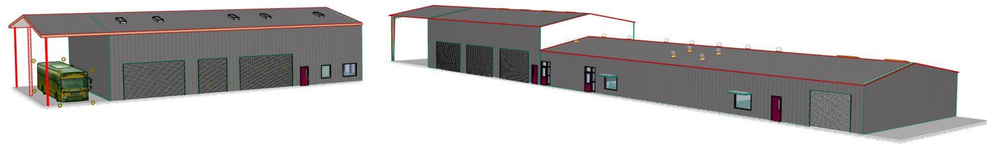
LUHSD TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

850 2ND STREET, BRENTWOOD, CA 94513

LIBERTY UNION HIGH SCHOOL DISTRICT



DSA FILE NO: 7-H4 **DSA APPLICATION NO:** ###-###### **PTN:** 61721-0064

100% DESIGN DEVELOPMENT

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FOR REFERENCE ONLY

TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

850 2ND STREET
BRENTWOOD, CA 94513

LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO:	1707.00
DRAWN BY:	
DRAWING SCALE:	N.T.S.
PTN:	61721-0064

100% DD

MAY 25, 2018

SHEET TITLE

COVER SHEET

SHEET NUMBER

G-0.1

BIM Server: archiserver - BIM Server 21\1707.00 LUHSD TRANS M and O.5/23/2018 13:55

ABBREVIATIONS

&	AND	GA	GAUGE	S	SOUTH
L	ANGLE	GALV	GALVANIZED	S.A.D.	SEE ARCHITECTURAL DRAWINGS
@	AT	GB	GRAB BAR	S.AV.D.	SEE AUDIOVIDEO DRAWINGS
℄	CENTERLINE	GC	GENERAL CONTRACTOR	SC	SOLID CORE
'	FEET	GI	GALVANIZED IRON	S.C.D.	SEE CIVIL DRAWINGS
"	INCHES	GL	GLASS/ GLAZING	SCHED	SCHEDULE
d	PENNY	GLB	GLUE LAMINATED BEAM	SD	STORM DRAIN
#	POUND/ NUMBER	GND	GROUND	SECT	SECTION
		GR	GRADE	S.E.D.	SEE ELECTRICAL DRAWINGS
AB	ANCHOR BOLT	GYP BD	GYPSUM BOARD	SEP	SEPARATION
ABBREV	ABBREVIATION			SHR	SHOWER
AC	ASPHALT CONCRETE	HB	HOSE BIBB	SHTG	SHEATHING
A/C	AIR CONDITIONING	HC	HOLLOW CORE	SIM	SIMILAR
ACC	ACCESSIBLE	HDR	HEADER	SL	SLIDING
ACOUS	ACOUSTICAL	HDWD	HARDWOOD	S.L.D.	SEE LANDSCAPE DRAWINGS
AC T	ACOUSTICAL TILE	HDWR	HARDWARE	SM	SHEET METAL
AD	AREA DRAIN	HM	HOLLOW METAL	S.M.D.	SEE MECHANICAL DRAWING
ADJ	ADJUSTABLE	HOR	HORIZONTAL	SOV	SHUT OFF VALVE
A.F. F.	ABOVE FINISH FLOOR	HP	HIGH POINT	S.P.D.	SEE PLUMBING DRAWINGS
AGG	AGGREGATE	HR	HOUR	SPEC	SPECIFICATION
ALUM	ALUMINUM	HSS	HOLLOW STEEL SECTION	SPKR	SPEAKER
ANOD	ANODIZED	HT	HEIGHT	SQ	SQUARE
APPROX	APPROXIMATE	HTG	HEATING	SS	STAINLESS STEEL
ARCH	ARCHITECTURAL	HVAC	HEATING, VENTILATING, AIR-CONDITIONING	S.S.D.	SEE STRUCTURAL DRAWINGS
ASPH	ASPHALT			S.TH.D.	SEE THEATER DRAWINGS
				STA	STATION
BD	BOARD	ID	INSIDE DIAMETER	STD	STANDARD
BITUM	BITUMINOUS	INSUL	INSULATION	STL	STEEL
BLDG	BUILDING	INT	INTERIOR	STOR	STORAGE
BLK	BLOCK	INTEG	INTEGRAL	STRUCT	STRUCTURAL
BLKG	BLOCKING	INTERMED	INTERMEDIATE	SUSP	SUSPENDED
BM	BEAM	INV	INVERT	SYM	SYMMETRICAL
BOT	BOTTOM				
BO	BY OWNER	JH	JOIST HANGER	T	TREAD
BRK	BREAK	JST	JOIST	T&B	TOP & BOTTOM
BRG	BEARING	JT	JOINT	TC	TOP OF CURB
BTWN	BETWEEN			TEL	TELEPHONE
BU	BUILT-UP	KIT	KITCHEN	TER	TERRAZZO
BUR	BUILT-UP ROOFING	KP	KICK PLATE	T&G	TONGUE & GROOVE
				TH	THICK
CAB	CABINET	LAB	LABORATORY	THRU	THROUGH
CB	CATCH BASIN	LAM	LAMINATE	TJ	TOOL JOINT
CBU	CEMENTITIOUS BACKER UNIT	LAV	LAVATORY	TN	TOE NAIL
CEM	CEMENT	LL	LIVE LOAD	T.O.D.	TOP OF DECK
CER	CERAMIC	LP	LOW POINT	T.O.P.	TOP OF PLATE
CI	CAST IRON	LT	LIGHT	T.O.R.	TOP OF ROOF
CIR	CIRCLE			T.O.W.	TOP OF WALL
CJ	CONTROL JOINT	MAT	MATERIAL	T.P.	TOP OF PAVEMENT
CORR	CORRIDOR	MAX	MAXIMUM	TRN	TRANSOM
CL	CLOSET/ CENTER LINE	MB	MACHINE BOLT	TRANS	TRANSPARENT
CLG	CEILING	MC	MEDICINE CABINET	TS	TUBE STEEL
CLR	CLEAR	MECH	MECHANICAL	TUB	TUBULAR
CLS	CLOSURE	MED	MEDIUM	TV	TELEVISION
CMU	CONCRETE MASONRY UNIT	MEMB	MEMBRANE	TW	TACKWALL
CO	CLEANOUT	MFR	MANUFACTURER	TYP	TYPICAL
COL	COLUMN	MH	MANHOLE		
COMB	COMBINATION	MIN	MINIMUM	UNF	UNFINISHED
COMP	COMPOSITION	MIR	MIRROR	U.O.N.	UNLESS OTHERWISE NOTED
CONC	CONCRETE	MISC	MISCELLANEOUS	UR	URINAL
CONN	CONNECTION	MO	MASONRY OPENING	UTIL	UTILITY
CONST	CONSTRUCTION	MOD	MODULAR		
CONT	CONTINUOUS	MR	MOISTURE RESISTANT	VB	VAPOR BARRIER
CONTR	CONTRACTOR	MTD	MOUNTED	VCT	VINYL COMPOSITION TILE
CT	CERAMIC TILE	MTL	METAL	VERT	VERTICAL
CTR	CENTER	MUL	MULLION	VEST	VESTIBULE
CTSK	COUNTERSINK			V.I.F.	VERIFY IN FIELD
CUST	CUSTODIAN	N	NORTH	VTR	VENT THROUGH ROOF
CW	COLD WATER	(N)	NEW	VWC	VINYL WALL COVERING
		NAT	NATURAL		
DBL	DOUBLE	N.I.C.	NOT IN CONTRACT	W	WEST
DEPT	DEPARTMENT	NO	NUMBER	W/	WITH
DET	DETAIL	NOM	NOMINAL	WC	WATER CLOSET
DF	DRINKING FOUNTAIN	N.T.S.	NOT TO SCALE	WD	WOOD
DG	DECOMPOSED GRANITE			WDW	WINDOW
		O/	OVER	WH	WATER HEATER
DI	DRAIN INLET	OA	OVERALL	W/O	WITHOUT
DIA	DIAMETER	OBS	OBSCURE	WP	WATER PROOF
DIAG	DIAGONAL	OC	ON CENTER	W.P.	WORK POINT
DIM	DIMENSION	OD	OUTSIDE DIAMETER	WR	WATER RESISTANT
DISP	DISPOSAL	OF	OVERFLOW	WSCT	WAINSCOT
DIV	DIVISION	OFCI	OWNER FURNISHED/ CONTRACTOR INSTALLED	WT	WEIGHT
DN	DOWN	O.L.F.	OCCUPANT LOAD FACTOR	YD	YARD
DO	DOOR OPENING	OFF	OFFICE		
DIR	DIRECTLY	OPNG	OPENING		
DR	DOOR	OPP	OPPOSITE		
DS	DOWN SPOUT	OVHD	OVERHEAD		
DSP	DRY STAND PIPE				
DT	DRAIN TILE	PC	PORTLAND CEMENT		
DW	DISHWASHER	P.C.F.	POUNDS PER CUBIC FOOT		
DWG	DRAWING	PDA	POWER DRIVEN ANCHOR		
DWR	DRAWER	PERF	PERFORATED		
		PH	PLATE HEIGHT		
E	EAST	PL	PLATE		
(E)	EXISTING	P/L	PROPERTY LINE		
EA	EACH	PLAM	PLASTIC LAMINATE		
EB	EXPANSION BOLT	PLAS	PLASTER/ PLASTIC		
EE	EACH END	PLF	POUNDS PER LINEAL FOOT		
EF	EXHAUST FAN	PLYWD	PLYWOOD		
EJ	EXPANSION JOINT	P.O.C.	POINT OF CONTACT		
EL	ELEVATION GRADE	PR	PAIR		
ELEC	ELECTRICAL	PROP	PROPERTY		
ELEV	ELEVATION	PSF	POUNDS PER SQUARE FOOT		
EMER	EMERGENCY	PSI	POUNDS PER SQUARE INCH		
EMT	ELECTRIC METALLIC TUBING	PT	POINT		
ENCL	ENCLOSURE	PTDF	PRESSURE TREATED DOUGLAS FIR		
EP	ELECTRIC PANEL	PTN	PARTITION		
EQ	EQUAL	PTR	PAPER TOWEL RECEPTACLE		
EQUIP	EQUIPMENT	PVC	POLYVINYL CHLORIDE		
EQUIV	EQUIVALENT	PVMT	PAVEMENT		
ES	EACH SIDE				
EW	EACH WAY	R	RISER		
EXH	EXHAUST	R / RAD	RADIUS		
EXIST	EXISTING	RD	ROOF DRAIN		
EXP	EXPANSION	REF	REFERENCE		
EXT	EXTERIOR	REFR	REFRIGERATOR		
		REG	REGULAR		
F	FACE	REQD	REQUIRED		
FA	FIRE ALARM	REINF	REINFORCED		
FCO	FLOOR CLEAN OUT	RH	ROOF HATCH		
FD	FLOOR DRAIN	RHMS	ROUND HEAD MACHINE SCREW		
FDN	FOUNDATION	RHWS	ROUND HEAD WOOD SCREW		
FE	FIRE EXTINGUISHER	RM	ROOM		
FEC	FIRE EXTINGUISHER CABINET	RO	ROUGH OPENING		
FF	FINISH FLOOR	RWL	RAIN WATER LEADER		
FG	FINISH GRADE	RWD	REDWOOD		
FGL	FIBERGLAS				
FH	FIRE HYDRANT				
FHMS	FLAT HEAD MACHINE SCREW				
FHS	FIRE HOSE STATION				
FHWS	FLAT HEAD WOOD SCREW				
FIN	FINISH				
FIXT	FIXTURE				
FL	FLOOR LINE				
FLASH	FLASHING				
FLUOR	FLUORESCENT				
FLR	FLOOR				
FM / FOM	FACE OF MASONRY				
FN	FACE NAIL				
FOC	FACE OF CONCRETE				
FOF	FACE OF FINISH				
FOS	FACE OF STUD				
FRMG	FRAMING				
FR	FIRE-RESISTANT				
FRP	FIBERGLASS REINFORCED PANEL				
FT	FEET				
FTG	FOOTING				
FURR	FURRING				

LEGEND

ALL NOTES AND SYMBOLS ARE INTENDED TO APPLY AT ALL OTHER LOCATIONS OF SIMILAR GRAPHIC REPRESENTATION. SUCH INDICATIONS MAY BE LIMITED TO PROMOTE CLARITY. NO LIMITATION OF APPLICATION IS INTENDED EXCEPT AS SPECIFICALLY NOTED.

AA / A1 — COLUMN GRIDS A AND 1 IN BUILDING A

6'-0" — DIMENSION TO FACE OF STUD OR MASONRY

6'-0" — DIMENSION TO FACE OF FINISH

6'-0" — DIMENSION TO CENTER LINE OR COLUMN LINE

12'-0" — RELATIVE ELEVATION DIMENSION

B101A — DOOR A IN ROOM NUMBER 101 IN BUILDING B
ACCESSIBLE CLEARANCES SHOWN DASHED

009 — WINDOW NUMBER 009

11 / A-9.12 — DETAIL NUMBER 11 ON SHEET NUMBER A-9.12

3 / A-B6.2 — SECTION NUMBER 3 ON SHEET NUMBER A-B6.2

2 / A-B5.3 — ELEVATION NUMBER 2 ON SHEET NUMBER A-B5.3

FLOOR PLAN

CLASSROOM	ROOM NAME
A204	ROOM NUMBER 204 IN BUILDING A
F-4	FLOOR FINISH CODE F-4
A-A7.6	INTERIOR ELEVATION SHOWN ON SHEET A-A7.6

REFLECTED CLG PLAN

CLASSROOM	ROOM NAME
A204	ROOM NUMBER 204 IN BUILDING A
CL-6	CEILING FINISH CODE CL-6
10'-0"	FINISH CEILING HEIGHT 10'-0"

33 — KEYNOTE NUMBER 33

8" — METAL WALL FRAMING SIZE 8"

