give the minimum time in seconds acceptable for a pressure drop of 0.5 psig for the "averaged" diameter pipe.

13. Adjustment Required for Groundwater:

    a) An air pressure correction is required when the ground water table is above the sewer line being tested. Under this condition, the air test pressure must be increased .433 psi for each foot the ground water level is above the invert of the pipe.

    b) Where ground water is encountered or is anticipated to be above the sewer pipe before the air testing will be conducted, the following procedure shall be implemented at the time the sewer main and manholes are constructed.

        1) Install a 1/2" diameter pipe nipple (threaded one or both ends, approximately 10" long) through the manhole wall directly on top of one of the sewer pipes entering the manhole with threaded end of nipple extending inside the manhole.

2) Seal pipe nipple with a threaded 1/2" cap.

3) Immediately before air testing, determine the ground water level by removing the threaded cap from the nipple, blowing air through the pipe nipple to remove any obstructions, and then connecting a clear plastic tube to the pipe nipple.

4) Hold plastic tube vertically permitting water to rise in it to the groundwater level.

5) After water level has stabilized in plastic tube, measure vertical height of water, in feet, above invert of storm pipe.

6) Determine air pressure correction, which must be added to the 3.0 psig normal starting pressure of test, by dividing the vertical height in feet by 2.31. The result gives the air pressure correction in pounds per square inch to be added.

Example: if the vertical height of water from the sewer invert to the top of the water column measures 11.55 feet, the additional air pressure required would be

$$\frac{(11.55)}{(2.31)} = 5.0 \text{ psig}$$

Therefore, the starting pressure of the test would be 3.0 plus 5 or 8.0 psig, and the 1/2 lb. drop becomes 7.5 psig. There is no change in the allowable drop (0.5 psig) or in the time requirements established for the basic air test.

7) After the line has passed the air test, it shall be balled and flushed with water to clean. A metal screen shall be used downstream at the point of connection to the existing system to collect and remove any rock or other debris that is flushed out during cleaning.

3.3 PIPELINE INSPECTION

A. Prior to backfilling of the trench, the University inspector will inspect the trench bedding, pipe installation, and verify slope of the alignment.

END OF SECTION 33 40 00

SECTION 33 44 13

UTILITY AREA DRAINS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Provide landscape drainage, complete, as shown and as specified.

B. Related Work:

1. Section 32 1800 - Site Concrete
2. Section 32 9113 - Soil Preparation
3. Section 32 9119 - Finish Grading
4. Section 32 9300 - Planting
5. Division 33 - Utilities

1.02 REFERENCES

A. Standard Specifications - Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS.

B. ASTM - American Society for Testing and Materials

1.03 QUALITY ASSURANCE

A. Pre-construction conference: The Contractor will meet with the necessary parties prior to start of construction to review and discuss project conditions as it relates to the integrity and compatibility of drainage systems.

1.04 SUBMITTALS

A. Product Data: Manufacturers' current catalog cuts and specifications for the following:

1. Planter Drains
2. Drain Pipe
3. Trench Drain

B. Samples:

1. Filter Fabric: One six (6) inch x six (6) inch for each type.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: All containerized products shall be delivered to the site in manufacturer's original, unopened, legibly labeled containers. All pipes to be delivered bound securely to prevent damage. Supply pallets as required to protect products.

B. Storage: Protect materials from damage, water and rust. Store pipes on beds which are full length of pipe. Protect plastic materials from direct sunlight.

C. Pipe: Cap openings to prevent entry of dust, debris and other foreign matter.

1.06 SEQUENCING AND SCHEDULING

A. Concealed Work: Verify locations of existing stubouts to receive landscape area drains. Coordinate on-structure drainage with plumbing contractor in establishing drain locations.

B. Lines and Levels: Establish for each drainage system and coordinate with other systems to prevent conflicts and maintain proper clearances.

C. Notification: Submit written notification of all discrepancies in the Drawings or existing conditions, which preclude successful installation of landscape drainage work as specified.

D. Planting Area Drainage: Coordinate installation of sub-drainage systems with installer of plants.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Perforated and Non-Perforated Polyvinyl Chloride Pipe (PVC) for aeration tube, drain collar, and inspection tube):

1. Type: ASTM D1785, PVC 1120-1220, Schedule 40 and 80, pipes and fittings and as indicated on Drawings.

2. Perforations: as indicated on Drawings

B. Area Drain in Planting and Raised Grate:

1. Type and Size as per Drawings. . See Civil Engineer’s Drawings for outlet pipe sizes.

2. Finish: Nickel Bronze

C. Pedestrian Trench Drain and Grate

1. Trench Drain and Grate to match existing system.

2. Finish: To match existing

D. Area Drain in Paving. See Civil Drawings.

2.02 ACCESSORIES

A. Sand Backfill: Fine granular material naturally produced by the disintegration of rock, free of organic material, mica, loam, clay and other deleterious substances to be thoroughly suitable for pipe bedding.

B. Inspection tube grate

1. Basis of Design: "NDS 1040" 10" grate by NDS (www.ndspro.com, 877.301.5242) or acceptable equivalent.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify exact locations and quantity of all drains relative to planting areas and adjacent to paving, prior to beginning of work. Identify required lines, levels, contours, and datum. Immediately report to Architect all discrepancies found prior to installation of drains.

B. Deviations: Make no deviations from specified line or grade without written acceptance of change by Architect.

3.02 INSTALLATION

A. Planter / Trench Drains:

1. Install to locations and rim elevations as shown and detailed on the Drawings.

2. Connect to pipe stubouts in strict accordance with the manufacturer's current printed specifications.

B. Soil Backfill: Backfill with planter soil mix. See Soil Preparation -Section 32 9113

3.03 FIELD QUALITY CONTROL

A. Tests: Field density test for compaction.

B. Coordinate testing with field tests for waterproof membrane.

C. Manufacturer's Field Service: Installation of drainage matting.

3.04 PROTECTION

A. General: Keep clean and protect planter drains installation until commencement of work under Soil Preparation - Section 32 9113.

B. Sediments: Regularly inspect and clean all drain sediment buckets to prevent flooding. Sweep or hose clean all drains as necessary.

END OF SECTION

LEED 2009 for New Construction and Major Renovation

Project Checklist - 100% Construction Documents

JACOBS HALL

15-Aug-14

Sustainable Sites — Possible Points: 26

Y	N	?			
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
5			Credit 2	Development Density and Community Connectivity	5
	N		Credit 3	Brownfield Redevelopment	1
6			Credit 4.1	Alternative Transportation—Public Transportation Access	6
		1	Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
		3	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
2			Credit 4.4	Alternative Transportation—Parking Capacity	2
	N		Credit 5.1	Site Development—Protect or Restore Habitat	1
	N		Credit 5.2	Site Development—Maximize Open Space	1
	N		Credit 6.1	Stormwater Design—Quantity Control	1
	N		Credit 6.2	Stormwater Design—Quality Control	1
1			Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
		1	Credit 8	Light Pollution Reduction	1

Water Efficiency — Possible Points: 10

Y	N	?			
Y			Prereq 1	Water Use Reduction—20% Reduction	
2			Credit 1	Water Efficient Landscaping - 50% Reduction	2 to 4
	N		Credit 2	Innovative Wastewater Technologies	2
3		1	Credit 3	Water Use Reduction - 35% Reduction	2 to 4

Energy and Atmosphere — Possible Points: 35

Y	N	?			
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	0
Y			Prereq 3	Fundamental Refrigerant Management	
8			Credit 1	Optimize Energy Performance: Improve by 26% for New Bldgs	1 to 19
		7	Credit 2	On-Site Renewable Energy: 13% Renewable Energy	1 to 7
		2	Credit 3	Enhanced Commissioning	2
	N		Credit 4	Enhanced Refrigerant Management	2
	N		Credit 5	Measurement and Verification	3
		2	Credit 6	Green Power	2

Materials and Resources — Possible Points: 14

Y	N	?			
Y			Prereq 1	Storage and Collection of Recyclables	0
	N		Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
	N		Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
	N		Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	N	?			
1		1	Credit 4	Recycled Content	1 to 2
1		1	Credit 5	Regional Materials	1 to 2
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 15

Y	N	?			
Y			Prereq 1	Minimum Indoor Air Quality Performance	0
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	0
		1	Credit 1	Outdoor Air Delivery Monitoring	1
1			Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
1			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
	N		Credit 5	Indoor Chemical and Pollutant Source Control	1
1			Credit 6.1	Controllability of Systems—Lighting	1
		1	Credit 6.2	Controllability of Systems—Thermal Comfort	1
		1	Credit 7.1	Thermal Comfort—Design	1
		1	Credit 7.2	Thermal Comfort—Verification	1
		1	Credit 8.1	Daylight and Views—Daylight	1
1			Credit 8.2	Daylight and Views—Views	1

Innovation and Design Process — Possible Points: 6

Y	N	?			
		1	Credit 1.1	Innovation in Design: Process Energy Conservation - Elevator	1
1			Credit 1.2	Innovation in Design: Process Energy Conserv'n-Energy Star	1
1			Credit 1.3	Innovation in Design: Integrated Pest Management	1
1			Credit 1.4	Innovation in Design: Green Cleaning	1
1			Credit 1.5	Innovation in Design: Post Occupancy Survey	1
1			Credit 2	LEED Accredited Professional	1

Regional Priority Credits — Possible Points: 4

Y	N	?			
1			Credit 1.1	Regional Priority: Water Use Reduction	1
		1	Credit 1.2	Regional Priority: Onsite Renewable Energy	1
		1	Credit 1.3	Regional Priority: Daylight & Views - Daylight	1
	N		Credit 1.4	Regional Priority: Innovative Wastewater Technologies	1