50 — WALL ACOUSTIC RATING OF STC 50

C — TOILET ACCESSORY C

222 — ARCHITECTURAL WOODWORK STANDARDS (AWS) CABINET DESIGN SERIES IDENTIFIER

W-2 — FINISH CODE, WALL FINISH 2 SHOWN

E1 — ROOM / BUILDING ACCESSIBLE SIGNAGE TYPE E1. SEE ARCHITECTURAL GRAPHICS PLAN AND ACCESSIBLE SIGNAGE DETAIL

W.P. — RELATIVE ORIGIN OR WORK POINT

A — EQUIPMENT TAG
REFER TO EQUIPMENT SCHEDULE

GENERAL NOTES

1. ALL WORK IS SHOWN, DESCRIBED OR SPECIFIED IN THE DRAWINGS INDEXED ON THIS PAGE OR IN THE SPECIFICATIONS.
ALL WORK NOT INDICATED AS EXISTING (E) IS NEW.
2. ALL FRAMING DIMENSIONS ARE TO FACE OF STUD UNLESS NOTED OTHERWISE.
3. DO NOT SCALE DRAWINGS.
4. VERIFY ALL DIMENSIONS WHERE WORK INVOLVES FRAMING FOR WINDOWS, DOORS, OR CABINETS.
5. ONLY WORK SO NOTED IS NOT IN CONTRACT (N.I.C.) ALL N.I.C. ITEMS ARE NOT PART OF DSA APPROVAL
6. GOVERNING CODES:
CALIFORNIA CODE OF REGULATIONS TITLE 24 BUILDING STANDARDS CODE:
PART 1 2016 CALIFORNIA ADMINISTRATIVE CODE (CAC), PART 1, TITLE 24 CCR
PART 2 2016 CALIFORNIA BUILDING CODE (CBC), PART 2, TITLE 24 CCR
(2015 INTERNATIONAL BUILDING CODE, VOL. 1 & 2, AND 2016 CALIFORNIA AMENDMENTS)
PART 3 2016 CALIFORNIA ELECTRICAL CODE (CEC), PART 3, TITLE 24 CCR
(2014 NATIONAL ELECTRICAL CODE AND 2016 CALIFORNIA AMENDMENTS)
PART 4 2016 CALIFORNIA MECHANICAL CODE (CMC), PART 4, TITLE 24 CCR
(2015 IAPMO UNIFORM MECHANICAL CODE AND 2016 CALIFORNIA AMENDMENTS)
PART 5 2016 CALIFORNIA PLUMBING CODE (CPC), PART 5, TITLE 24 CCR
(2015 IAPMO UNIFORM PLUMBING CODE AND 2016 CALIFORNIA AMENDMENTS)
PART 6 2016 CALIFORNIA ENERGY CODE (CEC), PART 6, TITLE 24 CCR
PART 9 2016 CALIFORNIA FIRE CODE (CFC), PART 9, TITLE 24 CCR
(2015 INTERNATIONAL FIRE CODE AND 2016 CALIFORNIA AMENDMENTS)
PART 10 2016 CALIFORNIA EXISTING BUILDING CODE (CEBC), PART 10, TITLE 24 CCR
(2015 INTERNATIONAL EXISTING BUILDING CODE AND 2016 CALIFORNIA AMENDMENTS)
PART 11 2016 CALIFORNIA GREEN BUILDING STANDARDS CODE (CAL-GREEN), PART 11, TITLE 24 CCR
PART 12 2016 CALIFORNIA REFERENCED STANDARDS CODE, PART 12, TITLE 24 CCR

TITLE 19 CCR, PUBLIC SAFETY CODE, STATE FIRE MARSHAL REGULATIONS
2010 ADA STANDARDS FOR ACCESSIBILITY DESIGN
2013 ASME A17.1/CSA B44-13 SAFETY CODE FOR ELEVATORS AND ESCALATORS

7. STANDARD AND GUIDES:

NFPA 13	INSTALLATION OF FIRE SPRINKLER SYSTEMS (CA AMENDED)	2016 EDITION
NFPA 14	INSTALLATION OF STANDPIPE AND HOSE SYSTEMS	2013 EDITION
NFPA 17	DRY CHEMICAL EXTINGUISHING SYSTEMS	2013 EDITION
NFPA 17A	WET CHEMICAL FIRE EXTINGUISHING SYSTEMS	2013 EDITION
NFPA 20	INSTALLATION OF STATIONARY PUMPS FOR FIRE PROTECTION	2016 EDITION
NFPA 22	STANDARD FOR WATER TANKS FOR PRIVATE FIRE PROTECTION	2013 EDITION
NFPA 24	STANDARD FOR THE INSTALLATION OF PRIVATE FIRE SERVICE MAINS AND THEIR APPURTENANCES	2016 EDITION
NFPA 25	CALIFORNIA EDITION - TESTING, MAINTENANCE OF WATER-BASED FIRE PROTECTION SYSTEMS	2013 EDITION
NFPA 72	NATIONAL FIRE ALARM AND SIGNALING CODE (CA AMENDED)	2016 EDITION
NFPA 80	STANDARD FOR FIRE DOORS AND OTHER OPENING PROTECTIVES	2016 EDITION
NFPA 110	EMERGENCY AND STANDBY POWER SYSTEMS	2016 EDITION
NFPA 170	STANDARD FOR FIRE SAFETY AND EMERGENCY SYMBOLS	2015 EDITION
NFPA 2001	STANDARD ON CLEAN AGENT FIRE EXTINGUISHING SYSTEMS	2015 EDITION
UL 300	STANDARD FOR FIRE TESTING OF FIRE EXTINGUISHING SYSTEMS FOR PROTECTION OF COMMERCIAL COOKING EQUIPMENT	2005 (R2010)
UL 464	AUDIBLE SIGNALING DEVICES FOR FIRE ALARM AND SIGNALING SYSTEMS, INCLUDING ACCESSORIES	2003 EDITION
UL 521	STANDARD FOR HEAT DETECTORS FOR FIRE PROTECTIVE SIGNALING SYSTEMS	1999 EDITION
UL 1971	STANDARD FOR SIGNALING DEVICES FOR THE HEARING IMPAIRED	2002 EDITION
ICC 300	STANDARD FOR BLEACHERS, FOLDING AND TELESCOPIC SEATING, AND GRANDSTANDS	2012 EDITION

8. A COPY OF TITLE 24 PARTS 1-5 SHALL BE KEPT ON THE JOB AT ALL TIMES.
9. IN ACCORDANCE WITH TITLE 24 PART 1 CHAPTER 4: THE ADMINISTRATIVE REGULATIONS FOR THE DIVISION OF THE STATE ARCHITECT STRUCTURAL SAFETY (DSA/SS).
● ALL CONSTRUCTION CHANGE DOCUMENTS AND ADDENDA SHALL BE SIGNED BY THE ARCHITECT AND THE OWNER AND APPROVED BY DSA.CONSTRUCTION CHANGE DOCUMENTS NOT VALID UNTIL APPROVED BY DSA (4-338).
● ALL TESTS SHALL CONFORM TO THE REQUIREMENTS OF SECTION 4-335 AND APPROVED T & I SHEET (DSA-10)
● TESTS OF MATERIALS AND TESTING LAB SHALL BE IN ACCORDANCE WITH SECTION 4-335 AND THE DISTRICT SHALL EMPLOY AND PAY THE LAB. COSTS OF RE-TEST MAY BE BACKCHARGED TO THE CONTRACTOR.
● DSA SHALL BE NOTIFIED AT THE START OF CONSTRUCTION AND PRIOR TO THE PLACEMENT OF CONCRETE IN ACCORDANCE WITH SECTION 4-331
● INSPECTOR SHALL BE APPROVED BY DSA. INSPECTION SHALL BE IN ACCORDANCE WITH SECTION 4-333(b). THE DUTY OF THE INSPECTOR SHALL BE IN ACCORDANCE WITH SECTION 4-342.
● SUPERVISION OF CONSTRUCTION BY DSA SHALL BE IN ACCORDANCE WITH SECTION 4-334.
● VERIFIED REPORTS SHALL BE SUBMITTED BY CONTRACTORS, INSPECTORS (DSA - 6), ARCHITECTS AND ENGINEERS (DSA 6AE) IN ACCORDANCE WITH SECTIONS 4-336 AND 4-343.
● THE ARCHITECT AND THE STRUCTURAL ENGINEER SHALL PERFORM THEIR DUTIES IN ACCORDANCE WITH SECTIONS 4-333(a) AND 4-341.
● THE CONTRACTOR SHALL PERFORM HIS DUTIES IN ACCORDANCE WITH SECTION 4-343.
10. FOOD HANDLING FACILITIES SHALL COMPLY WITH ALL LOCAL HEALTH REQUIREMENTS AND CALIFORNIA UNIFORM RETAIL FOOD FACILITIES LAW.
11. THE INTENT OF THE DRAWINGS AND SPECIFICATIONS IS THAT THE WORK OF ALTERATION, REHABILITATION OR RECONSTRUCTION IS TO BE IN ACCORDANCE WITH TITLE 24, C.C.R. SHOULD ANY EXISTING CONDITIONS BE DISCOVERED WHICH IS NOT COVERED BY THE CONTRACT DOCUMENTS WHERE IN THE FINISHED WORK WILL NOT COMPLY WITH SAID TITLE 24 C.C.R. A CONSTRUCTION CHANGE DOCUMENT DETAILING AND SPECIFYING THE REQUIRED REPAIR WORK SHALL BE SUBMITTED TO AND APPROVED BY DSA BEFORE PROCEEDING WITH THE REPAIR WORK. (TITLE 24 PART 1, SECTION 4-338(c))
12. COMPLIANCE WITH CFC CHAPTER 33, FIRE SAFETY DURING CONSTRUCTION AND DEMOLITION AND CBC CHAPTER 33, SAFETY DURING CONSTRUCTION SHALL BE ENFORCED.
13. EMERGENCY VEHICLE ACCESS ROADS AND ON-SITE FIRE HYDRANTS SHALL BE IN SERVICE AND OPERABLE PRIOR TO LOADING THE SITE WITH COMBUSTIBLE MATERIALS.
14. GRADING PLANS, DRAINAGE IMPROVEMENTS, ROAD AND ACCESS REQUIREMENTS, AND ENVIRONMENTAL HEALTH CONSIDERATIONS SHALL COMPLY WITH ALL LOCAL ORDINANCES.

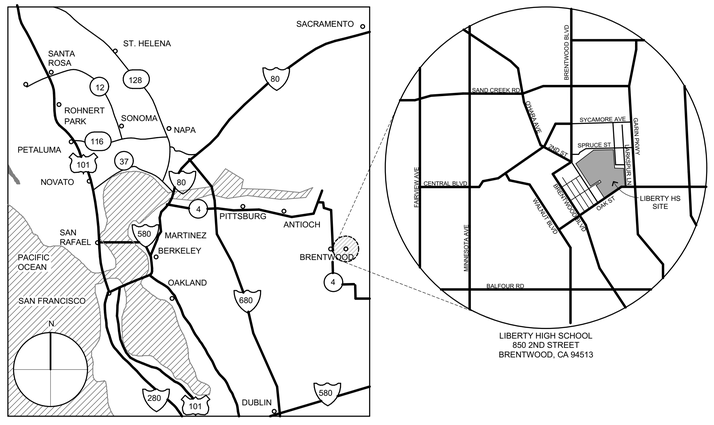
PROJECT DESCRIPTON

-MANUFACTURED METAL BUILDING FOR MAINTENANCE & OPERATIONS / TRANSPORTATION FACILITIES.
-MANUFACTURED METAL BUILDING FOR BUS SHOP INCLUDING WASH BAY
-BUS PARKING.
-FUEL STATION/ TANK (DIESEL AND GAS)
-PARKING FOR STAFF AND GENERAL PUBLIC

DEFERRED APPROVALS

NONE.

VICINITY MAP



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TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

850 2ND STREET
BRENTWOOD, CA 94513

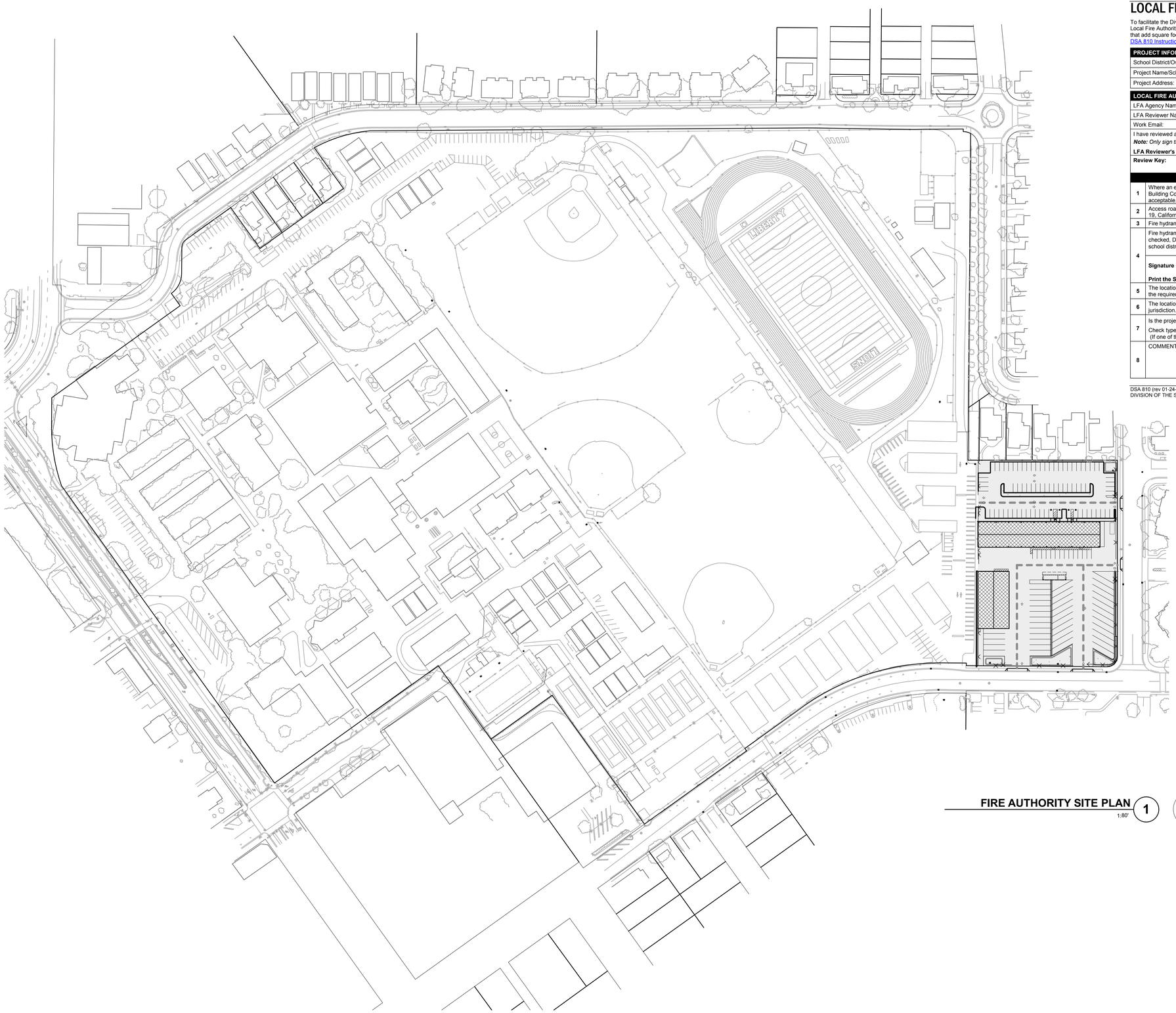
LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO: 1707.00
DRAWN BY:
DRAWING SCALE: N.T.S.
PTN: 61721-0064
100% DD
MAY 25, 2018

SHEET TITLE
ABBREVIATIONS AND NOTES

SHEET NUMBER
G-0.2

BIM Server: archiserver - BIM Server 21/1707.00 LUHSD TRANS M and O.5/23/2018,13:55



FIRE AUTHORITY SITE PLAN 1
1:80'

NORTH

DSA 810

LOCAL FIRE AUTHORITY REVIEW

To facilitate the Division of the State Architect's (DSA) approval of the Fire/Life Safety portion of a project, DSA requires Local Fire Authority (LFA) review of certain elements as identified in this form. Use of this form is mandatory for projects that add square footage to a campus or if any item on this form is relevant to the project. For additional information, see DSA 810 Instructions and DSA Policy 09-01.