49	0	28	**Total**	Possible Points: **110**

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

PAN-PACIFIC
MECHANICAL

UC Berkeley Jacobs Hall

LMS Architects

Mechanical and Plumbing Basis of Design

100% DD

June 18, 2014

Pan-Pacific Mechanical
1205 Chrysler Drive
Menlo Park, CA 94025
(650)561-8810
www.ppmechanical.com

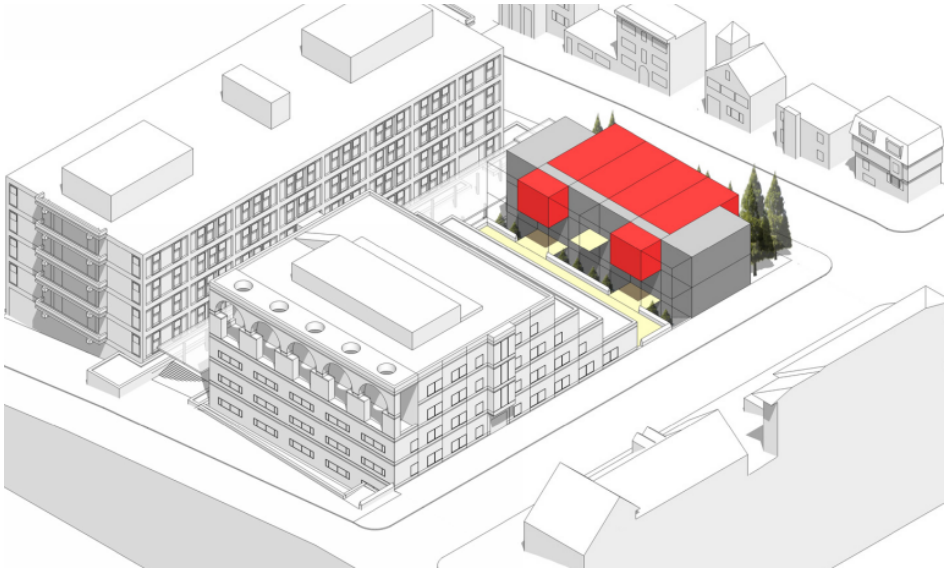
PART 1: HVAC SYSTEMS

1. Executive Summary

Jacobs Hall will be located on the University's campus in Berkeley, California. The building's mission is to provide an environment that cultivates personal and intellectual growth. The new site and design will support this mission by providing an innovative educational environment that promotes strong community, interdisciplinary interaction, and responsible environmental stewardship.

In pursuit of these goals, the first priority of the design team is to provide systems that give a transparent, welcoming, and open space with natural daylight and views. This can be achieved through an excellent building envelope, healthy indoor air quality, plenty of natural ventilation, passive cooling, active heating, energy efficient equipment, and active space cooling where required. Our final goal is to provide a design that allows for flexibility in schedules, staffing and courses. The design will showcase to the staff, students and community the importance of a responsible design and how this impacts our environment.

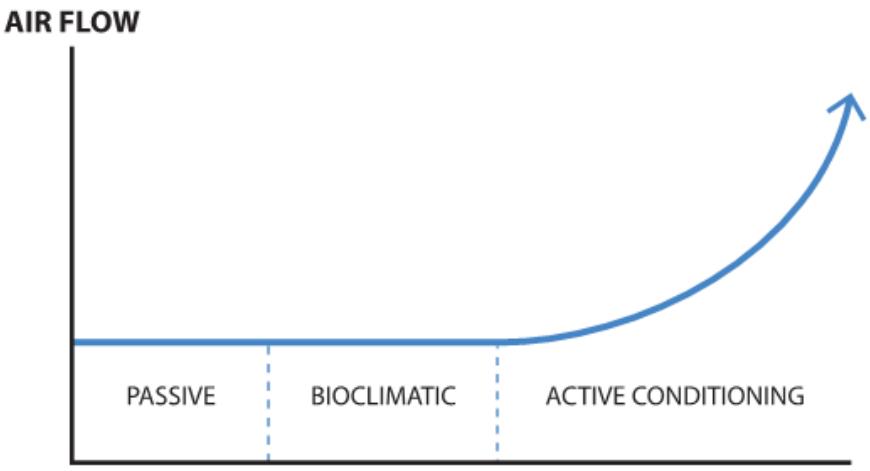
This narrative outlines the best options for mechanical and plumbing for Jacobs Hall. Significant energy and water savings may be realized with our proposed systems and energy saving features. All proposed systems will provide the building with an excellent and efficient indoor environment, regardless of the energy saving potential of the systems.

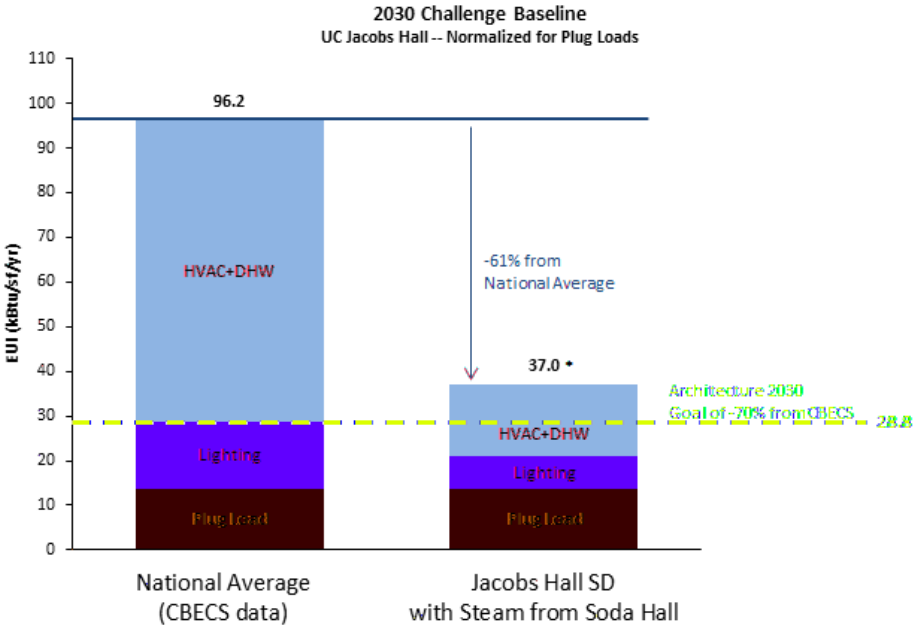


Summary of Energy Efficiency Strategies

To make this a high performance, low energy consumption campus, we will rely on the following main strategies:

- Radiant ~~floor~~ panel heating system in perimeter~~most~~ areas
- High efficiency mechanical equipment
- Natural ventilation where applicable
- Variable speed, primary-only pumping for hydronic distribution loops
- Variable speed fan for air distribution
- Control of ventilation air quantity with CO2 and occupancy sensors in large high-occupancy areas such as studios, conference and meeting rooms.
- Limited-capacity "Bump" Mechanical Cooling in base design areas that can be naturally ventilated.





Commercial Buildings Energy Consumption Survey (CBECS)
A nation-wide study of buildings conducted by the US Energy Information Administration. This data approved by the AIA for use as a baseline for the Architecture 2030 Challenge.

2. Design Criteria

Location

Berkeley, CA

Outside Design Conditions

Temperature statistics based on the 2010~~0~~ Title 24 Energy Code Design Day Data (0.5% cooling and 99.4% heating) for Berkeley, CA:

Summer: 83°F DB/63°F MCWB

Winter: 40°F DB

These design conditions are based on statistical analysis of historical data and represent the typical peak conditions expected during a typical year. The 0.5% design conditions may be exceeded for a number of hours per year (due to outside temperatures exceeding these design conditions). While designing to the 0.5% conditions by definition indicates that design setpoints will be exceeded during peak periods, typical design often requires a minimal amount of over sizing so that control is always maintained. This results in small amounts of risk and results in significant first cost and operating cost savings.

Interior Design Conditions

The indoor environmental conditions in a given space are normally controlled to satisfy the requirements of the Thermal Environmental Conditions for Human Occupancy Standard 55-2004 using the Predicted Mean Vote model, developed and published by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and ANSI. Designing to meet that Standard produces a design with industry accepted comfort conditions. ASHRAE 55 specifies conditions in which a specified fraction of the occupants will find the environment thermally acceptable. It takes into account air temperature, radiant temperature, air movement, air moisture content, metabolic rate, and clothing level. The acceptable indoor temperatures for Jacobs Hall is a range of 65°F to 78°F with 85°F as a maximum on extreme cooling days.

Space Type	Density (#/1000 sq. ft.)	People Outdoor Air Rate (CFM/person)	Area Outdoor Rate (CFM/ sq. ft.)
Main Entry Lobbies	10	5	0.15
Office Space	5	5	0.15
Conference/ Meeting	50	5	0.15
Corridors	-	-	0.15
Break Room	25	5	0.15
Storage	-	-	0.15
Classroom/ Studio	50	10	0.15

Acoustics

Acoustical design criteria and recommendations, including vibration isolation, are determined by the Acoustical Consultant, and are included in the mechanical and plumbing design. Maximum background noise levels allowable due to mechanical equipment shall never exceed the level allowed by the City of Berkeley Noise Ordinance**.** Air distribution systems shall be selected with the following criteria. Both ductborne noise and radiated noise from ducts and equipment are to meet these performance requirements. These are based on the client's programmed uses and ASHRAE Guidelines.

Space Type	Diffuser Noise Criteria	Max Supply Air Branch Duct Velocity (fpm)	Max Relief and Exhaust Air Branch Duct Velocity (fpm)
Private Office, Classrooms/Studios, Lobby/Exhibit	35	500-600	600-700
Meeting Room	30	425-500	500-600
Circulation/Corridors	40	500-600	600-700
Toilet Rooms	45-50	600	700

Code Standards and References

The project will be designed to comply with the following building codes, standards, and rating systems.