PROJECT INFORMATION
School District/Owner:
Project Name/School:
Project Address:

LOCAL FIRE AUTHORITY (LFA)	
LFA Agency Name:	
LFA Reviewer Name:	Title:
Work Email:	Work Telephone Number:

I have reviewed and responded to the applicable items for this project as listed below.

***Note:** Only sign this form when it is imaged onto the site plan. A loose form is not acceptable to DSA.*

LFA Reviewer's Signature: _____ **Date:** _____

Review Key: **"Y"** = Complies with LFA requirements **"N"** = Not approved (complete Section 8)
"NA" = Not applicable to the project **"NR"** = LFA elects not to review

	Description	Y	N	NA	NR
1	Where an elevator does not meet medical emergency service cab size, per the California Building Code (CBC), use of stairways for emergency rescue and patient transport is acceptable.				
2	Access roads, fire lane markings, pavers and gate entrances are in accordance with Title 19, California Code of Regulations and the California Fire Code, Chapter 5.				
3	Fire hydrant location and distribution complies with the California Fire Code (or see # 4).				
4	Fire hydrant location and distribution complies with NFPA 1142, "Alternate Means." If "NR" is checked, DSA can only approve on-site water storage as an alternate. The signature of the school district official is required to acknowledge the use of alternate means. **Signature of School District Official:** _____ **Date:** _____ **Print the School District Official's Name:** _____				
5	The location(s) of the proposed post indicator valve and fire department connection meet the requirements of this jurisdiction.				
6	The location(s) of the detector check valve assembly meet the requirements of this jurisdiction.				
7	Is the project located in a hazard severity zone area? (CBC, Chapter 7A, Section 701A.) ☐ Yes ☐ No Check type if "Yes": ☐ Moderate ☐ High ☐ Very High ☐ WIFA (If one of these boxes is checked, the project design must meet the requirements of Chapter 7A.)				
8	COMMENTS (note deficiencies):				

DSA 810 (rev 01-24-18) Page 1 of 1
DIVISION OF THE STATE ARCHITECT DEPARTMENT OF GENERAL SERVICES STATE OF CALIFORNIA

FIRE ACCESS PLAN LEGEND

- NEW BUILDING
- (E) BUILDING TO REMAIN
- EVA
- (N) FIRE HYDRANT
- (E) FIRE HYDRANT
- PROPERTY LINE

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100% DD
MAY 25, 2018

SHEET TITLE
FIRE AUTHORITY APPROVAL PLAN

SHEET NUMBER
G-0.3

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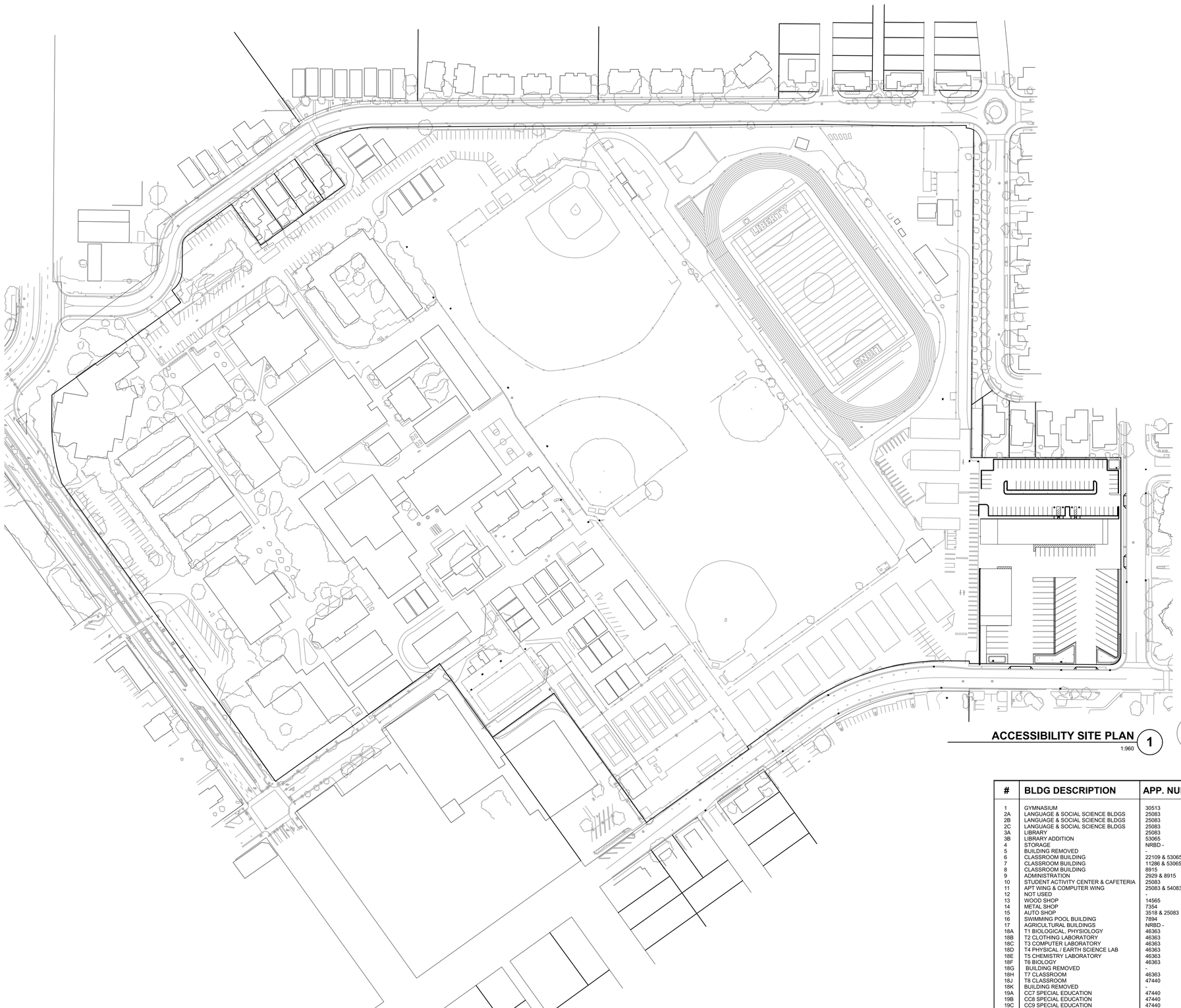

ACCESSIBILITY SITE PLAN 1
1:960

NORTH

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ACCESS NOTES

1. ALL NEW WORK SHALL BE ACCESSIBLE. ALL NEW WALKWAYS SHALL CONFORM TO CBC11B-403 PAVING MATERIALS NOT OTHERWISE NOTED SHALL BE CONCRETE.
   - CONCRETE SHALL SLOPE 2% AWAY FROM BUILDINGS. S.C.D.
   - EXTERIOR DOOR LANDINGS SHALL SLOPE 2% AWAY FROM BUILDING FOR DRAINAGE.
2. REFER TO ARCHITECTURAL SIGNAGE DRAWINGS FOR DETAILS OF DIRECTIONAL SIGNAGE.
   PARKING & PEDESTRIAN SITE SIGNAGE SHALL COMPLY WITH CBC SECTIONS 11B-502.6 & 11B-703.7.2.1.
   BUILDING SIGNAGE SHALL COMPLY WITH CBC 11B-703.
   INDICATES BARRIER FREE PATH OF TRAVEL
   - 1:20 MAXIMUM SLOPE WITHOUT A RAMP.
   - 1:50 MAXIMUM CROSS SLOPE.
   - NO ABRUPT VERTICAL CHANGES EXCEEDING 1/4". CHANGES BETWEEN 1/4" TO 1/2" VERTICAL CAN BE AT 1:2 MAX SLOPE. CHANGES LESS THAN 1/4" CAN BE VERTICAL.
   - 48" MIN. CLEAR IN WIDTH (60" MIN PASSING SPACE)
   - NON-SLIP SURFACE -HEAVY BROOM FINISH AT EXTERIOR CONCRETE PAVING WHERE SLOPED >6%, MEDIUM BROOM FINISH AT SLOPES <6%
   - MAINTAIN FREE OF OVERHANGING OBSTRUCTIONS TO 80" MIN.
   - PROTRUDING OBJECTS NOT GREATER THAN 4" SHALL BE MOUNTED BETWEEN 27" AND 80" A.F.F.
   - PROTRUDING OBJECTS NOT GREATER THAN 4" SHALL BE MOUNTED BETWEEN 27" AND 80" A.F.F.
   - WHERE A DRAIN INLET IS IN THE PATH OF TRAVEL, THE GRATE SHALL BE ORIENTED SO THAT MAX. OPENING IS 1/2" & LONG DIM IS PERPENDICULAR TO THE P REDOMINANT DIRECTION OF PEDESTRIAN TRAVEL.
   - CONTRACTOR TO VERIFY THAT NO BELOW-GRADE PULL BOXES OCCUR WITHIN THE AREA OF TRUNCATED DOMES.
4. PEDESTRIAN GATES SHALL COMPLY WITH CBC 1008.2 & 11B-206.5

"(E) ACCESS TO PUBLIC RIGHT OF WAY IS NOT RESTRICTED BY FENCES OR GATES ALONG PRIMARY CAMPUS STREET FRONTAGE"

ACCESS SITE PLAN LEGEND

- NEW BUILDING
- (E) BUILDING TO REMAIN
- ACCESSIBLE PATH OF TRAVEL PER GENERAL NOTES
- ACCESSIBLE ENTRY/ EXTERIOR DOOR AT P.O.T.
- ACCESSIBLE DRINKING FOUNTAIN
- G — RESTROOM - GIRLS
- B — RESTROOM - BOYS
- S — RESTROOM - STAFF

(N) = NEW (E) = EXISTING

PARKING COUNT

	OVERALL	ACC STALL	ACC VAN STALL	REQUIRED STD	REQUIRED VAN
(N) PARKING LOT GENERAL	X	X	X	X	X
PARKING LOT VISITOR & STAFF	X	X	X	X	X
PARKING LOT STAFF	X	X	X	X	X
PARKING LOT STAFF	X	X	X	X	X
TOTAL REQUIRED	X	X	X	X	X

CBC 2016 TABLE 11B-208.2:
26-50 TOTAL SPACES = 2 REQ'D ACC SPACES

CBC 2016 SECTION 2088.2.4:
FOR EVERY 6 OR FRACTION OF 6 ACC PARKING SPACES REQUIRED, AT LEAST 1 SHALL BE A VAN ACCESSIBLE PARKING SPACE.

EXISTING TOILET COUNT

	OVERALL	ACC STALL	
TOILETS	X	X	

#	BLDG DESCRIPTION	APP. NUMBER
1	GYMNASIUM	30513
2A	LANGUAGE & SOCIAL SCIENCE BLDGS	25083
2B	LANGUAGE & SOCIAL SCIENCE BLDGS	25083
2C	LANGUAGE & SOCIAL SCIENCE BLDGS	25083
3A	LIBRARY	25083
3B	LIBRARY ADDITION	53065
4	STORAGE	NRBD -
5	BUILDING REMOVED	-
6	CLASSROOM BUILDING	22109 & 53065
7	CLASSROOM BUILDING	11286 & 53065
8	CLASSROOM BUILDING	8915
9	ADMINISTRATION	2929 & 8915
10	STUDENT ACTIVITY CENTER & CAFETERIA	25083
11	APT WING & COMPUTER WING	25083 & 54083
12	NOT USED	-
13	WOOD SHOP	14565
14	METAL SHOP	7354
15	AUTO SHOP	3518 & 25083
16	SWIMMING POOL BUILDING	7894
17	AGRICULTURAL BUILDINGS	NRBD -
18A	T1 BIOLOGICAL, PHYSIOLOGY	46363
18B	T2 CLOTHING LABORATORY	46363
18C	T3 COMPUTER LABORATORY	46363
18D	T4 PHYSICAL / EARTH SCIENCE LAB	46363
18E	T5 CHEMISTRY LABORATORY	46363
18F	T6 BIOLOGY	46363
18G	BUILDING REMOVED	-
18H	T7 CLASSROOM	46363
18J	T8 CLASSROOM	47440
18K	BUILDING REMOVED	-
19A	CC7 SPECIAL EDUCATION	47440
19B	CC8 SPECIAL EDUCATION	47440
19C	CC9 SPECIAL EDUCATION	47440
19D	CC10 SPECIAL EDUCATION	47440
19E	CC11 SPECIAL EDUCATION	47440
19F	CC12 SPECIAL EDUCATION	47440
19G	CC13 SPECIAL EDUCATION	47440
19H	BUILDING REMOVED	-
19J	NEW RELOCATABLE CLASSROOM	01-105226
19K	NEW RELOCATABLE CLASSROOM	01-105226
19L	NEW RELOCATABLE CLASSROOM	01-105226

#	BLDG DESCRIPTION	APP. NUMBER
20A	TOILETS & STORAGE	25803
20B	REFRESHMENT STAND	NRBD -
20C	REMOVED	-
20D	REFRESHMENT STAND	NRBD -
21	BUS GARAGE	NRBD -
22D	P4 - CHAPTER 1	48291
22F	P6 - DRIVER TRAINING & SIMULATOR	48291
22T	P18 - DRAFTING	47440
23A	MAINTENANCE BUILDING	UNKNOWN
23B	MAINTENANCE BUILDING	NRBD -
23C	MAINTENANCE BUILDING	NRBD -
23D	MAINTENANCE BUILDING	NRBD -
23E	MAINTENANCE BUILDING	NRBD -
24	SCIENCE BUILDING	46950
25	COUNTY SPECIAL ED. FACILITY	48347
26	COUNTY SPECIAL ED. FACILITY	48347
27	NOT USED	-
28A	MATH & SCIENCE CLASSROOMS	53065
28B	MATH & SCIENCE CLASSROOMS	53065
29	PERFORMING ARTS BUILDING	54083
30A	R7 CLASSROOMS	59655
30B	R10 CLASSROOMS	59655
30C	R11 CLASSROOMS	59655
30D	R12 CLASSROOMS	59655
30E	R8 CLASSROOMS	59655
30F	R13 CLASSROOMS	59655
30G	R14 CLASSROOMS	59655
30H	R15 CLASSROOMS	59655
31A	R9 TOILETS	61129
31B		
31C		
31D		
31E		
32		
33A		
33B		
33C		
33D		
33E		
33F		
34A		
34B		
34C		
34D		

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LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO: 1707.00
DRAWN BY:
DRAWING SCALE:
PTN: 61721-0064

100% DD

MAY 25, 2018

SHEET TITLE

ACCESSIBILITY PLAN

SHEET NUMBER

G-0.4

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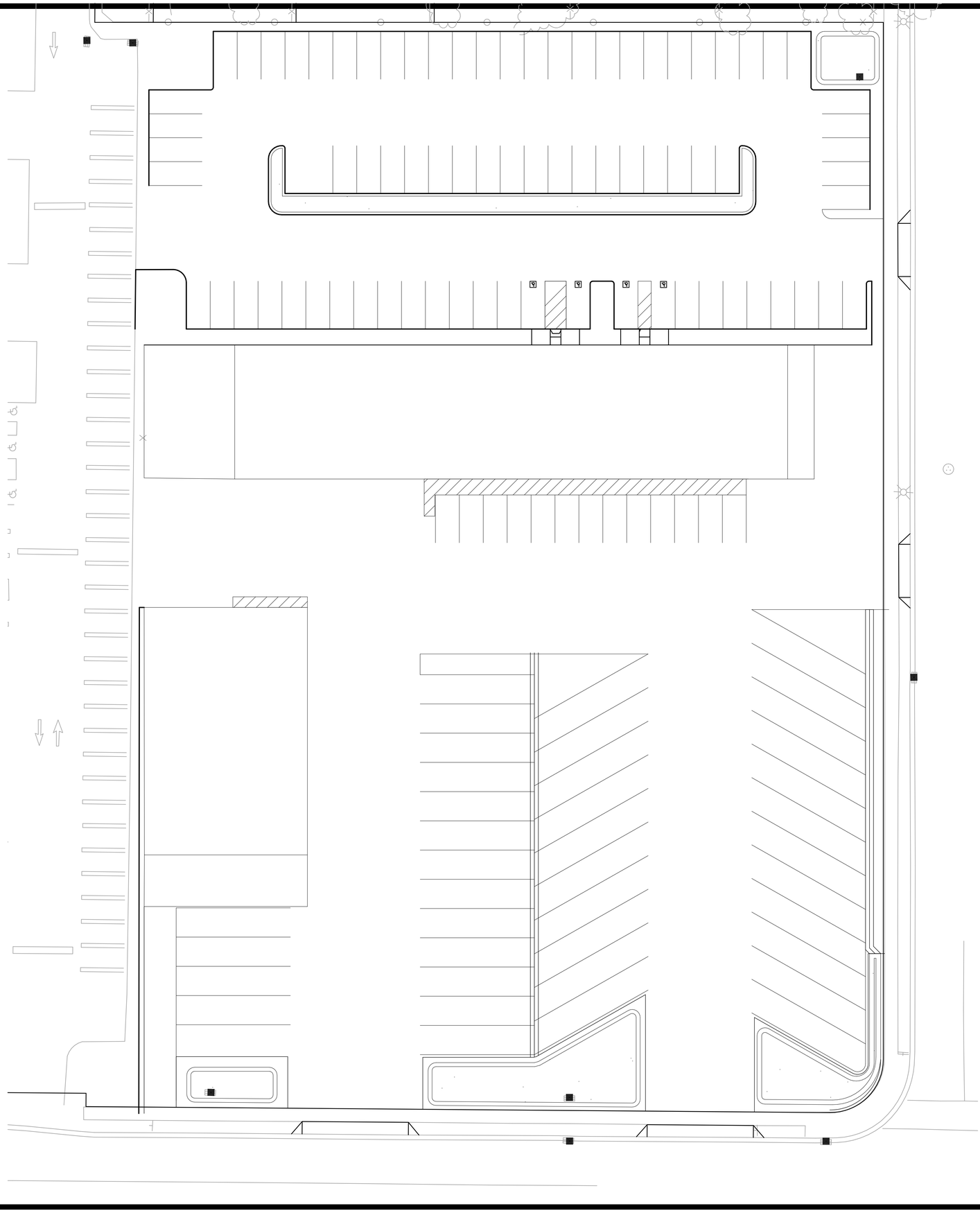

LEGEND:

- 20' CLEAR FRONTAGE
- 30' CLEAR FRONTAGE
- (E) BUILDING A FOOTPRINT

OCCUPANCY	B	S-1
USE	OFFICE	STORAGE
CONSTRUCTION TYPE	TYPE V-B	TYPE V-B
AUTOMATIC FIRE SPRINKLERS	NO	
ALLOWABLE AREA C.B.C. TABLE 506.2, At	9,000 SF	
ALLOWABLE AREA WITH FRONTAGE INCREASE, At x If	2,880 SF	
ALLOWABLE AREA Aa = At + (NS X If)	Aa = 9000 SF + (9000 SF X 0.75) Aa = 9000 SF + 6,750 SF) Aa = 15,750 SF	
ACTUAL TOTAL AREA	5,023 SF	
SEPARATED OCCUPANCIES ALLOWABLE BUILDING AREA, SEC 508.4.2	5,023 SF/15,750 SF + 6,660 SF/14,875 SF + 1,416 SF/15,750 SF = 0.85 ∴ 0.85 < ALLOWABLE OF 1	
ALLOWABLE BLDG HEIGHT, TABLE 504.3	40'	
ACTUAL BLDG HEIGHT	30'	
ALLOWABLE NUMBER OF STORIES, TABLE 504.4	2	
ACTUAL STORIES	1	

FRONTAGE INCREASE:
If = [F/P - 0.25] W/30
where:
If = area increase due to frontage
F = building perimeter that fronts on public way
P = perimeter of entire building
W = width of public way or open space
W=30'

If = [144.16'+48'+89.33' / 384.33' - 0.25] 30'/30
If = [281.49' / 384.33' - 0.25] 1.06
If = [.73 - .25] 1.00
If = 0.48

ALLOWABLE AREA:
Aa = {At + [At X If) + [At X Is]}
Aa = {6,000 SF + [6,000 SF X 0.48) + [6,000 SF X 0}
Aa = 6,000 SF + 2,880 SF + 0
Aa = 8,880 SF

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DRAWN BY:
DRAWING SCALE: N.T.S.
PTN: 61721-0064
100% DD
MAY 25, 2018

SHEET TITLE

CODE ANALYSIS PLAN

SHEET NUMBER

G-0.5

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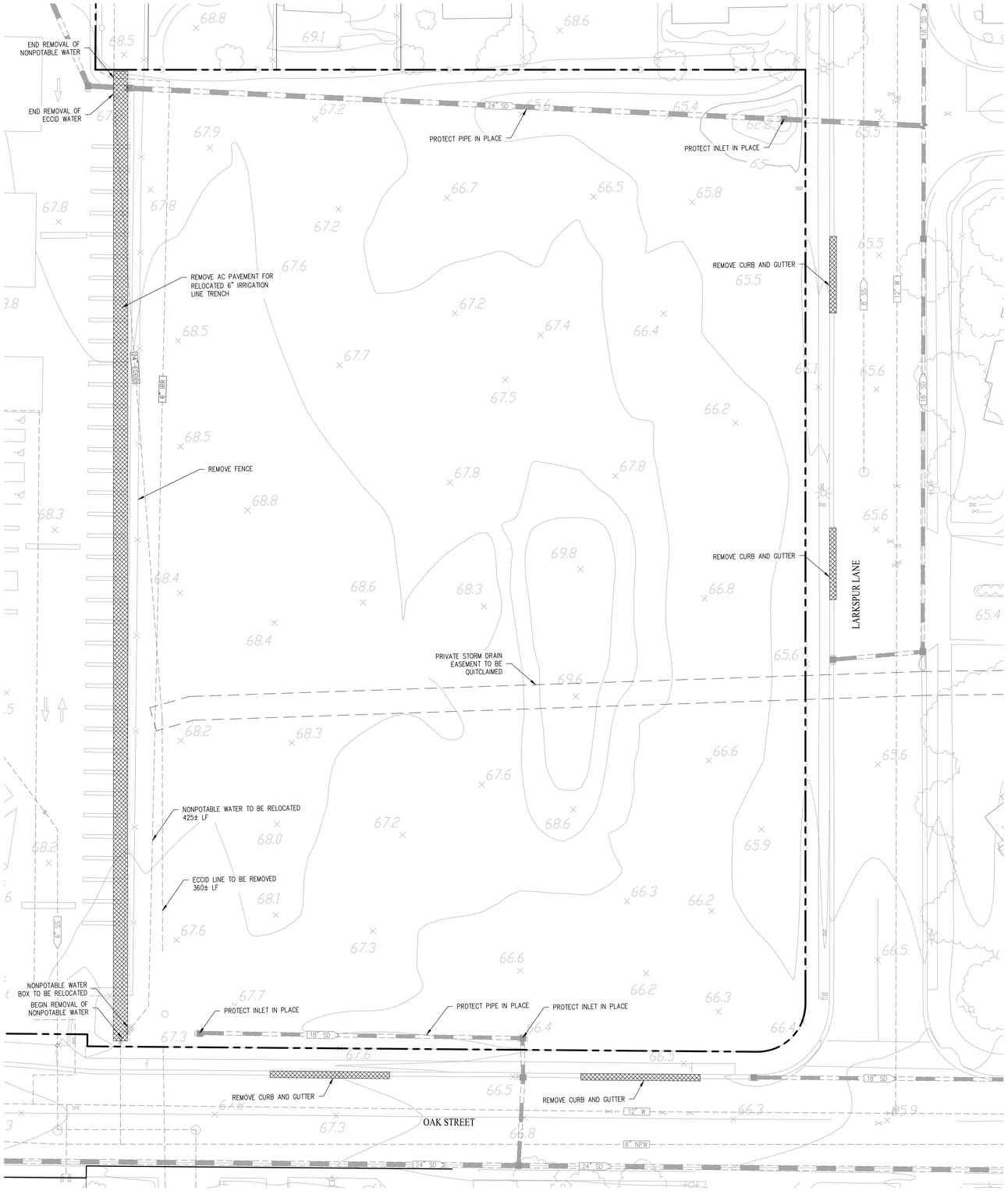

LEGEND

- REMOVE CURB AND GUTTER
- 8" SS — EXISTING SEWER
- 18" SD — EXISTING STORM DRAIN
- 12" W — EXISTING WATER
- 6" RR — EXISTING NONPOTABLE WATER
- EXISTING FIELD INLET

0' 20' 60' 80'

SCALE: 1" = 20'

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REVISIONS

CIVIL PROJECT NO: 1257-020
DRAWN BY: MJV
DRAWING SCALE: 1" = 20'

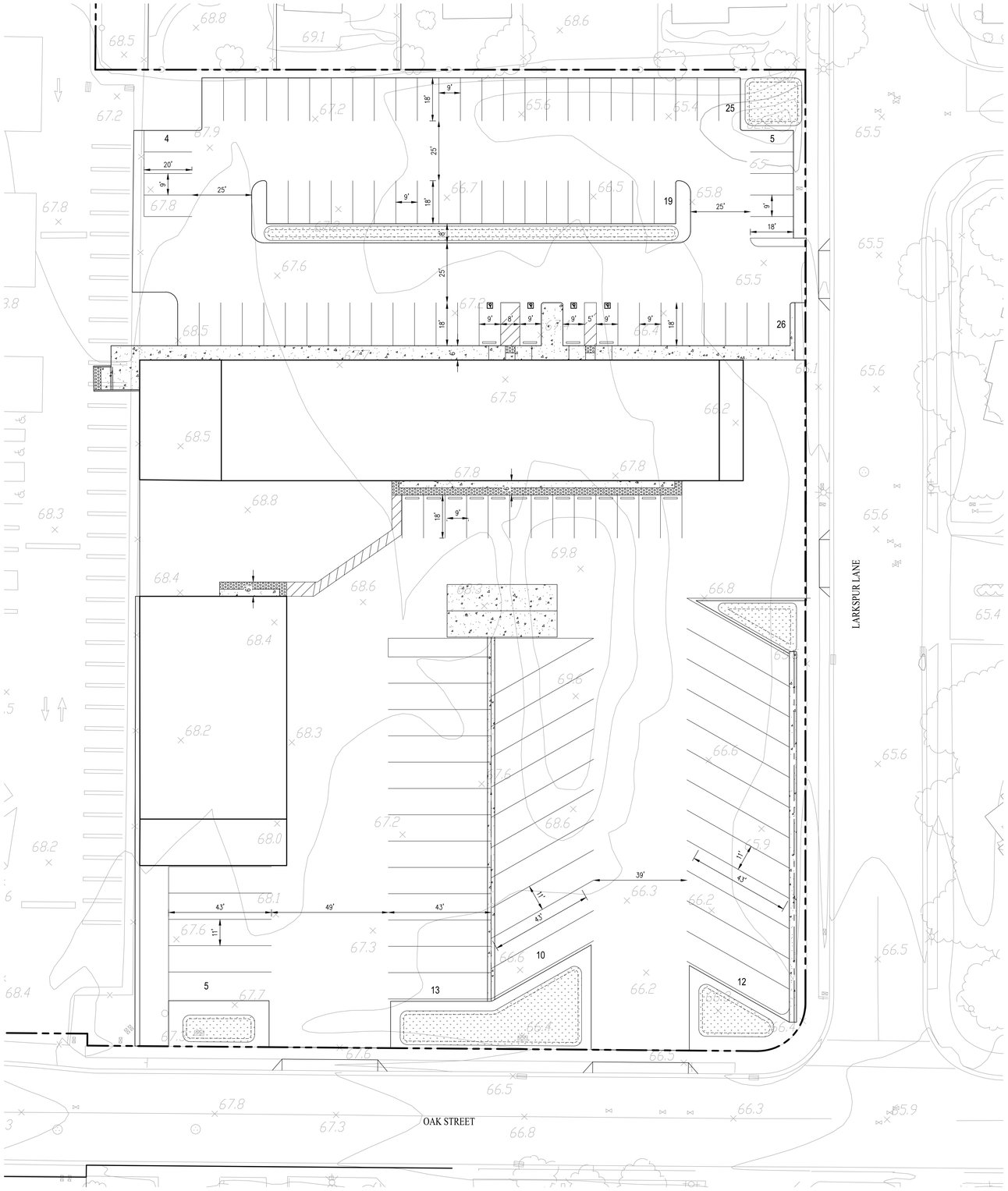
100% DD
MAY 10, 2018

SHEET TITLE

DEMOLITION PLAN

SHEET NUMBER

C-1.0



LEGEND

- PROPERTY BOUNDARY
- CONCRETE SIDEWALK/GUTTER
- VALLEY GUTTER
- CURB AND GUTTER
- BIO-RETENTION AREA
- WHEEL STOP
- 12 PARKING COUNT