2013~~0~~ Title 24 California Code of Regulations

- Part 2 California Building Code
- Part 3 California Electrical Code
- Part 4 California Mechanical Code
- Part 5 California Plumbing Code
- 2010 Part 6 California Energy Code
- Part 9 California Fire Code
- Part 11 California Green Building Standards Code
- Part 11 California Green Building Standards Code Supplement

ASHRAE Standard 55-2004, Thermal Environmental Conditions, with provisions per LEED requirements

ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality, with provisions per LEED requirements

ASHRAE Standard 90.1-2010, Energy Standard for Buildings, with provisions per LEED requirements

University of California Berkeley Campus Standards and Requirements.

3. Building Envelope

Typ Exterior Wall:

exterior

- Aluminum Panel rain screen or dry joint clip assembly 2" thick.
- WP membrane
- 5/8" ext sheathing
- high density batt insulation R21
- 6" mtl stud framing @ 16" O.C.
- 5/8" gyp bd

interior

1st Story Retaining Wall:

exterior, sometimes below grade

- 12" cast in place concrete wall
- 3-1/2" batt insulation R13
- 3-5/8" mtl stud furred framing @ 16" OC.
- 5/8" gyp bd

interior

Slab on Grade:

exterior, below grade

- Vapor Barrier
- 8" concrete slab

interior

Typ Low Flat Roof:

exterior

- WP membrane
- rigid insulation, R38
- ¾" ext sheathing
- 6 1/4" conc. metal deck

interior

Typ High Sloped Roof:

exterior

- WP membrane
- 6" rigid insulation, R38
- ¾" ext sheating
- 3" metal deck

interior

Windows:

- Thermally Broken 6" or 7-1/2" curtain wall.
- 1" IGU PPG Solarban 60XL @ East / North 70XL @ South / West, Low E, Argon Filled
- 6" Insulated spandrel panel @ north façade, see elevations.

Shading Devices:

- Aluminum exterior horizontal sun shades at south elevations to studios, see elevations.
- Aluminum exterior vertical sun shade at west elevation in front of stair wells and lounges, see elevations.

4. CAMPUS CHILLED AND HOT WATER TEMPERATURES

Chilled Water Temperature:

- Supply water temperature: 42F
- Return water temperature: 54F

Hot Water Temperatures:

- Supply water temperature: 180F
- Return water temperature: 140F

53. HVAC Systems Descriptions

Summary

The appeal for a highly efficient building is a challenge that can be met with collaboration, dedication, communication, and attention to detail by all members of the ownership, design, and construction team. Essential to a successfully integrated design are creative thinking about how and when the building will be used, an embrace of innovation and collaboration between owners and all members of the project design and construction team, as well as sustained attention to detail throughout project delivery.

The building will use water directly in the space conditioning systems. The amount of energy used by these systems may be minimized through a high performance building envelope, low power consuming systems within the building, and a mechanical system responsive to the resources of the site. Additional energy savings may be sought through the use of high efficiency hydronic heating system, natural ventilation in some spaces, and proper maintenance of daily operation.

In the heating season, the most effective strategies will be to focus on optimizing the building envelope and maximizing the efficiency of mechanical systems.

In the cooling season, however, there is wonderful opportunity to use the climatic resources found on site as an integral part of the space conditioning strategies. The biggest resources Jacobs Hall has in this respect are a temperate climate resulting in little cooling needs and cool nighttime temperatures. The design challenge is to find a way to maximize the use of this resource. The desire is to bring that cool temperature into the space in a way that meets the daytime cooling loads without creating openings in the building that will compromise its heating season performance. The wind may be used for natural ventilation during the day, eliminating fan energy from the mechanical ventilation system.

Our challenge was finding a system concept that would both
a) Produce and deliver heating and cooling with minimal equipment to maintain the desired openness of the architectural design and
b) Serve a variety of space types with differing heating, cooling, and ventilation needs.
These constraints were then paired with a cost effective and energy efficient system selection.

Passive/Architectural Strategies

The first targets for energy efficient comfort design are passive and low-energy architectural strategies to best use the resources of the site.

Heating

The biggest determining factor in total building heating energy use is not the efficiency of the source of the heat, but in how quickly it is lost to the outside. Highly insulated roofs, walls, and high performance windows all help to lower this heating loss. The particular challenge for this project is in providing enough glazing to allow for the project's desired open views and daylighting without severely compromising the thermal integrity of the assembly. High performing glass can insulate to the level of R-3 to R-5. When compared to an R-30 wall or an R-60 roof, significant glazing in any given area of wall or roof severely hampers its thermal performance. In addition, over-glazing can create local thermal comfort problems due to drafts on cold days and radiant hot spots on hot days.

In addition to these conductive losses is the infiltration load, which can be as significant, if not more so, than those other envelope elements. Typical buildings leak one half of the volume of a given room each hour through the envelope (0.5 air changes per hour). Providing a robust air barrier, as well as well-detailed windows, doors, joints, seams, corners, and other openings into the building will eliminate leaks and keep building-wide infiltration rates at below 0.15 air changes per hour.

Cooling and Ventilation

Because of the temperate climate in Berkeley, CA, the desire is to eliminate mechanical cooling systems from the design as much as possible. For this reason, ventilation with dedicated outside air is closely tied to the cooling design for Jacobs Hall. A reduced mechanical system can be achieved through thoughtful planning and coordination of mechanical systems with the architecture. Again, the main challenge was to balance the desire for high transparency and views with the thermal performance of the building envelope. In hot weather, unwanted heat enters the building through conduction, similar to the heating season. However, the building is also heated by direct solar gains to building mass through un-shaded windows, and indirect solar radiation through shaded windows. The building will address these needs primarily through the use of air movement and cool night temperatures.

One of the site resources that can easily be incorporated into the building system is the wind. This will provide natural ventilation by cross approach. The architectural features to assist in this process are doors and operable windows. Cross-ventilation relies on outdoor wind forces to create a pressure gradient, drawing outside air in from operable windows on the high pressure side of the building and out openings on the low-pressure side.

Mechanical System

Central System

For Jacobs Hall, we recommend using water as the working fluid for delivering heat to the building. Adjacent Soda Hall has existing chiller and steam to hot water plants, which both have excess capacity to serve the loads introduced by the new building.

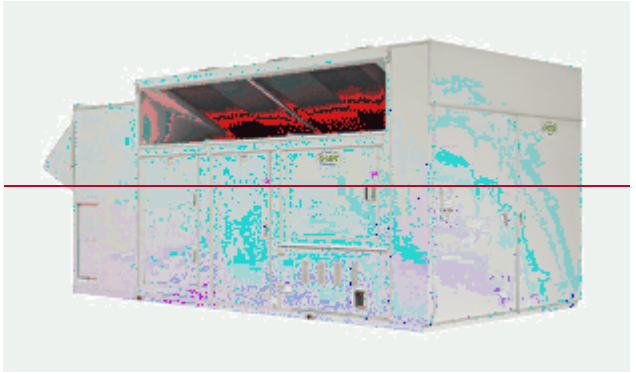
Central Packaged Unit

This system utilizes a packaged unit to provide 100% outside ventilation air to spaces within the building. The unit will temper the outside air and deliver it at moderate temperatures.

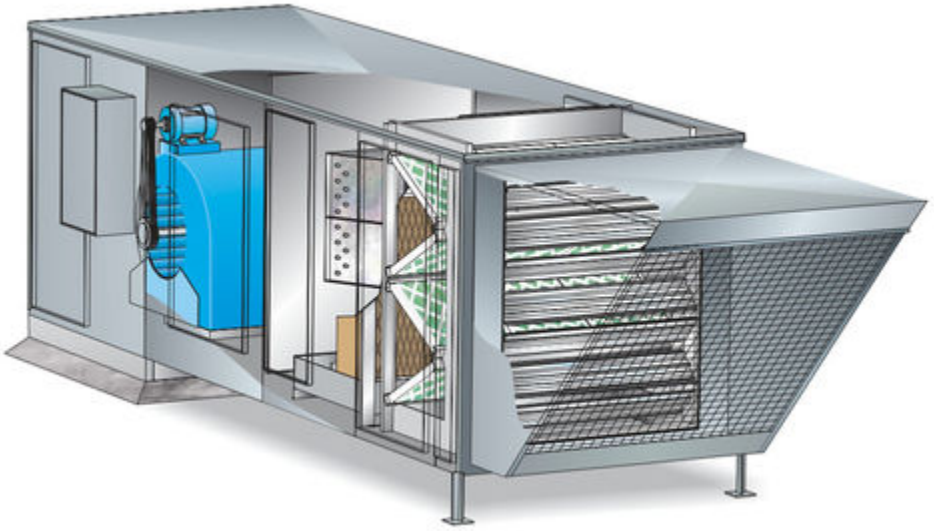
The unit provides ~~heating with hot water produced by the existing steam plant in Soda Hall. Similarly, the unit will provide limited~~ "bump" cooling with the chilled water produced by the existing chiller plant. The bump cooling will help offset the temperature within the studios on the extreme cooling days. The coil for the bump cooling will be sized in order to temper the outside air to approximately 60°F-65°F on the hotter desing days.

The air system will be dramatically smaller than if it were providing full conditioning and ventilation. This allows for less fan energy and smaller ductwork, in turn, decreasing the required sizes of soffits and shafts needed to hide the ductwork. The smaller ventilation unit shall be sized to fit the limited rooftop area shown on drawings.