0' 20' 60' 80'

SCALE: 1" = 20'

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REVISIONS

CIVIL PROJECT NO:	1257-020
DRAWN BY:	MJV
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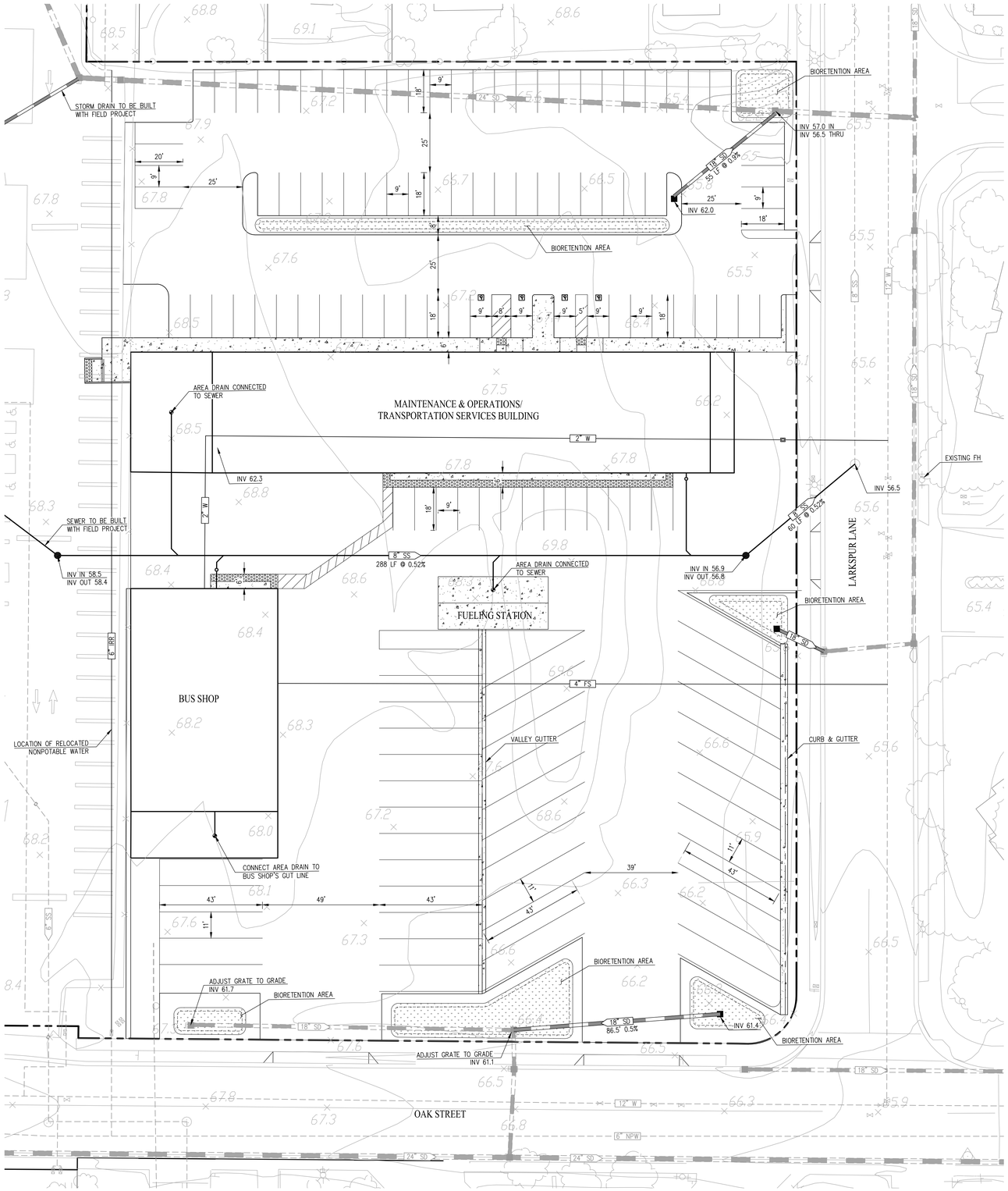
MAY 10, 2018

SHEET TITLE

HORIZONTAL CONTROL PLAN

SHEET NUMBER

C-2.0



LEGEND

- PROPERTY BOUNDARY
- CONCRETE SIDEWALK/GUTTER
- VALLEY GUTTER
- CURB AND GUTTER
- BIO-RETENTION AREA
- 15" SD — PROPOSED STORM DRAIN
- 4" SS — PROPOSED SEWER LATERAL
- 2" W — PROPOSED WATER LATERAL
- 4" FS — PROPOSED FIRE SERVICE
- PROPOSED CATCH BASIN
- PROPOSED SEWER CLEANOUT
- 8" SS — EXISTING SEWER
- 18" SD — EXISTING STORM DRAIN
- 12" W — EXISTING WATER
- 6" IRR — EXISTING IRRIGATION
- EXISTING FIELD INLET

0' 20' 60' 80'

SCALE: 1" = 20'

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REVISIONS

CIVIL PROJECT NO:	1257-020
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MAY 10, 2018

SHEET TITLE

GRADING AND UTILITIES PLAN

SHEET NUMBER

C-3.0

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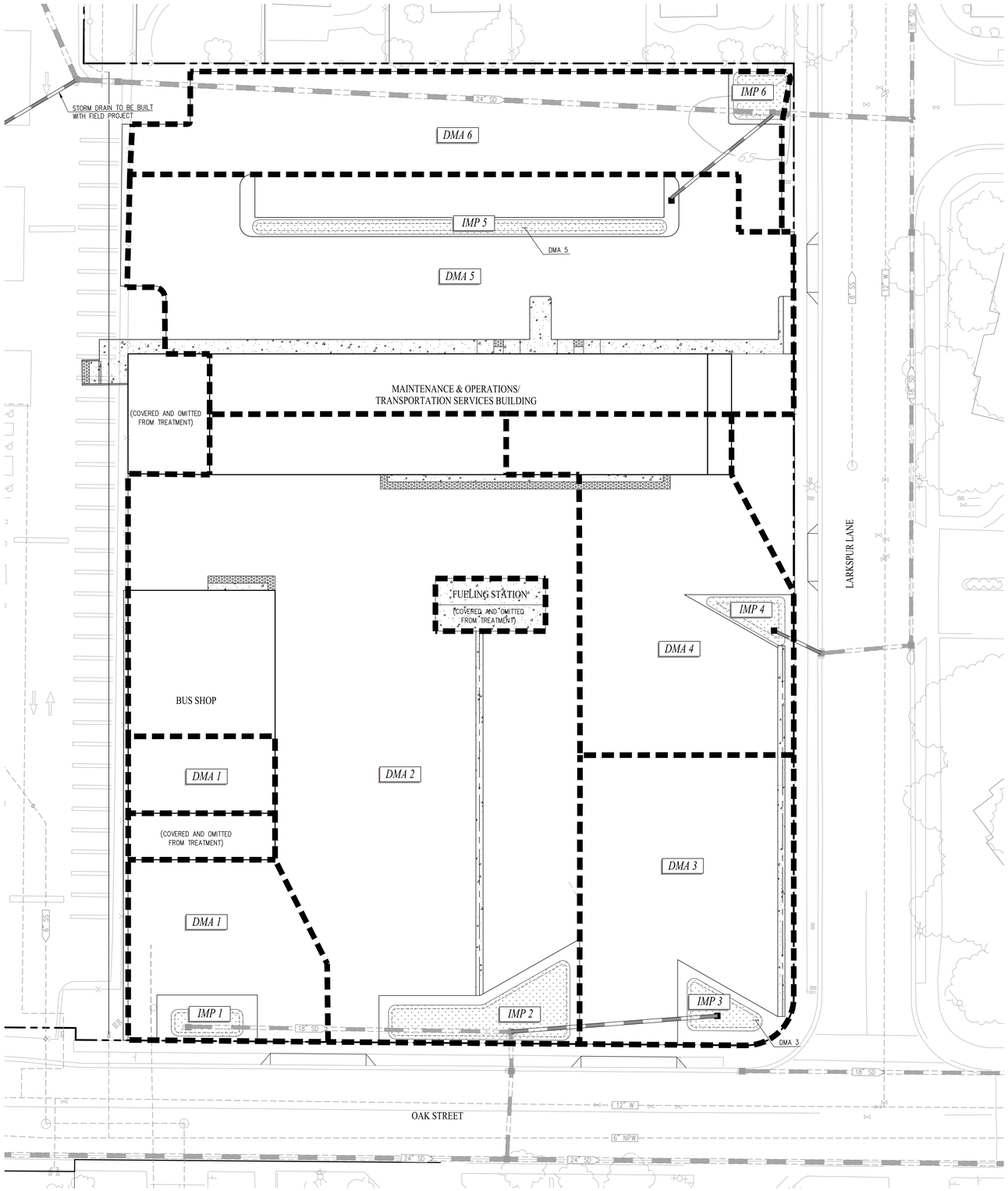

LEGEND

IMP 1 — INTEGRATED MANAGEMENT PRACTICE – BIORETENTION AREA

DRAINAGE MANAGEMENT AREA BOUNDARY

DMA 1 — DRAINAGE MANAGEMENT AREA DRAINING TO PARKING INFILTRATION TRENCH AREA OR BIO-RETENTION AREA

BIORETENTION AREAS

DMA	REQUIRED TREATMENT AREA (SF)	PROVIDED TREATMENT AREA (SF)
1	283	329
2	1,436	1,459
3	380	462
4	400	402
5	997	1,030
6	447	466
TOTAL	3,943	4,148

FOR REFERENCE ONLY

0' 20' 60' 80'

SCALE: 1" = 20'

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REVISIONS

CIVIL PROJECT NO: 1257-020
DRAWN BY: MJV
DRAWING SCALE: 1" = 20'

100% DD
MAY 10, 2018

SHEET TITLE

PRELIMINARY STORMWATER CONTROL PLAN

SHEET NUMBER

C-4.0

5/10/2018 4:04 PM
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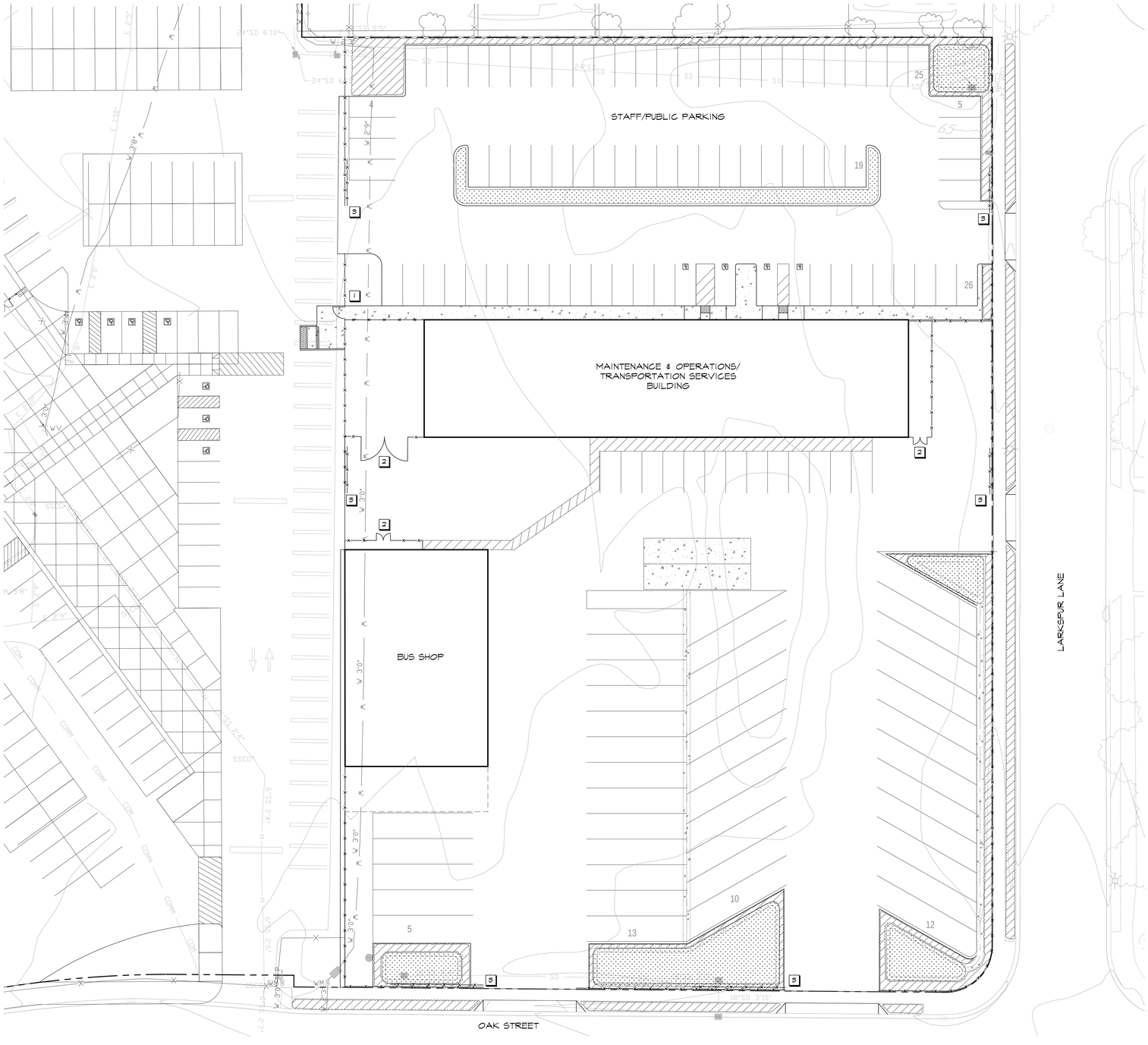

PLANT LEGEND

LANDSCAPING

Shrubs, Groundcover, and Vines

BIOINFILTRATION FACILITY

Biofiltration Planting

MATERIALS LEGEND

—x—x— 8' High Chain Link Non-Climbable Fence

KEY NOTES

1 Single Gate, 8' High Chain Link Non-Climbable

2 Double Gate, 8' High Chain Link Non-Climbable

3 Sliding Gate (Manual), 8' High Chain Link Non-Climbable

GRAPHIC SCALE IN FEET
1"=20'

PRELIMINARY
NOT FOR CONSTRUCTION

FOR REFERENCE ONLY

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REGISTERED LANDSCAPE ARCHITECT
GRETCHEN STRANZL MCCANN
No. 2790
Exp. 10-31-18
STATE OF CALIFORNIA

LIBERTY HIGH SCHOOL

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REVISIONS

ARCH PROJECT NO: 1707.00
DRAWN BY: ECD/BHF
DRAWING SCALE: AS SHOWN

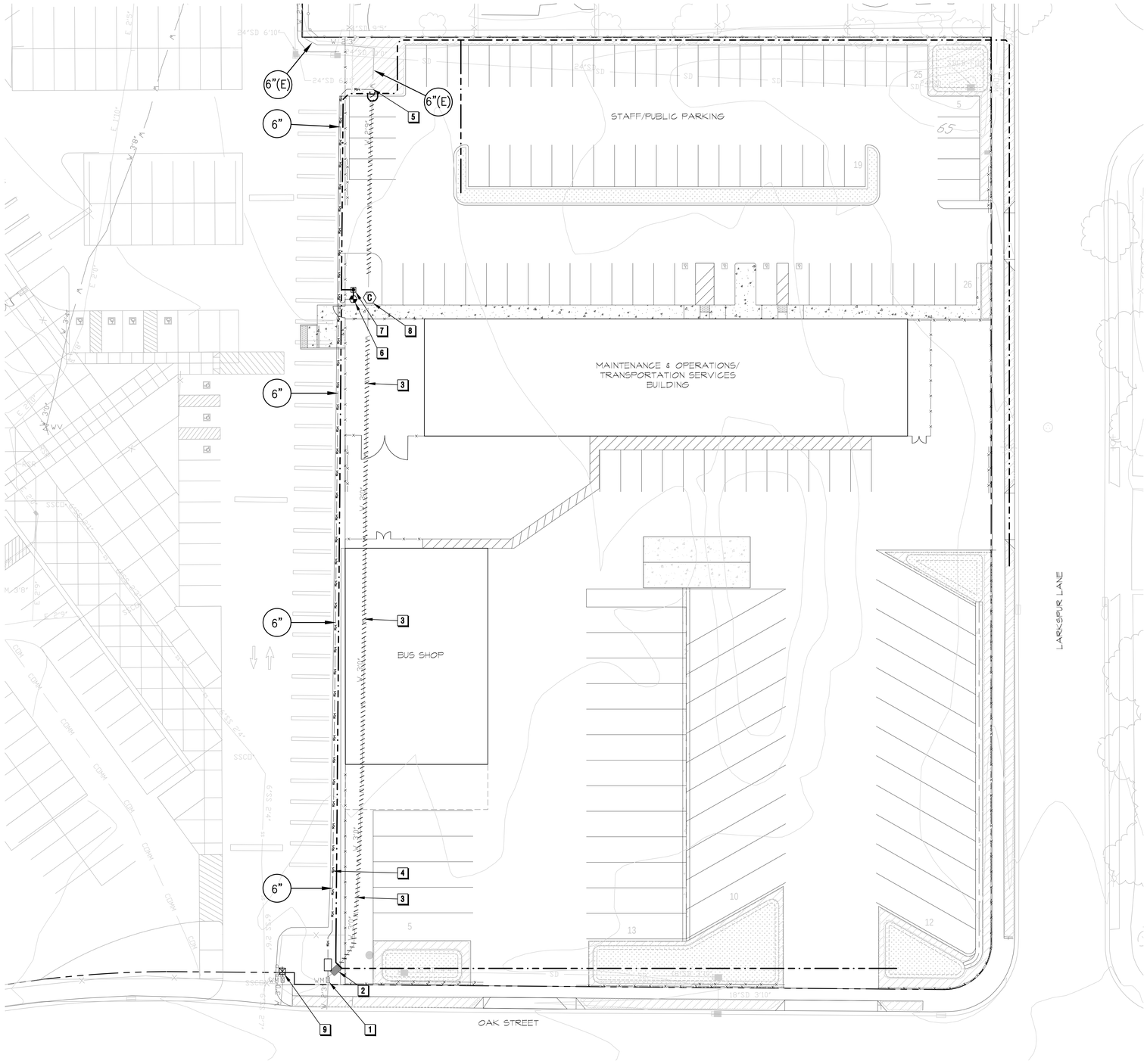
100% DD
MAY 10, 2018

SHEET TITLE

LANDSCAPE SITE PLAN

SHEET NUMBER

L1.0



SHEET NOTES

1. (E) RECYCLED WATER METER DEDICATED FOR IRRIGATION USE. PSI = 80 PSI STATIC.
2. (E) RECYCLED WATER APPURTENANCE SHALL BE RELOCATED AND REPOSITIONED AS SHOWN.
3. (E) 6" DIA. RECYCLED WATER LINE SHALL BE ABANDONED AND RELOCATED AS SHOWN. (E) MAIN LINE NEEDS RELOCATION DUE TO (N) BUILDING POSITIONS.
4. (N) 6" DIA. RECYCLED WATER LINE TO SERVE THE MAINTENANCE FACILITY AND HIGH SCHOOL BALL FIELDS.
5. POINT OF CONNECTION FOR (N) RECYCLED WATER MAIN TO (E) RECYCLED WATER MAIN. INSTALL A 90 DEGREE ELBOW AT CONNECTION TO (E) RECYCLED WATER LINE BELOW GRADE.
6. MASTER VALVE AND FLOW SENSOR
7. FILTER
8. IRRIGATION CONTROLLER (PEDESTAL MOUNT). PROVIDE POWER AND ETHERNET TO IRRIGATION CONTROLLER.
9. (E) BACKFLOW ASSEMBLY SHALL REMAIN IN SERVICE, AS-IS.

NOTE:
(E) IRRIGATION MAIN LINE SERVING LIBERTY HIGH SCHOOL CAMPUS FIELDS SHALL REMAIN IN SERVICE AT ALL TIMES. INSTALL (N) RECYCLED WATER IRRIGATION MAIN LINE OUTSIDE OF THE PROPOSED BUILDING ENVELOPE. DEMOLISH (E) RECYCLED WATER IRRIGATION MAIN LINE WITHIN THE SPHERE OF INFLUENCE FOR PROPOSED BUILDINGS AFTER (N) RECYCLED WATER IRRIGATION MAIN LINE IS FULLY OPERATIONAL. PROVIDE AND INSTALL IRRIGATION MAIN LINE, POINT OF CONNECTION, MASTER CONTROL VALVE, FLOW SENSOR, WATER FILTER, AND IRRIGATION CONTROLLER.

WATER SOURCE NOTE: THIS PROJECT'S IRRIGATION SYSTEM USES A RECYCLED WATER SOURCE FOR IRRIGATION WATER.

NORTH
0 20' 40'
GRAPHIC SCALE IN FEET
1"=20'

PRELIMINARY
NOT FOR CONSTRUCTION

FOR REFERENCE ONLY

DIGALERT 811

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LIBERTY UNION HIGH SCHOOL DISTRICT

REVISIONS

ARCH PROJECT NO:	1707.00
DRAWN BY:	ST/JDE
DRAWING SCALE:	AS SHOWN

100% DD
MAY 10, 2018

SHEET TITLE

IRRIGATION PLAN

SHEET NUMBER

L2.0

IRRIGATION INSTALLATION NOTES

REFER TO IRRIGATION SPECIFICATIONS FOR DETAILED INFORMATION.
LUHSD = LIBERTY UNION HIGH SCHOOL DISTRICT

1. PROVIDE INSTALLATION BY PERSONS FAMILIAR WITH IRRIGATION WORK AND UNDER THE SUPERVISION OF A QUALIFIED SUPERVISOR.
2. OBTAIN THE PERMITS REQUIRED AND PROVIDE LABOR AND MATERIALS NECESSARY TO FULLY COMPLETE THE WORK IN ACCORDANCE WITH THE DRAWINGS AND THE SPECIFICATIONS.
3. LOCATE AND PROTECT NEW AND EXISTING UTILITIES PRIOR TO EXCAVATION. DO NOT DAMAGE EXISTING UTILITIES, PAVING OR STRUCTURES. PROVIDE THE NECESSARY REPAIRS AT NO ADDITIONAL COST TO LUHSD.
4. REMOVE DEBRIS AND ACCUMULATION OF DEBRIS AS A RESULT OF IRRIGATION CONSTRUCTION FROM THE SITE AND LEAVE AREA IN A CLEAN CONDITION ACCEPTABLE TO LUHSD. MAINTAIN SITE FOR THE SPECIFIED CALENDAR DAYS FOLLOWING ACCEPTANCE OF THE WORK BY LUHSD AND MAKE CORRECTIONS OR REPAIRS TO THE IRRIGATION AS DIRECTED BY LUHSD AT THE COMPLETION OF THE MAINTENANCE PERIOD.
5. THE DRAWINGS ARE DIAGRAMMATIC. PIPE AND EQUIPMENT MAY BE SHOWN IN PAVING FOR CLARITY ONLY – INSTALL IN PLANTING AREAS WHERE POSSIBLE. DUE TO THE SCALE OF THE DRAWINGS, ALL OFFSETS, FITTINGS, SLEEVES, ETC. WHICH MAY BE REQUIRED ARE NOT INDICATED. INVESTIGATE THE STRUCTURAL AND FINISHED CONDITIONS AFFECTING THE CONTRACT WORK INCLUDING OBSTRUCTIONS GRADE DIFFERENCES OR AREA DIFFERENCES WHICH MAY HAVE NOT BEEN CONSIDERED IN THE ENGINEERING. WHERE FIELD CHANGES EXIST, COORDINATE THE INSTALLATION WORK ACCORDINGLY BY NOTIFICATION AND APPROVAL OF LUHSD AS PER THE CONTRACT SPECIFICATIONS. COORDINATE IRRIGATION CONTRACT WORK WITH ALL APPLICABLE CONTRACTORS FOR THE LOCATION AND INSTALLATION OF PIPE, CONDUIT, OR SLEEVES OF PIPE, CONDUIT OR SLEEVES THROUGH OR UNDER WALLS, ROADWAYS, PAVING, STRUCTURE, ETC. BEFORE CONSTRUCTION. ASSUME FULL RESPONSIBILITY FOR REQUIRED REVISIONS IF THESE NOTIFICATIONS ARE NOT PERFORMED.
6. CONTRACTOR SHALL COORDINATE WITH OTHER CONTRACTORS ALL IRRIGATION SLEEVES, CONDUIT, AND PIPING INSTALLED UNDER PAVEMENT PRIOR TO INSTALLATION.
7. THE INTENT OF THIS IRRIGATION SYSTEM DESIGN IS TO PROVIDE THE MINIMUM AMOUNT OF WATER REQUIRED TO SUSTAIN GOOD PLANT HEALTH.
8. PROGRAM THE CONTROLLER TO PROVIDE THE MINIMUM AMOUNT OF WATER NEEDED TO SUSTAIN GOOD PLANT HEALTH. MAKE ADJUSTMENTS TO THE PROGRAM FOR SEASONAL WEATHER CHANGES, PLANT MATERIAL, WATER REQUIREMENTS, MOUNDS AND SLOPES, SUN, SHADE AND WIND EXPOSURES.
9. THE IRRIGATION SYSTEM IS DESIGNED FOR 1 VALVE TO OPERATE AT ONE TIME. THIS WILL ALLOW THE SYSTEM TO IRRIGATE IN APPROXIMATELY 8 HOURS OR LESS ACCORDING TO WEATHER CONDITIONS. TOTAL GPM DEMAND OF SYSTEM WILL BE APPROXIMATELY 45 GPM MAXIMUM. DO NOT UNDER ANY CIRCUMSTANCE EXCEED 45 GPM OR OPERATE MORE THAN ONE (1) VALVE AND ONE QUICK COUPLING VALVE AT THE SAME TIME.
10. IRRIGATION CONTROL WIRE: SOLID STRAND COPPER WITH U.L. APPROVAL FOR DIRECT BURIAL IN GROUND, SIZE AWG–UF #14–1. COMMON GROUND WIRE: WHITE INSULATING JACKET. CONTROL WIRE: INSULATING JACKET OF COLOR OTHER THAN WHITE. SPLICES: MADE WITH 3M–DBY SEAL PACKS. MULTIPLE CONTROLLERS: COLOR CODE WIRES FOR EASE OF IDENTIFICATION BY PROVIDING DIFFERENT COLOR CONTROL WIRE FOR EACH CONTROLLER.
11. SPLICES: MADE WITH 3M–DBY, OR SPEARS MODEL #400, OR APPROVED EQUAL SEAL PACKS.
12. INSTALL TWO SPARE CONTROL WIRES AND ONE COMMON WIRE FROM CONTROLLER ALONG THE ENTIRE MAIN LINE. INSTALL 36" EXCESS WIRE INTO A QUICK COUPLER BOX AT EACH VALVE GROUP. WEATHERPROOF UNUSED WIRE ENDS. SPLICING OF 24 VOLT WIRES IS NOT PERMITTED EXCEPT IN VALVE BOXES. LEAVE A 36" LONG, 1" DIAMETER COIL OF EXCESS WIRE AT EACH SPLICE AND A 36" LONG EXPANSION LOOP EVERY 100 FEET ALONG WIRE RUN.
13. PLASTIC VALVE BOXES AND LIDS SHALL BE PURPLE IN COLOR WITH BOLT DOWN, NON–HINGED COVER MARKED "IRRIGATION". BOX BODY SHALL HAVE KNOCK OUTS. MANUFACTURER: RAIN BIRD, NDS, CARSON/BROOKS, OR APPROVED EQUAL.
14. INSTALL REMOTE CONTROL VALVE BOXES 12" FROM WALK, CURB, BUILDING OR LANDSCAPE FEATURE. AT MULTIPLE VALVE BOX GROUPS, EACH BOX SHALL BE AN EQUAL DISTANCE FROM THE WALK, CURB, ETC. AND EACH BOX SHALL BE 12" APART. SHORT SIDE OF RECTANGULAR VALVE BOXES SHALL BE PARALLEL TO WALK, CURB, ETC. REFER TO BOX INSTALLATION DETAIL.
15. FLUSH AND ADJUST IRRIGATION HEADS FOR EFFICIENT PERFORMANCE. PREVENT OVERSPRAY ON THE WALKS, PLAYGROUNDS, ROADWAYS, SIGNS, LIGHTS, AND/OR BUILDINGS. SELECT THE BEST DEGREE OF ARC TO FIT THE EXISTING SITE CONDITIONS AND THROTTLE THE FLOW CONTROL OR PRESSURE REGULATION DEVICE AT EACH VALVE TO OBTAIN THE BEST OPERATING PRESSURE FOR EACH SYSTEM.
16. SET POP–UP HEADS PERPENDICULAR TO FINISH GRADE OF THE AREA TO BE IRRIGATED UNLESS OTHERWISE NOTED ON THE DRAWINGS.
17. IRRIGATION HEAD LAYOUT AND PIPING AS SHOWN ON THE DRAWINGS IS INDICATIVE OF THE WORK TO BE INSTALLED. IRRIGATION HEADS, ARC OF SPRAY, RADIUS OF SPRAY AND PIPING AT CERTAIN LOCATIONS MAY REQUIRE FIELD ADJUSTMENT TO PREVENT HARM TO TREE ROOTS AND INTERFERENCE OF TREES TO IRRIGATION SPRAY.
18. EXERCISE PARTICULAR ATTENTION AT ALL EXISTING AND NEW TREES TO ELIMINATE DIRECT SPRAY OF IRRIGATION HEADS ON TREE TRUNKS.
19. THE SPRINKLER SYSTEM DESIGN IS BASED ON THE MINIMUM OPERATING PRESSURE SHOWN ON THE IRRIGATION DRAWINGS. VERIFY WATER PRESSURE PRIOR TO CONSTRUCTION. REPORT ANY DIFFERENCE BETWEEN THE WATER PRESSURE INDICATED ON THE DRAWINGS AND THE ACTUAL PRESSURE READING AT THE IRRIGATION POINT OF CONNECTION TO LUHSD.
20. IRRIGATION DEMAND: 45 GPM MAX. AT 80 PSI RECYCLED WATER PRESSURE.
21. PIPE SIZING SHOWN ON THE DRAWINGS IS TYPICAL. AS CHANGES IN LAYOUT OCCUR DURING STAKING AND CONSTRUCTION ADJUST THE SIZE ACCORDINGLY.
22. PIPE THREAD SEALANT COMPOUND SHALL BE PERMATEX 51 OR RECTORSEAL T+2.
23. BEFORE COMMENCING WITH WORK UNDER THIS CONTRACT, NOTIFY UNDERGROUND SERVICE ALERT AT 811 OR 1–800–227–2600. DETERMINE THE EXACT LOCATION OF EXISTING UTILITIES, PIPES, AND STRUCTURES BEFORE COMMENCING WORK. COSTS OF DAMAGES WHICH OCCUR FROM FAILURE TO ACCURATELY LOCATE AND PRESERVE THESE UTILITIES SHALL BE THE RESPONSIBILITY OF THE IRRIGATION CONTRACTOR.
24. CAUTION: USE SHOVELS AND HAND DIG TRENCHES AROUND (E) TREE ROOT SYSTEMS. INSTALL PIPING AWAY FROM (E) TREE ROOT SYSTEMS. PROTECT (E) TREE ROOT SYSTEMS AT ALL TIMES. TYPICAL FOR ALL (E) TREE ROOT SYSTEMS. INSTALL ALL BURIED IRRIGATION SUCH AS PVC PIPING, VALVES, HEADS, BOXES, CONDUIT WITH WIRES, IN A MANNER TO AVOID EXCAVATING OR TRENCHING WITHIN THE EXISTING TREE DRIPLINES AND ROOTZONES.
25. NOTE: NO PLASTIC PIPE OR SOLVENT WELDED JOINTS ARE PERMITTED ABOVE GRADE.
26. CONTROLLER, MASTER VALVE, AND FLOW SENSOR NOTE: CONTRACTOR SHALL BE RESPONSIBLE FOR ORDERING, COORDINATION WITH DISTRIBUTOR AND "SITEONE GREENTECH", THE INSTALLATION OF MASTER VALVE, FLOW SENSOR, AND ALL ASSOCIATED PARTS AND HARDWARE TO PROVIDE A COMPLETE AND FULLY OPERABLE SYSTEM.
27. CONTRACTOR SHALL COORDINATE WORK AFFECTING EXISTING, TEMPORARY AND PROPOSED IMPROVEMENTS TO PROVIDE CONTINUOUS IRRIGATION SYSTEM OPERATION.