~~The basement of Jacobs Hall will conist of a computer lab with approximately 60 computer stations. A second air handling unit will provide conditiond outdoor air and cooling as necessary to the computer lab. The basement unit will be similar to the central unit, utilizing the heating hot water and chilled water supplied from Soda Hall. The unit will operate with a VFD and have the ability to provide 100% outdoor air on days when the outside conditions are suitable for cooling.~~



~~*Packaged Central Unit*~~



Packaged Central Air Handling Unit

Heating System

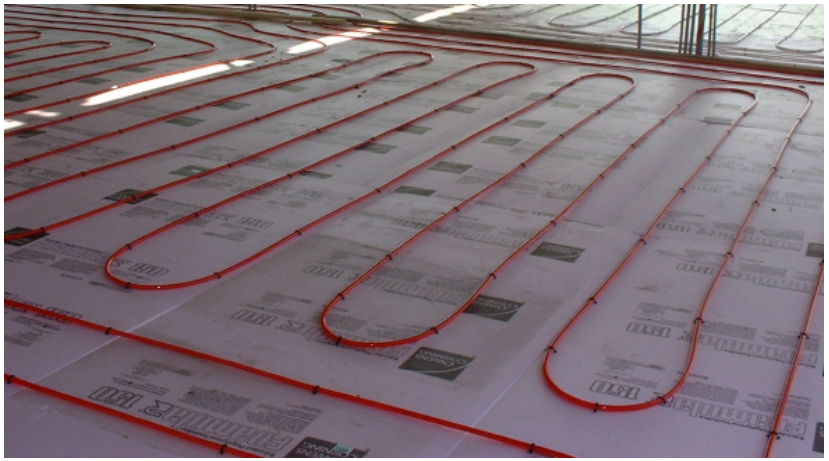
Wall mounted radiant panels located along the perimeter of the building will provide heating to the occupied spaces. The interior spaces of the building will be heated as necessary via a heating coil within the ductwork at the zone level on each floor. Each zone will have the capability of temperature control as well as ventilation control. ~~—An in-slab radiant floor system will transport heating energy throughout the building. The distribution system will be served off of a common 2-pipe system. Piping will be sized and configured to minimize friction loss.~~

Each radiant panel will have its own thermostatic control valve to allow user control per zone. The radiant panel layout can be seen on the following page. All radiant panels will make up an individual zone with the exception of the two panels in each studio, which will operate off of one thermostatic valve. DDC controls will be utilized to control the temperature and air flow within the studio and offices spaces.

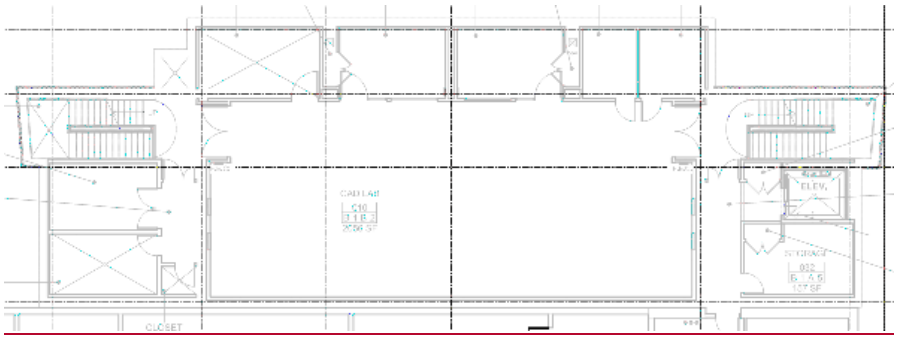
~~This system will provide heating. The radiant floor system will be separated into zones with manifolds. This zoning allows for varying water temperatures within the building, providing flexibility for maintaining different desired indoor conditions. Radiant slabs work best without carpet but in areas where carpeting, use a thin carpet with dense padding and install as little carpeting as possible. If only some rooms will have a floor covering, then those rooms should have a separate tubing loop to make the system heat the space more efficiently. The water flowing under the covered floor will need to be hotter to compensate for the floor covering. If a wood floor is desired, it should be laminated instead of solid to reduce the possibility of shrinking and cracking. Ceramic tile is the most common and effective floor covering for radiant floor heating.~~

~~*Hydronic Radiant Slab Installation*~~

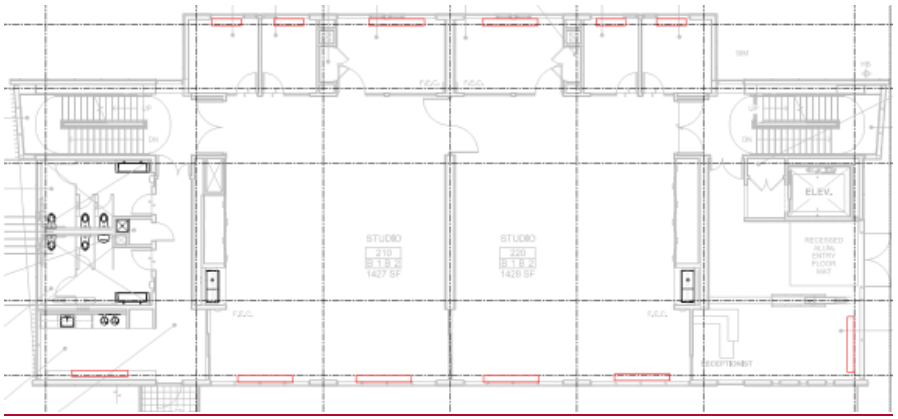
Wall mounted radiant panels



Radiant Panel ~~Zoning~~ Layout



Basement – Primary heating will be provided via the AHU



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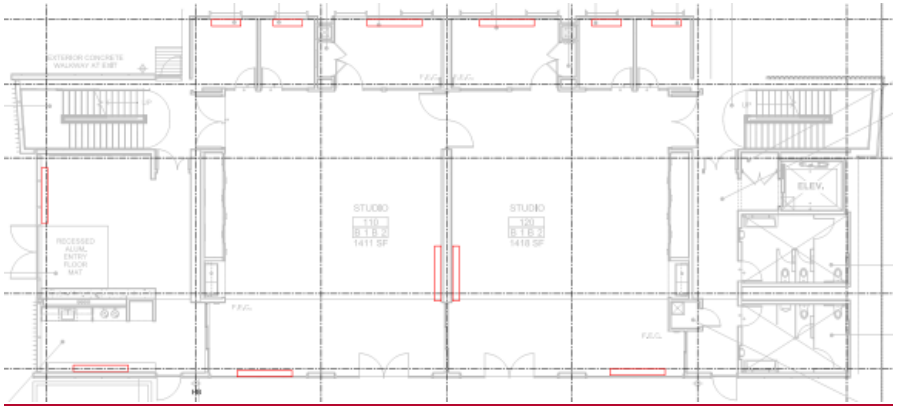

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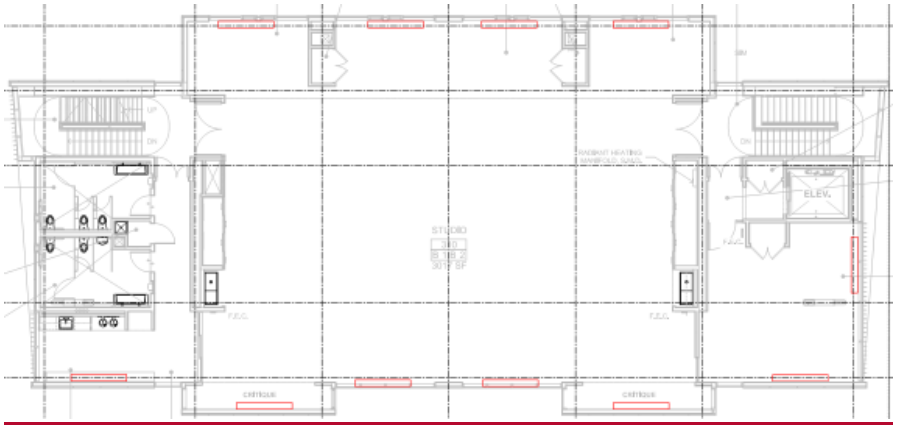
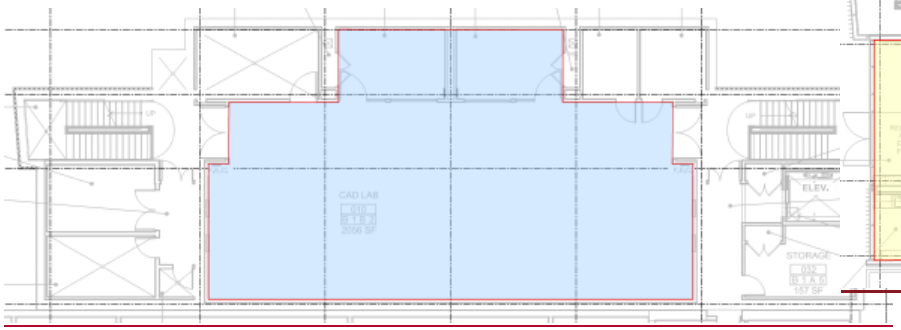


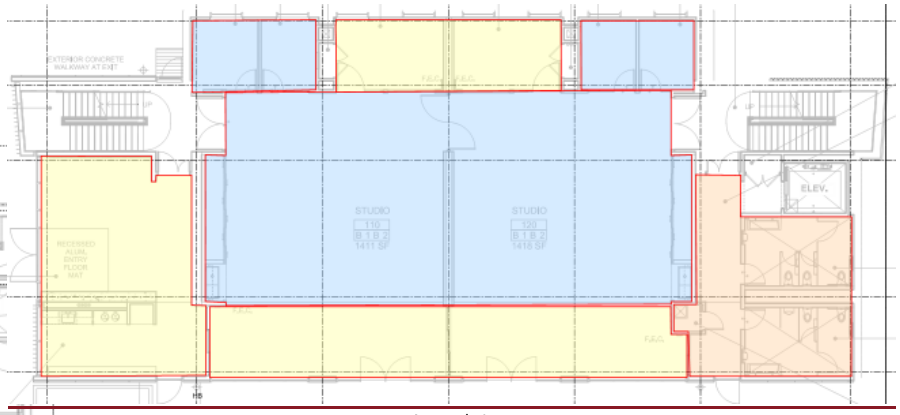
Level 3

Ventilation Zoning Layout

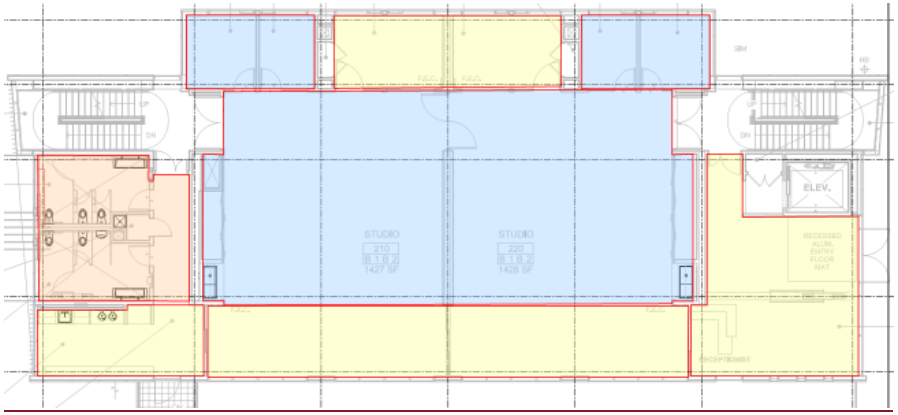
~~Outlined zones denote spaces with mechanical ventilation. Remaining spaces shall be naturally ventilated.~~Blue zones denote spaces with mechanical ventilation. Yellow zones denote spaces with natural ventilation. Orange zones denote spaces passively ventilated through exhaust air. The black rectangles show the barometric relief damper locations.



Basement



Level 1



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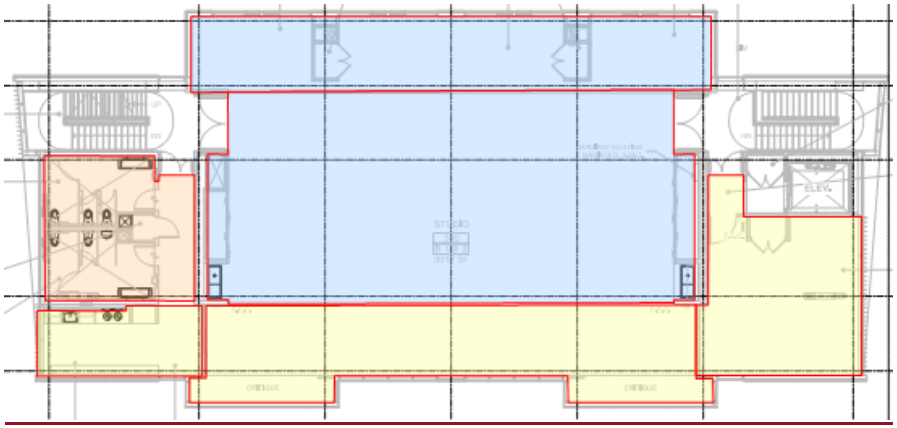

Level 3

4. Indoor Air Quality and Energy Efficiency

The building systems will be designed to provide exceptional indoor air quality with a high degree of user control through the use of high-efficiency filtration, pretreatment of outdoor air, exhaust of contaminants, and operable windows.

Airflow to mechanically ventilated spaces will be in compliance with ASHRAE Standard 62.1-2007 or LEED 2009 ventilation effectiveness requirements, whichever is greater. Naturally ventilated spaces will be, at minimum, designed to comply with section 5.1 of this standard and to meet the LEED 2009 requirements for naturally ventilated spaces.

Building Ventilation Systems

Mechanical Ventilation

The proposed ventilation is primarily mechanically ventilated via a dedicated outside-air air handling unit. Interior spaces lacking access to operable windows will be supplied outside air through more conventional ceiling diffusers. Filtered and tempered outside air will be supplied to classrooms/studios, perimeter private offices in the first and second floor along the North side of the building and meeting rooms in the third floor alongf the North side of the building. Natural ventilation may be used in lobbies, lounges, and Level 3 equipment rooms.

All visible HVAC devices and equipment shall be submitted to and accepted by the Architect. Roof plans and equipment shall be fully dimensioned both horizontally and vertically so that sight lines can be reviewed and accepted. All visibile HVAC ductwork, diffusers, grilles, panels, sensors, thermostats, and other equipment shall be in locations agreed to by both the Engineer and Architect.

CO2 sensors will be used in all densely occupied areas (i.e. with 25 people/1000sf or greater) to modulate fan based ventilation systems to meet the requirements of the LEED IAQ credit. The central air handler will be equipped with a VFD and direct airflow measurement to ensure that minimum required amounts of ventilation air are provided to all spaces. There will be provisions to control airflows in these spaces based on measured CO_2 concentrations.

Relief air shall exit the building through gravity operated pressure relief dampers sized for 300 FPM. Louvers will be sized by the engineer and selected by the Architect to hide the pressure relief damper on the outside face of the building.

Natural Ventilation

The project site is located in an ideal location for natural ventilation. Doors and operable windows can be used to provide a ventilation path to the spaces shown on the drawings. A natural ventilation system will reduce the site mechanical energy use, reduce equipment first cost and lower repair and maintenance expenditures. Natural ventilation will be utilized during temperate periods of the year, allowing the mechanical equipment to operate at a much lower energy level or be turned off completely.

In the spaces using natural ventilation only, individual thermal comfort expectations are often re-evaluated for a wider range of indoor temperatures. Most building occupants are accustomed to conventional centralized HVAC systems that provide a narrow range of indoor temperatures, developing high expectations for individual thermal comfort.

Ceiling fans are recommended when using a natural ventilation and radiant heating system for the following benefits:

- Provide users control over their comfort level through operable windows and fan control
- Reduce the perceived temperature by about 5 °F
- Moving air creates a wind chill effect that cools your body
- Natural ventilation with ceiling fans will guarantee that continuously moving air will be provided at all times
- Field studies verify warm and neutral users prefer more air movement
- Encourage stratification during warm days by pushing warmer air upwards away from the occupied level
- Discourage stratification during cooler days by bringing warmer air downwards to the occupied level

Air Filtration

Design Minimum Air Filtration for Air Handlers Only:

- Final filters: MERV 13 (85% minimum ASHRAE 52-76) V-shaped mini-pleat
- Pre-filters: MERV 8 (30% minimum ASHRAE 52-76)

Standard filtration provides for protection of equipment (coils, fans, etc.) but does not provide for occupant health. High-efficiency filtration ensures that indoor air quality is also maintained. By increasing the efficiency of filtration, especially for the smallest particles, dust and common airborne pollutants, especially pollen, diesel soot, and dust, are greatly reduced. With the right selection and design of the filtration system, the energy required for filtering ventilation air will be controlled to a manageable level.

In rooms containing equipment such as mills, sanders, drills, laser cutters, and soldering stations, filtration of the exhaust air is required to capture wood particles, dust, fumes, and any odors before it is released to the outdoors.

A dedicated exhaust system for laser cutters shall be routed to a roof mounted fan. Multiple laser cutters may be exhausted by a common system provided they are in close proximity. Welding is not anticipated at the facility. If welding is done in the future, there are products on the market that provide local exhaust that are designed to filter air and recirculate it within the space. If this is acceptable for the work performed, this eliminates the need for a makeup air system and associated high energy use.

A dust collection system is required at equipment rooms on the basement level~~the third floor~~ with woodworking equipment. Dust collection exhaust shall be collected, filtered, and exhausted to the outdoors up through the roof.

Each ~~CNC machine~~, laster cutter, and 3D printer shall have a direct, dedicated exaust system.

5. HVAC System Preliminary Equipment List

The cost estimating for the HVAC system will be provided based on the preliminary equipment list provided below. Individual costs will be provided for each system component. Additionally, pricing options will be provided for any alternative listed. For line item prices that include ancillary components, a list of those components will be provided. BMS system requirements and description shall be provided along with unit cost per point.

Central System

- Cooling Baseline: ~~(E) 60 ton Chiller in basement of Soda Hall~~Tap into existing Chilled water system in Soda Hall
- Heating Baseline: Tap into existing HHW System in Soda Hall
- ~~See attached sketch for proposed routing of connections from Jacobs Hall to Soda Hall utilities~~.

Distribution System

- ~~Radiant Slab Heating (Base Bid) - 1 manifold per zone; 1 in-slab temperature sensor per zone; 1 control valve per zone; Max. 300 ft. tubing per loop; Max. 10 loops per manifold; Radiant rollout mat to be used where possible; 12" tube spacing~~ The baseboards will be controlled by themostatic valves
- ~~Dedicated Outdoor Air System (DOAS) Aaon M2-H-011 indoor Packaged Air Handling Unit – 5000 CFM, discharge through the top of the casing, sized for basement CAD lab cooling, with HHW coil, CHW coil, MERV 13 filter, VFD, return and outside air motorized dampers, and duct smoke detector; sized to fit within the basement mechanical room, see drawings.~~
- ~~Basement Air Handling Unit: Aaon RN-030 Rooftop Packaged Air Handling Unit – 7,830 CFM horizontal discharge, sized for "bump" cooling, with HHW coil, CHW coil, MERV 13 filter, VFD, no return air, and duct smoke detector; sized to fit within roof mechanical well, see drawings~~
- Radiant panels along the perimeter of the building. Radiant panels are controlled by thermostatic valves
- One dedicated Outdoor Air System (DOAS) chilled water coil. The DOAS will supply 8,000 CFM. Supply air to the basement will be 1,400 CFM, and 2,200 CFM for the first, second, and third floor respectively. The DOAS will be provided with 30% pre-filters and 85% final filters, a Variable Speed Drive and Sunbelt control system. There will be a total of seven zones. One for the basement, and two zones for the the first, second, and third floor.
- The chilled water coil for the DOAS will be sized for 42 degrees chilled water supply and 54 degrees chilled water return.
- ~~The heating water coil for the DOAS will be sized for 180 degrees hot water supply and 140 degrees hot water return.~~