ABBREVIATIONS:

AV	AIR VALVE
CI	CAST IRON
CU	COPPER
DEG	DEGREES
DI	DUCTILE IRON
DIA	DIAMETER
ECV	EMITTER CONTROL VALVE
EFF	EFFICIENCY
ETWU	ESTIMATED TOTAL WATER USE
ETO(ET)	EVAPOTRANSPIRATION
(E)	EXISTING
FT	FEET
FIPT	FEMALE IRON PIPE THREAD
FPS	FEET PER SECOND
(F)	FUTURE
FS	FLOW SENSOR
FV	FLUSH VALVE
GA	GAUGE
GI	GALVANIZED IRON
GV	GATE VALVE
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
ID	INTERNAL DIAMETER
IN	INCHES
IRR	IRRIGATION
MAWA	MAXIMUM APPLIED WATER ALLOWANCE
MAX	MAXIMUM
MCV	MASTER CONTROL VALVE
MV	MASTER VALVE
MIN	MINIMUM
MIPT	MALE IRON PIPE THREAD
MPR	MATCHED PRECIPITATION RATE
MWELO	MODEL WATER EFFICIENT LANDSCAPE ORDINANCE
(N)	NEW
NIC	NOT IN CONTRACT
NPW	NON POTABLE WATER
NTS	NOT TO SCALE
OD	OUTSIDE DIAMETER
PE	POLYETHYLENE
POC	POINT OF CONNECTION
PRECIP	PRECIPITATION
PRV	PRESSURE REDUCING VALVE
PVBA	PRESSURE VACUUM BREAKER ASSEMBLY
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYLCHLORIDE
PW	POTABLE WATER
QTY	QUANTITY
QCV	QUICK COUPLING VALVE
RCV	REMOTE CONTROL VALVE
RPBA	REDUCED PRESSURE BACKFLOW ASSEMBLY
RS	RIGID STEEL
RW	RECYCLED WATER
SCH	SCHEDULE
SF	SQUARE FOOT OR FEET
SQ	SQUARE
SS	STAINLESS STEEL
STD	STANDARD
TBD	TO BE DETERMINED
TBE	THREADED BOTH ENDS
TOE	THREADED ONE END
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
UPC	UNIFORM PLUMBING CODE
UV	ULTRAVIOLET
UVR	ULTRAVIOLET RESISTANT
VAC	VOLTS–ALTERNATING CURRENT
VB	VALVE BOX
WM	WATER METER

IRRIGATION LEGEND

SYMBOL	NUMBER	DESCRIPTION	PSI	GPM OR GPH	RADIUS (MIN./MAX.)	PRECIP. RATE
6" POP-UP SPRAYS AT TURF						
○ ⊖ ⊕	PROS–06–NSI–PRS30–CV–R/ 15F,H,Q	HUNTER 6" POP–UP BODY WITH CHECK VALVE, RECYCLED CAP, & HUNTER NOZZLE	30	3.7,1.9,1.0	12–15	1.8 IN/H
⊖	PROS–06–NSI–PRS30–CV–R/ 15A	HUNTER 6" POP–UP BODY WITH CHECK VALVE, RECYCLED CAP, & HUNTER NOZZLE	30	0.5–3.7	12–15	1.8 IN/H
● ◒ ◕	PROS–06–NSI–PRS30–CV–R/ 12F,H,Q	HUNTER 6" POP–UP BODY WITH CHECK VALVE, RECYCLED CAP, & HUNTER NOZZLE	30	2.7,1.3,0.7	10–12	2.0 IN/H
◕	PROS–06–NSI–PRS30–CV–R/ 12A	HUNTER 6" POP–UP BODY WITH CHECK VALVE, RECYCLED CAP, & HUNTER NOZZLE	30	0.3–2.5	10–12	2.0 IN/H
◆ ◆	PROS–06–NSI–PRS30–CV–R/ 10F,H	HUNTER 6" POP–UP BODY WITH CHECK VALVE, RECYCLED CAP, & HUNTER NOZZLE	30	1.6,0.9	8–10	2.0 IN/H
◆	PROS–06–NSI–PRS30–CV–R/ 10A	HUNTER 6" POP–UP BODY WITH CHECK VALVE, RECYCLED CAP, & HUNTER NOZZLE	30	0.25–2.0	8–10	2.0 IN/H
■	PROS–06–NSI–PRS30–CV–R/ 8F	HUNTER 6" POP–UP BODY WITH CHECK VALVE, RECYCLED CAP, & HUNTER NOZZLE	30	1.0	6–8	1.7 IN/H
TREE ROOT WATERING SYSTEM WITH SOCK AND PURPLE GRATE						
▪	[RWS–B–C–1401]+[RWS–SOCK]+ [RWS–GRATE–P]	RAIN BIRD (INSTALL 1 BUBBLER PER TREE IN SHRUB AREAS)	30	0.25	FLOOD	0.25 GPM
▪▪	[RWS–B–C–1401]+[RWS–SOCK]+ [RWS–GRATE–P]	RAIN BIRD (INSTALL 2 BUBBLERS PER INDIVIDUAL STAND–ALONE TREE)	30	0.25	FLOOD	0.5 GPM
BUBBLERS						
▪	1401	RAIN BIRD BUBBLER	30	0.25	FLOOD	0.25 GPM
VALVES						
	[2160RK.IB]+[FS–B200]	GRISWOLD 2" MASTER CONTROL VALVE, NORMALLY OPEN, WITH INTEGRAL UNION, BALL VALVE, PURPLE CROSS HANDLE, AND RAINMASTER 2" BRASS FLOW SENSOR. NO MINIMUM FLOW AND RATED AT 10–50 GPM.				
	TBD	FILTER ASSEMBLY				
	2000RH.IB–R (1") 2000RK.IB–R (1.5")	GRISWOLD REMOTE CONTROL VALVE WITH INTEGRAL UNION, BALL VALVE, AND PURPLE CROSS HANDLE (BUBBLERS AND SPRAY HEADS)				
	[DWS–100R.IS–R]+[PRL–30]	GRISWOLD DRIP ZONE SOLENOID CONTROL REMOTE CONTROL VALVE, NORMALLY CLOSED, BRASS CONSTRUCTION, FIPT, WITH INTEGRAL UNION BALL VALVE, STRAINER, PURPLE CROSS HANDLE, AND SENNINGER LOW FLOW PRESSURE REGULATOR. SIZE: 1". (EMITTER ZONES)				
	44NP–ACME (1")	RAIN BIRD QUICK COUPLING VALVE WITH ACME THREADS AND NON–POTABLE LOCKING COVER				
	LGT1515SS304X (1.5")	LEEMCO SS GATE VALVE WITH THREADED CONNECTIONS AND CROSS HANDLE. SIZE: 1.5".				
	LMV–11BB (2"); LMV–22BB (2.5")	LEEMCO RESILIENT WEDGE GATE VALVE WITH SLIP–ON CONNECTIONS AND 2" SQ. WRENCH NUT. IPS SERIES (BELL X BELL). SIZE TO BE EQUAL TO MAIN LINE PIPE SIZE.				
	[LMV–66MM W/SON]+ [LMJD–600(2)](6")	LEEMCO RESILIENT WEDGE GATE VALVE WITH MECHANICAL JOINT CONNECTIONS FOR C900 PVC PIPE AND 2" SQ. WRENCH NUT. DPS SERIES (MJ X MJ). SIZE: 6". PROVIDE A LEEMCO JOINT RETRAINT ON EACH SIDE OF VALVE.				
CONTROLLER						
Ⓒ	SA6–RM4–18/PMR/ RSE–DX/RDM/TDI/ 1GTD–050/ FSAV–100B–150	SATELLITE CONTROLLER ASSEMBLY CONSISTING OF A RAINMASTER DX2 "EVOLUTION" SATELLITE CONTROLLER MASTER SATELLITE WITH 18 STATIONS AND THE FOLLOWING OPTIONS: • RAINMASTER REMOTE ASSEMBLY (PMR) • RAIN SENSOR (ENCLOSURE MOUNT) • RADIO & DOME ANTENNA • FLOW BOARD & FLOW SENSOR • RM 1" BRASS FLOW SENSOR • SUPERIOR N/O MASTER VALVE • 1.5" MASTER VALVE • UNIVERSAL TWO–WIRE DECODER INTERFACE • SINGLE STATION DECODER • LIGHTNING ARRESTOR (EVERY 600 FEET) • WIRE SPLICE CONNECTORS COMPLETE ASSEMBLY SHALL BE BUILT, INSPECTED, AND CERTIFIED BY SITE–ONE GREENTECH (XX STATIONS USED, XX STATIONS EXTRA).				
⊠	(E)	(E) BACKFLOW ASSEMBLY TO REMAIN IN SERVICE, AS–IS				
		CONTROLLER STATION NUMBER APPROXIMATE FLOW (GPM) REMOTE CONTROL VALVE SIZE				
SLEEVES AND PIPE						
		6 INCH MAIN LINE: 1120–CLASS 200 (DR21) C900 PVC PURPLE PLASTIC PIPE FOR RECYCLED WATER USE WITH GASKETED CONNECTIONS. USE LEEMCO DUCTILE IRON C900 GASKETED FITTINGS AND JOINT RESTRAINTS AT ALL CHANGES IN DIRECTION. USE AN EPOXY COATED DUCTILE IRON SADDLE FOR VALVE CONNECTIONS AND CONTINUATION OF 2.5–INCH OR SMALLER MAIN LINE. SOIL COVER: 24–INCH IN SOIL, 24–INCH UNDER PEDESTRIAN PAVEMENT, 24–INCH UNDER VEHICULAR PAVEMENT. SIZE AS NOTED. 2.5–INCH & SMALLER MAIN LINE: 1120–SCHEDULE 40 PVC PURPLE PLASTIC PIPE FOR RECYCLED WATER USE WITH SOLVENT WELDED CONNECTIONS, SCHEDULE 40 PVC PLASTIC SOLVENT WELDED FITTINGS. SOIL COVER: 18–INCH IN SOIL, 18–INCH UNDER PEDESTRIAN PAVEMENT, 24–INCH UNDER VEHICULAR PAVEMENT. SIZE AS NOTED.				
		LATERAL LINE: 1120–SCHEDULE 40 PVC PLASTIC PIPE WITH SCHEDULE 40 PVC PLASTIC SOLVENT WELDED FITTINGS. 12–INCH SOIL COVER. SIZE 1–INCH UNLESS OTHERWISE NOTED.				
		SLEEVE: 1120–CLASS 200 OR 1120–SCHEDULE 40 PVC PLASTIC PIPE, WHICHEVER HAS THE LARGEST WALL THICKNESS, WITH SCHEDULE 40 PVC PLASTIC SOLVENT WELDED FITTINGS. SOIL COVER TO BE EQUAL TO COVER REQUIRED FOR PIPE CONTAINED WITHIN SLEEVE 18–INCH MINIMUM COVER. 2–INCH DIA. UNLESS OTHERWISE NOTED.				
		ELECTRICAL CONDUIT FOR LOW VOLTAGE CONTROL WIRES: 1120–SCHEDULE 40 PVC GRAY PLASTIC ELECTRICAL CONDUIT WITH SCHEDULE 40 PVC GRAY PLASTIC SOLVENT WELDED SWEEP ELBOWS AND FITTINGS. COVER: 24–INCHES; SIZE: 2–INCH DIA.				
		ELECTRICAL PULL BOX FOR CONDUIT: RECTANGULAR PLASTIC BOX WITH PLASTIC BOLT–DOWN LID. USE A CONCRETE PULL BOX WITH A TRAFFIC RATED LID FOR ALL PULL BOXES LOCATED IN VEHICULAR PAVEMENT (WHERE NECESSARY).				
RECYCLED WATER SIGNAGE						
Ⓢ		CITY OF BRENTWOOD RECYCLED WATER ADVISORY SIGN AVAILABLE FROM THE CITY. VERIFY FIELD CONSTRUCTION DETAILS AND FIELD LOCATIONS WITH THE CITY'S RECYCLED WATER REPRESENTATIVE.				