Miscellaneous

- ~~Corridor/Restroom Ventilation: HRV 1500 CFM~~
- Each space to have "Haiku" Big Ass Fan ceiling fans where shown on drawings (Provided by Electrical Contractor)
  - Northside offices: Mechanical ventilation from register at ceiling duct
- Exhaust Fans
  - Lounge/Breakroom/Pantry: (1) ~~each Greenheck centrifugal inline SQ with Vari-Green motor~~Exhaust register each that connects to a single shaft served by a roof top Greenheck GB fan with Vari-Green motor.
  - Printer/Machine rooms: (1)~~ each Greenheck centrifugal inline~~ Exaust register per room which connects to a single shaft served by a roof top Greenheck GB fan~~SQ~~ with Vari-Green motor, (1) vacuum 'snorkle' hood system,~~ welding exhaust system,~~ location to be coordinated with the College of Engineering (1) Unimaster UMA-150 dust collector ~~per room~~for the basement equipment room.
  - Multiple occupant restrooms: (1) Exhaust register each which connects to a single shaft served by a roof top Greenheck GB fan ~~centrifugal inline SQ~~ with Vari-Green motor. Restroom exhaust fan will also serve the Lounge/Breakroom/Pantry spaces. First floor restrooms will have (1) Greenheck centrifugal inline SQ fan with Vari-Green motor.
  - Janitor closets: (1) ~~each Panasonic Energy Star WhisperGreen ceiling mounted model FV~~Exhaust register each which is connected to the restroom exhaust fan for the floor.
  - Electrical room: (1) Greenheck centrifugal inline SQ with Vari-Green motor ~~(may be required to have additional mechanical cooling)~~
- Telecom/Server: (1) Mitsubishi cooling only split system

Ductwork and Accessories

- Sheet Metal Ducting (all exposed ductwork shall be painted spiral or oval)
- Ductwork Insulation (includes acoustical lining as required to meet acoustical criteria)
- Balancing Dampers
- (6) Modulating Dampers (two at each floor) and (1) for the Basement
- Diffusers and Grilles
- Miscellaneous Ductwork Accessories
- Fire smoke dampers
- Pressure relief dampers (Architect to provide louvers, mechanical contractor to install)
- (7)Duct mounted heating coils sized for 180°F hot water supply and 140°F hot water return

Pipework and Accessories

- Cooling Baseline: Approx. 460' total of CHWS/R piping from Soda Hall to Jacobs Hall and additional piping to rooftop air handler for tempering and bump cooling
- Heating Baseline: Approx. 460' total of HHW S/R piping from Soda Hall to Jacobs Hall radiant manifolds and to DOAS on Jacobs Hall roof
- Valves and Accessories
- Radiant panel piping
- ~~Radiant Slab Piping~~
- 1.5" Fiberglass insulation on all pipes
- Radiant Manifolds and Accessories

Controls & Instrumentation

- Equipment Tags and ID
- Wall mounted controls for mechanical equipment
- (1) CO2 sensor per studio and meeting room
- DDC control system
- (1) Duct Static Pressure Sensor
- BMS – 1 point/entire building per UC Standards
- Thermostatic control valves for radiant panels. One thermostatic control valves for each private office and one thermostatic control valve per radiant panel up to 20ft long for naturally ventilated spaces
- Alternate: Multiple points of collection with dashboard; provide cost per point
- ~~(1) Pressure independent module per floor~~
- ~~(1) Slab temperature sensor per zone~~
- ~~(1) Control valve per radiant zone~~
- Base number of control points: Analog – 100, Binary – 90 (Contractor to provide allowance for each additional point exceeding base quantity)

PART 2: PLUMBING SYSTEMS

1. Project Plumbing Goals

The focus of the plumbing system design will be to reduce domestic water consumption and the resulting wastewater production. Low-flow fixtures will be used in all of the domestic water spaces and will reduce the domestic water demand significantly. Energy and water use related to plumbing systems shall be designed to target LEED Gold (LEED Silver minimum) certification standards. The system will be designed in accordance with UCB standards (Capital Projects) as well as the California Plumbing Code.

2. Plumbing System Description

Fire department connection, backflow preventer and point of connection to municipal water supply is to be omitted from plumbing scope of work and assumed to be part of civil scope of work.

All work from connections to civil infrastructure is to be included in the plumbing scope of work for this project. ~~Disregard any notes indicating that p~~Plumbing scope ~~ends 5' from the edge of the building,~~includes pipe installation up to determined p~~the plumber will be responsible to go all the way to the noted P~~oint of ~~C~~connections.

Building Utility Metering and Monitoring

Coordinate with utility company to verify that the existing water meter is appropriate. The extended service to Jacobs Hall will be equipped with a sub-meter to determine the building's water usage.

Domestic Cold Water (CW)

Domestic cold water shall be connected to lounge sinks, mop sinks, water closets, and drinking water fountains.

Domestic water will be brought into the building from the adjacent Etcheverry Hall, located below Soda Hall. Isolation valve shall be provided at connection to Jacobs Hall. The existing pipe size and loads in Etcheverry Hall will need to be verified to determine if the load from Jacobs Hall can be added to the Etcheverry Hall domestic cold water system. Preliminary calculations show that a 3" line will be required and approximately 350 linear feet of pipe will be required to bring water service to Jacobs Hall. The water piping may need to cross seismic joint and possibly shear wall. The location is in the southeast corner of the first floor basement of Etcheverry Hall. Since Etcheverry Hall is already provided with a backflow preventer, an additional backflow prevention device is not expected to be required. Pipe sizing inside of the building shall comply with the requirements in the California Plumbing Code.

Domestic water pipe material shall be type L copper above grade and type K copper underground. All buried domestic water pipe will be protected with 20 mil polyethylene tape and/or pipe sleeve.

Domestic Hot Water (HW)

Domestic hot water shall be supplied to the restroom lavatories, lounge sinks, and janitor's closets. The domestic hot water system shall be designed as an electric on-demand system at the point of use that shall provide hot water quickly and efficiently. This type of system will reduce the amount of water wasted down the drain while waiting for hot water to arrive.

Restroom lavatories will be provided with tempered water at 105°F. Mop sinks will be provided with hot water limited to 120°F. Lounge sinks will be provided with hot water limited to 110°F. A tempering valve compliant with the California Plumbing Code shall be provided to ensure hot water is no higher than the temperature noted above at the fixtures.

Pipe sizing shall comply with the requirements in the California Plumbing Code. Domestic hot water pipe material will be type L copper above grade. All piping shall be insulated and jacketed.

Sanitary Waste and Vent (SAN/V)

The new sanitary system for Jacobs Hall shall tie into the sanitary sewer on Ridge Road.

A complete sanitary waste (SAN), and vent (V) system shall be provided throughout the building in accordance with the California Plumbing Code. A gravity system shall be provided for fixtures above grade. The sanitary may need to cross seismic joint and possibly shear wall. A single 4" gravity sanitary lateral will be provided to serve all floors.

~~The floor drains and within the basement and at the basement level will drain into a sanitary sewer sump. The sump shall have duplex pumps, and an audible high~~

~~water alarm. The sump will be pumped to the 4" waste line draining by gravity to the Ridge Road poing of connection.~~

~~Plumbing contractor to verify if it is possible to~~The sanitary waste system will connect to the existing Etcheverry ~~the basement sanitary waste piping to theexisiting Etcheverry~~ Level 2 restroom waste at Northeast corner. See site plan. Floor drains with trap primers will be provided for each restroom.

Condensate waste from cooling coils and other mechanical equipment shall be discharged as an indirect waste. Condensate waste will be discharged to a location acceptable to the Authority Having Jurisdiction.

Waste piping material should be no-hub cast iron for gravity piping. Condensate waste piping shall be type L copper.

Storm Drainage (SD/OD)

A storm water drainage system will be installed in the building to transfer storm water from the roof collection system to the storm drainage system serving building. Rainwater quantities will be computed on the basis of 1.5" rainfall per hour as per Capital Projects Standards.

~~The~~ The lower flat roof will be provided with combination roof/overflow drain. Both lines are to be routed internally with the storm drain piping to terminate at the municipal storm drain and the overflow exiting the building ~18" above the ground and onto a splash block. Minimum sizes for leaders will be 3".

Zurn Combination Roof and Overflow Drain

The upper sloped roof will drain to internal gutter and route through the interior soffit and downspout within the north exterior wall. Near grade the downspout ~~will connect to cast iron soil pipe and be routed~~ to daylight into the north planted area and divert into the swale ~~to storm storage and filtration planters at the terrace on the south side of the building~~ before connecting to the municipal storm drainage system.

All ~~A~~area drains, linear drains, site drainage, and foundation drainage including points of connection are to be included in plumbing scope of work. Note that some site drainage occurs over existing Etcheverry basement and may need to be routed as required through the basement. ~~Roof drains and downspouts are to be routed from roof down south façade, across terrace bridge and within concrete retaining wall at Leroy to stormwater treatment planters. Treated water is then to connect to stormwater system.~~

Fire Protection (FP)

A 6" building firewater line will be connected to the water main at LeRoy Avenue. A double check valve assembly will be installed to protect the supply water main. Downstream of the building double check valve assembly, a fire department connection will be provided to allow the fire department to pressurize the building firewater lines. The double-check valve assembly, fire department connection and fire water service line to the building will meet the requirements of the Authority Having Jurisdiction.

The UC Berkeley Fire Marshal requires that the fire department connections for each building shall be remote from the building. The fire department connections shall have a 5" Storz connection in accordance with City of Berkeley requirements.

A standpipe riser will be provided in each required exit stairwell with a 2-1/2" fire hose valve. All fire valves except the drain and sprinkler test valve shall be provided with a valve supervision switch. The building will be protected by a hydraulically calculated automatic wet sprinkler system. Each floor shall be provided with its own sprinkler control valve, flow switch and drain valve.

The hydraulically designed sprinkler system shall be provided with a minimum 10 percent safety margin. A fire flow test should be performed in order to confirm the available capacity and pressure. If either capacity or pressure is found to be insufficient, a fire pump will be required. The results of the fire flow test are required to determine if a fire pump is necessary. A fire pump should be included in pricing as an alternate until verification of the resultsof a fire flow test has been

performed. The actual fire sprinkler system provided is subject to the Fire Marshal's approval. Sprinkler lines and head locations shall be coordinated with the architect prior to submittal to the Fire Marshal for review.

Compressed Air (CA)

The building will be provided with a permanently installed duplex air compressor equipped with air dryer to provide clean, dry air. Compressed air piping shall be type L copper pipe. Provide flexible type tube sprayers with one quick connects at wall location of each Studio Room and each Equipment Room. Contractor to verify design criteria with UCB before designing the system. Compressor to be located in the basement mechanical room.

Elevator Pit

Elevator pit will be provided. A sump with water level sensor, remote warning light, and identification signage for monitoring water for possible polluting liquids will be installed.

Distribution Materials

The service distribution mains shall be as follows:

- HW, CW, HWR, ICW: Copper with sweat fittings
- Sanitary Waste (SAN): Cast Iron No-Hub
- Sanitary Vent (V): Cast Iron No-Hub
- Storm water and Overflow (SD/OD): Cast Iron No-Hub

Fixtures

Low-flow plumbing fixtures will be chosen for this installation that will conserve water. These low-flow plumbing fixtures will reduce the domestic water consumption significantly. All fixtures will be be lead-free.

~~TOTO~~ KOHLER High Efficiency Water Closet ~~& Flush Valve~~

The 1.28 gpf ~~TOTO EcoPower~~Kohler Kingston High Efficiency Wall Mounted Water Closet ~~and~~ complete with Sloan Optima Systems battery-powered sensor ~~F~~flush ~~V~~valve will be used in all restrooms. The combination of flush valve and water closet have a MaP score of 1000.

~~TOTO~~ KOHLER ~~EcoPower~~ High Efficiency Urinal ~~& Flush Valve~~

The 0.125 gpf ~~TOTO~~ Kohler ~~EcoPower~~ Bardon High Efficiency Urinal ~~and~~ complete with Sloan Optima Systems battery-operated sensor ~~F~~flush ~~V~~valve will be used in the men's restrooms.

The restroom lavatories and faucets will be Sloan Solis solar powered sensor operated faucet provided supplied with warm water only. Faucets will be supplied with 0.35-gpm aerators.

Lavatory and Sloan Solar Powered Faucet

Lounge sinks will have low flow faucets that will reduce the amount of water being consumed at the faucets to 1.0 gpm.

Mop sinks will have standard faucets that will not limit the amount of water being consumed.

Studio sink will be be a stainless steel 2 bowl sink with right and left hand drainboards. Faucet shall be heavy duty pre-rinse and splash mounted.

Compressor-free high/low drinking fountains with bottle filler will be located areas as shown on the architectural floor plan.

~~Halsey~~ Elkay ~~Taylor HydroBoost®~~EZH2O® ~~In-Wall Bottle Filler and~~ Drinking Fountain with Bottle Filling Station

3. Plumbing System Preliminary Equipment List

The cost estimating for the plumbing system will be provided based on the narrative above and the preliminary equipment list provided below. Individual costs will be provided for piping, equipment, and systems. For line item prices that include ancillary components, a list of those components will be provided. Fixture quantities can be obtained from the architectural drawings.

Piping

- Storm and Overflow Drainage: Cast Iron No Hub
- Waste Drainage and Vent: Cast Iron No Hub
- Domestic Water (above ground): Copper Type L Distribution Piping with sweat fittings
- Domestic Water (below ground): Copper Type K Distribution Piping with sweat fittings
- Condensate: Copper Type L Drainage Piping with sweat fittings
- Insulation: Fiberglass w/ PVC jacket

Fixtures and Connections

- Water Closets: 1.28 gpf flushometer style
- Urinals: 0.125 gpf
- Lavatories: Low-Flow, Sensor Operated, 0.35-gpm
- Lounge Sink: 1-gpm aerator
- Mop Sinks
- Floor Drains
- Roof Drains/Overflow Drains
- Hose Bibbs
- Drinking Fountain w/ Bottle Filling Station: Compressor free
- (1) Studio sink per classroom/studio

Equipment

- Domestic Water Heating:
  - Restroom Lavatories– (1) electric, tankless water heater per set of three lavatories. Eemax Accumix
  - Mop Sink – electric, tankless water heater. Eemax 3-Phase Series
  - Lounge Sink– electric, tankless water heater. Eemax 3-Phase Series
  - Elevator Sump: 2'x2'x2' sump with water level sensor, alarm, and 25 A GFCI outlet for portable pump connection
- Air Compressor:
  - Ingersoll Rand small reciprocating air compressor, model 2545K10V.

Accessories

- Domestic Water sub-meters
- Water Hammer Arrestors
- Trap Primers
- Shut-off Valves
- Check Valves
- Floor Cleanouts
- Wall Cleanouts
- Overflow Drain terminations with splash blocks

Fire Protection

- Hydraulically calculated fire sprinkler system
- Black Steel with malleable fittings

MORROW-
MEADOWS
CORPORATION
Northern California

UCB Jacobs Hall

Berkeley, California

MEP Design Build Schematic Narrative
Electrical Basis of Design

Revised 8.5.2014

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Northern California
1050 Bing Street
San Carlos, CA 94070
(650) 634-0682
morrow-meadows.com

ELECTRICAL SYSTEMS

Project Electrical Goals

Convenience

- The building's electrical systems will be convenient to use and maintain. Power and data receptacles will be located in appropriate locations. Power and data infrastructure will be flexible and allow for easy future expansion and modification.

Energy Efficiency

- The most efficient electrical systems available, including lighting, lighting controls, and transformers, shall be specified within the building's electrical system to reduce the overall energy footprint of the building. The electrical engineer will work closely with the architect and owner, to help analyze and select the most efficient equipment, office equipment, and the like.

Setting an Example

- Every effort will be made to ensure that designs and equipment used within the building are easily and efficiently deployed by future buildings such that this building can become an example of easy, sustainable design strategies for green building projects. This includes keeping costs in line with traditional construction.

Electrical Service

The project site shall be served by the existing unit substation 'MSB' located in Soda Hall. Based on the initial design requirements, it is expected that the existing 2500A, 277/480V service from existing unit substation 'MSB' has adequate capacity to serve Jacobs Hall, which has an anticipated service of 600A. A new drawout circuit breaker shall be provided in existing unit substation 'MSB' and shall serve as the overcurrent protection device to the new service; the breaker shall match the existing manufacturer and AIC rating of those currently installed in existing unit substation 'MSB'. Refer to Electrical Exhibits for additional information.

Electrical Distribution

Refer to single line diagram for additional information.

Dry-Type Transformers

- Distribution transformer shall be dry-type, 480V primary, 120/208V, 3 phase, 4 wire secondary. Transformers shall be Energy Efficient, naturally ventilated, with 220°C insulation, 130°C temperature rise. For the highest efficiency, least no-load losses, and to allow for right-sizing of equipment, transformer shall be E-Saver-C3L by Powersmiths.

Powersmith E-Saver

Panelboards and Distribution Boards

- Distribution boards shall be deadfront assemblies with copper bus bars and bolt on circuit breakers. Energy meters shall be provided on each circuit breaker feeding panelboards and transformers.
- Panelboards shall be deadfront assemblies, door-in-door trim, with copper bus bars and bolt on circuit breakers.
- All panels shall be fully rated, series rating not allowed.
- Refer to "Energy Monitoring" section for additional requirements.

Conduit and Wiring

Use electrical metallic tubing (EMT) in exterior or exposed interior work up to ten and a half feet above finished floor, and galvanized rigid steel (GRS) for work embedded in concrete; rigid non-metallic conduit (HDPE or PVC) for all underground exterior work; electrical metallic tubing (EMT) and metal clad cable (MC) for all interior work or above eight feet exposed, metal clad cable (MC) to be used to all power and lighting feeds throughout the project; flexible metal conduit (Greenfield) for interior work in short lengths for the connection of recessed lighting fixtures, motors, separate building structures and any vibrating equipment; liquid tight flexible metal conduit (Sealtight) wherever moisture may be present.

Data, communications, security and CATV wiring in inaccessible concealed spaces, exposed in unfinished areas below eight feet above finished floor or exposed in finished areas will be run in plenum rated cable. Data, communications, security and CATV wiring in accessible concealed spaces or unfinished areas above eight feet above finished floor shall be run on J-Hooks with individual systems bundled separately. All fire alarm system wiring shall be run in plenum rated cable in free air and J-Hooks.

Separate wires will be provided for each of the following loads:

- HVAC and Plumbing Systems
  480V, 3 phase, 3 wire, 60 hertz and 120V, 1 phase, 2 wire, 60 hertz.
- Motors of 1/2 horsepower and larger will be served at 480 volt service, 3 phase, 3 wire. Motors less than 1/2 horsepower will be served at 277 volt or 120 volt service, 1 phase, 2 wire.
- Elevators
  480V, 3 phase, 3 wire, 60 hertz
- Lighting and General Purpose Receptacles
  480Y/277V, 3 phase, 4 wire, 60 hertz for fluorescent and LED lighting.
  208Y/120V, 3 phase, 4 wire, 60 hertz for general purpose receptacles (via local dry type transformers). Spare branch circuits will be provided within the tenant area on the basis of one 277 volt, 20 ampere circuit per 1,250 sq. ft. of net usable space to permit connection of fluorescent and H. I. D. lighting fixtures at any location.
- Spare branch circuits will be provided within the tenant area on the basis of one 120 volt, 20 ampere circuit per 600 sq. ft. of net usable space to permit connection of receptacles and incandescent lighting fixtures at any location.
- Dedicated circuits for equipment at equipment rooms, including shop tools, CNC routers, laser cutters, and dust collection systems.
- Dedicated circuits for overhead retractable power cables at studios.
- Process Equipment
  480Y/277V and/or 208Y/120V, 3 phase, 4 wire, 60 hertz. 220V if required by manufacturer.
  Branch circuit design will be based upon a maximum of 1,600volt amperes per 20 ampere, 120 volt circuit.

Branch circuit design will be based upon a maximum of 3,600 volt amperes per 20 ampere, 277 volt circuit.

20 Amp continuous electrical loads, such as lighting, servers, etc. shall have increased wire sizes in order to reduce power loss in the wiring itself, #10Awg in lieu of #12Awg.

Grounding

- A central grounding system shall be provided for all distribution equipment. All grounded buses from switchboards, transformers, and panelboards shall be connected at a central ground bus in the main electrical room. The central grounding system shall be extended to each electrical room by means of vertical riser ground wire, and terminate at a ground bus bar
- A separate green equipment grounding conductor shall be provided for all feeders & branch circuits.
- The central grounding system shall be extended to the communications rooms to include all telecommunications closets, and connected to a telecommunications ground bus bar.
- Provide grounding for incoming telephone and cable services.
- Grounding of the emergency generator shall conform to the NEC Article 250.30 – Grounding Separately Derived Alternating-Current Systems.

Receptacles and Devices

We will provide general purpose receptacles for private offices, administrative areas, studios, break out rooms, and other rooms with controllable loads. Receptacles for equipment such as computers shall be provided unswitched so that it doesn't damage computer equipment. Switched receptacles shall be marked so that occupants can properly identify occupancy-controlled outlets.

Receptacle connection and support for retractable power cords or power reels shall be provided at Studio ceilings. Heavy Duty cord reels will be supplied and installed by UCB. 10 per studio, 20 per floor, plus 1 per equipment room.

Receptacle quantity per typical space type shall be as follows:

1. Exterior
   - (1) WP Duplex Receptacles 30'-0" OC at Terrace
   - (2) WP Duplex Receptacle at lobby entrance
2. Mechanical/Electrical Storage:
   - (4) Duplex Receptacles
   - (1) Voice/Data
3. Equipment Room
   - As required, refer to Architectural Plans for equipment locaitons.
   - (1) Retractable power cord
4. Data/Telecom
   - (6) Quad Outlets, dedicated circuits
   - (2) Voice/Data
5. Meeting
   - (4) Duplex Receptacle
   - (4) Voice/Data
6. Equipment Room
   - As required, refer to Architectural Plans for equipment locaitons.
   - (1) Retractable power cord

7. Equipment Room
    - As required, refer to Architectural Plans for equipment locaitons.
    - (1) Retractable power cord
8. Data/Telecom
    - (6) Quad Outlets, dedicated circuits
    - (2) Voice/Data
9. Meeting
    - (4) Duplex Receptacle
    - (4) Voice/Data
10. Office
    - (1) Quad Receptacle
    - (1) Duplex Receptacle
    - (2) Voice/Data
11. Lobby
    - (2) Duplex Receptacle
    - (2) Voice/Data
    - (1) 6” Poke-thru or Floor box (Power, Voice/data) or furniture whip to electrified furniture
12. Studio
    - (1) 20A Power reel over each table (see drawings)
    - (2) Duplex Receptacle per wall
    - (2) Duplex Receptacle at ceiling
    - (2) Voice Data outlet per wall
    - (2) Voice Data outlet at ceiling
    - Power for projects and automated screens (see drawings)
13. Lounge
    - (3) GFCI Duplex Receptacle (at countertop), dedicated circuits
    - (1) Duplex for Refrigerator
    - (2) Duplex Receptacles for general power
    - (1) Voice/Data
14. Typical Restroom
    - (1) Duplex Receptacle
    - (1) GFCI Duplex Receptacle (at countertop)
15. Hallways
    - (1) Duplex Receptacle every 25’-0”
12. Basement
    - The basement has been incorporated as part of this BOD
13. Ceiling Fans quantity (19)
14. Lobby TV’s

Emergency and Standby Distribution System Emergency power will be provided for all code required equipment. Emergency egress lighting will be provided via central battery inverter. Egress lighting shall be designed to provide 1 foot-candle average along the path of egress. Exit signage shall be edge-lit type, with low level signage as required by code

Edge-lit Exit Signage

The fire alarm system will have dedicated emergency battery backup for 24 hours in supervisory mode, followed by 5 minutes at full alarm.

Standby power will be provided via UPS as directed by the Owner for all critical equipment such as telephone equipment, servers, etc. Telecom will be backed up by UCB separate system

Energy Monitoring

Under base package, a single building meter shall be provided and the main switchboard per UC Berkeley metering standards. Refer to single line diagram for additional information.

Lighting Control

Provide a lighting control system that meets the minimum requirements for Title 24 mandates. Lighting power density shall exceed Title 24 allowance by 20%

Each fixture or group of fixtures will be controlled by individual room controllers. Provide a lighting control system with local occupancy sensors to save energy.

Enclosed stairs shall include occupancy sensor controls to reduce the lighting within the stair (by a minimum of 50%) when it is not occupied. Occupancy sensors shall fail to 100% in the event of a power outage.

Lighting Fixture Value Engineering

Provide value engineering to the light fixture package by providing an alternate package which will be submitted and released only after approval. Alternate light fixtures submittals to follow.

50 foot-candle maintained average lighting level in open studio rooms, and Cad lab. 30 foot-candle maintained average lighting level for offices.

LIGHTING CONTROL SEQUENCE OF OPERATIONS										
	Manual Control	Time Clock	Occupancy Sensor	Daylight Harvesting	Dimming (1)	Centralized PC Control	Automatic Shade Integration (3)	Scene Control	50% Plug Load Control via Lighting Control system (2)	Notes
Storage	X		X						X	
Mechanical	X		X						X	
Equipment	X		X		X				X	
Electrical	X								X	
Data/Telecom	X		X						X	
Shop	X		X		X				X	
Meeting	X		X	X	X				X	
Office	X		X	X	X				X	
Lobby/Exhibit	X			X	X			X	X	
Lounge	X		X	X	X				X	
Restroom	X		X						X	
Gallery	X	X	X	X	X				X	
Studio	X		X	X	X				X	
Stairs			X	X	X					Occ Sensor control 50% off
Meeting	X		X	X	X				X	
Break Out	X		X	X	X				X	
Exterior		X								
Circulation	X	X	X	X	X					
Additional:										
Notes:										

Low Voltage

Jacobs Hall shall derive telephone and data service from the existing server room at Soda Hall. (2) 4"C shall be routed from the existing server room at Soda Hall Rm #284 to the Telecom room of Jacobs hall. Vertical riser from main telecom room shall be via 4"C to each floor. Horizontal distribution shall be via J-Hooks. Data drops from J-Hooks shall be in plenum rated cable.

Wireless Access Points (WAPs) shall be distributed throughout the building. Provide infrastructure (back box) for each WAP.

Security

Provide infrastructure (plenum cable, pull string, and back boxes as required) for security system. Devices, programming, and installation of security devices shall be by others.

1. Card Key – Qty. 11 per SE drawings dated 3/31/14
   - Level 3: West main Entrance, South entrance door, (2) Studio Entrances, (1) Telecom Room
   - Level 4: East Entrance to Leroy, (2) Studio Entrances, (1) South exit door to bridge
   - Level 5: (2) Studio entrances(east & west)

2. Security Cameras (coverage areas) – Qty. 7 per 3/31/14 RFP
   - Level 3: West entrance and lobby, (2) south at terrace
   - Level 4: East main entrance and lobby, (2) east corridor exits, (2) studios, gallery hallway
   - Level 5: (2) Corridor cameras (east & west), (2) studio cameras, Perimeter (1) West, 1(East), (2) South

Fire Alarm System

The building shall have a Siemens addressable fire alarm system. The system shall consist of manual pull stations, smoke detectors in most corridors, elevator lobbies and smoke doors, duct smoke detectors and flow and tamper switches on the fire protection system. Horns and strobes throughout shall be adequately located. In order to save costs, (20) smoke detectors will be eliminated. The built in fire alarm printer will not be used. Three power booster panels will be installed to reduce costs. All cabling shall be plenum rated cable.

All fans and HVAC equipment required to be shut down in the event of a fire shall be connected to the fire alarm system.

All fire smoke dampers (FSD's) shall be connected to 120V power though an interposing relay controlled by the fire alarm system to automatically close the damper.

Automatic door holds shall be provided at each stairwell door and as shown on architectural drawings. These doors shall be automatically closed by the fire alarm system. Duct detectors shall be provided for systems 2000CFM and over, and shall shut down air handling unit upon detection. Any telecommunication rooms equipped with pre-action fire suppression system shall be interlocked with fire alarm system.

For any modification made to Etchevarry as a result of this project, update existing fire alarm system to comply with Fire Marshal requirements.

Photovoltaic System (Alternate)

A photovoltaic system will be capable of readily tying into the electrical service for Jacobs Hall at a future date, if desired. The photovoltaic system will allow for reduced demand from existing unit substation 'MSB' and lowering the overall energy consumption of Jacobs Hall by utilizing a highly efficient photovoltaic system. The electrical distribution system for Jacobs hall will have conduit stubbed to roof for future PV use. Future PV connection will be tied into Soda Hall Unit Substation MSB.