NOTE: MINIMUM SPRINKLER RADIUS IS BASED UPON 80% OF THE MANUFACTURER'S SPECIFIED MAXIMUM RADIUS.

TREE BUBBLER QUANTITY CHART

TREE SIZE	TREE LOCATION	DEEP ROOT BUBBLER QTY.	TOTAL GPM	PRECIP RATE (GPM)	NOTES
24" BOX	WITHIN SHRUB AREA	1	0.25	0.25	
24" BOX	WITHIN LANDSCAPE MULCH	2	0.5	0.5	INSTALL DEEP ROOT BUBBLERS 180 DEG APART & AT ROOTBALL.

PRELIMINARY
NOT FOR CONSTRUCTION

FOR REFERENCE ONLY

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Exp. 10-31-18
STATE OF CALIFORNIA

IRRIGATION DESIGNER:
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LIBERTY HIGH SCHOOL

NEW MAINTENANCE, OPERATIONS & TRANSPORTATION FACILITIES

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LIBERTY UNION HIGH SCHOOL DISTRICT

REVISIONS

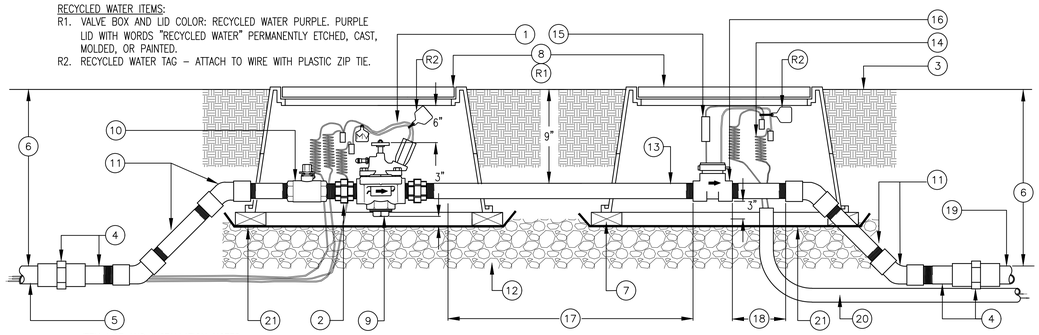
ARCH PROJECT NO: 1707.00
DRAWN BY: ST/JDE
DRAWING SCALE: AS SHOWN

100% DD
MAY 10, 2018

SHEET TITLE
IRRIGATION LEGEND & NOTES

SHEET NUMBER
L2.1

RECYCLED WATER ITEMS:
R1. VALVE BOX AND LID COLOR: RECYCLED WATER PURPLE. PURPLE LID WITH WORDS "RECYCLED WATER" PERMANENTLY ETCHED, CAST, MOLDED, OR PAINTED.
R2. RECYCLED WATER TAG – ATTACH TO WIRE WITH PLASTIC ZIP TIE.



ITEM LIST AND INSTALLATION NOTES:

1. VALVE CONTROL WIRE – PROVIDE 3M DBY SEAL PACKS AT SPLICES, 36" OF EXCESS UF WIRE IN A 1" DIAMETER COIL AND VALVE TAG
2. UNION, BRASS, THREADED
3. FINISH GRADE
4. FEMALE ADAPTER, 2" X 2.5", SCH 80 PVC, S X S, AND 2" TOE NIPPLE, SCH 80 PVC
5. PVC MAIN LINE FROM PRESSURE REDUCING VALVE
6. REFER TO IRRIGATION LEGEND OR SPECIFICATIONS FOR SOIL COVER
7. COMMON BRICK, 8 TOTAL, INSTALL AT EACH CORNER OF EACH VALVE BOX
8. VALVE BOX, PLASTIC, RECTANGULAR WITH BOLT-DOWN LID. INSTALL BOX AS SHOWN IN BOX INSTALLATION DETAIL. USE JUMBO BOX FOR MASTER VALVE AND STANDARD BOX FOR THE FLOW SENSOR.
9. MASTER CONTROL VALVE WITH FLOW CONTROL AND MANUAL BLEED (SIZE AS SPECIFIED IN IRRIGATION LEGEND OR SPECIFICATIONS)
10. BALL VALVE, BRASS, FULL PORT, THREADED, APOLLO 78-130 SERIES, SIZE EQUALS MCV SIZE
11. ELBOWS (45 DEGREE), NIPPLES (TBE), BRASS, THREADED, AS REQUIRED
12. DRAIN ROCK – 6" DEEP BELOW VALVE (NO SOIL IN VALVE BOX)
13. NIPPLE, BRASS, TBE (BETWEEN MASTER VALVE & FLOW SENSOR)
14. CONTROL WIRE: PROVIDE 3M DBY SEAL PACKS AT SPLICES, 36" OF EXCESS WIRE IN A 1" DIAMETER COIL (#14 AWG-UF WIRE) AND CONTROLLER I.D. TAG
15. 0.067 AMP FUSE LINK TO PROTECT METERING INSERT
16. FLOW SENSOR, SIZE AS SPECIFIED IN LEGEND – INSTALL FLOW SENSOR TO ALLOW STRAIGHT-FLOW OF A MINIMUM OF TEN TIMES THE DIAMETER OF THE MAIN LINE PIPE ON THE INLET SIDE AND FIVE TIMES THE DIAMETER OF THE MAIN LINE PIPE ON THE OUTLET SIDE OF THE SENSOR. WIRE TO CONTROLLER AS DIRECTED BY MANUFACTURER'S REPRESENTATIVE.
17. PROVIDE TEN (10) X THE PIPE DIAMETER; EX: 10 X 2.5" PIPE = 25" MINIMUM
18. PROVIDE FIVE (5) X THE PIPE DIAMETER; EX: 5 X 2.5" = 12.5" MINIMUM
19. PVC MAIN LINE TO IRRIGATION SYSTEM
20. INSTALL FLOW SENSOR CABLE IN 1" DIA. PVC CONDUIT FROM FLOW SENSOR TO CONTROLLER ENCLOSURE. USE RAINMASTER EV-CAB-SEN CABLE. PROVIDE AND INSTALL PULL BOXES EVERY 200 FEET. DO NOT SPLICE SENSOR CABLE.
21. METAL WIRE MESH TO PREVENT GOPHER INTRUSION, 1/2" MESH, 19 GA, GALVANIZED

1 MASTER CONTROL VALVE & FLOW SENSOR
NOT TO SCALE

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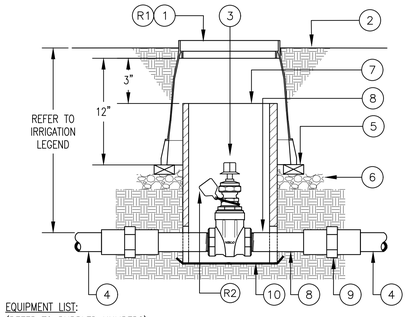
RECYCLED WATER ITEMS:
R1. VALVE BOX AND LID COLOR: RECYCLED WATER PURPLE
R2. RECYCLED WATER TAG – ATTACH TO VALVE WITH PLASTIC ZIP TIE.



EQUIPMENT LIST:
(REFER TO BUBBLED NUMBERS)

1. 10" ROUND PLASTIC VALVE BOX WITH PLASTIC BOLT-DOWN LID.
2. FINISH GRADE
3. GATE VALVE WITH SQ. NUT
4. PVC MAIN LINE, SIZE AND TYPE PER SPECIFICATIONS
5. COMMON BRICK, 2 TOTAL, 180 DEGREES APART.
6. CRUSHED GRAVEL BASE, 6" DEEP, ALL AROUND
7. 8" DIAMETER PVC VERTICAL SLEEVE FOR ACCESS – NOTCH SLEEVE TO FIT OVER PIPE
8. NIPPLE, PVC SCH 80, TOE, 2 TOTAL, SIZED EQUAL TO GATE VALVE
9. FEMALE ADAPTER, PVC SCH 80, S X S, 2 TOTAL, SIZED EQUAL TO GATE VALVE
10. METAL WIRE MESH TO PREVENT GOPHER INTRUSION, 1/2" MESH, 19 GA, GALVANIZED

INSTALLATION NOTES:

21. INSTALL VALVE BOX FLUSH WITH FINISH GRADE IN TURF AND 1" ABOVE FINISH GRADE IN SHRUB AREAS.
22. KEEP BRICKS AWAY FROM PIPE.

6 GATE VALVE, THREADED (1.5")
NOT TO SCALE

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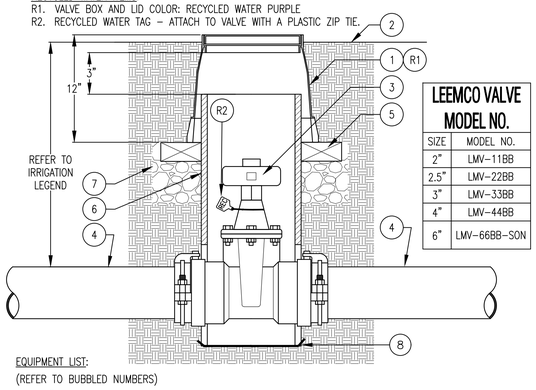
RECYCLED WATER ITEMS:
R1. VALVE BOX AND LID COLOR: RECYCLED WATER PURPLE
R2. RECYCLED WATER TAG – ATTACH TO VALVE WITH A PLASTIC ZIP TIE.



LEEMCO VALVE MODEL NO.

SIZE	MODEL NO.
2"	LMV-11BB
2.5"	LMV-22BB
3"	LMV-33BB
4"	LMV-44BB
6"	LMV-66BB-SON

EQUIPMENT LIST:
(REFER TO BUBBLED NUMBERS)

1. 10" ROUND PLASTIC VALVE BOX WITH PLASTIC BOLT-DOWN LID.
2. FINISH GRADE
3. LEEMCO GATE VALVE, BELL CONNECTIONS WITH INTEGRAL RESTRAINTS. UNLESS OTHERWISE NOTED, PLACE VALVE IN THE OPEN POSITION. BOLT TORQUE: 3" = 20 FT-LBS; 4", 6" & 8" = 50 FT-LBS.
4. MAIN LINE PIPE (ACCORDING TO LEGEND AND SPECIFICATIONS)
5. BRICK BASE (2 TOTAL, 180 DEGREES APART)
6. 10" SCH. 40 OR CLASS 200 PVC RISER-NOTCH RISER TO FIT OVER PIPE
7. CRUSHED GRAVEL, 6" DEEP, ALL AROUND
8. METAL WIRE MESH TO PREVENT GOPHER INTRUSION, 1/2" MESH, 19 GA, GALVANIZED

INSTALLATION NOTES:

21. INSTALL VALVE BOX FLUSH WITH FINISH GRADE IN TURF AND 1" ABOVE FINISH GRADE IN SHRUB AREAS.
22. KEEP BRICKS AWAY FROM PIPE.

7 GATE VALVE, LEEMCO WITH BELL CONNECTIONS & RESTRAINTS (2", 2.5", 3", & 4")
NOT TO SCALE

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REVISIONS

ARCH PROJECT NO: 1707.00
DRAWN BY: ST/JDE
DRAWING SCALE: AS SHOWN

100% DD
MAY 10, 2018

SHEET TITLE
IRRIGATION DETAILS

SHEET NUMBER
L2.2

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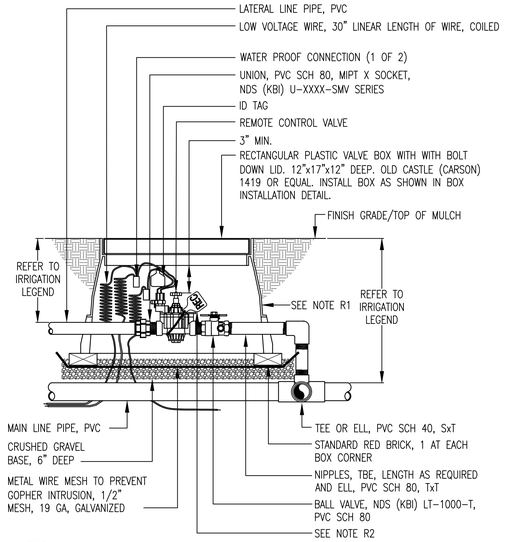
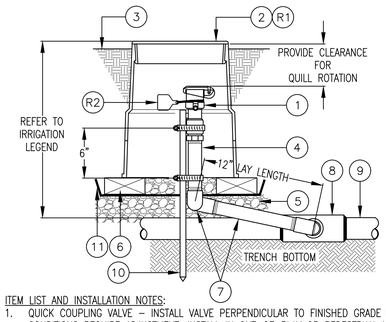
RECYCLED WATER ITEMS:
R1. VALVE BOX AND LID COLOR: RECYCLED WATER PURPLE
R2. RECYCLED WATER TAG – ATTACH TO VALVE WITH A PLASTIC ZIP TIE.



1 REMOTE CONTROL VALVE (SPRAY AND BUBBLER ZONES)
NOT TO SCALE

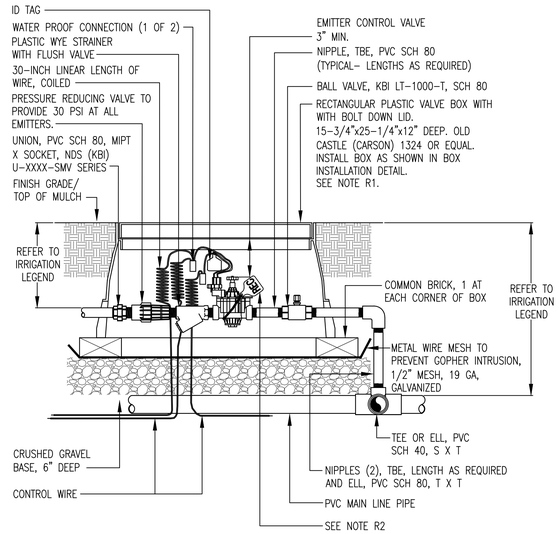
RECYCLED WATER ITEMS:
R1. VALVE BOX AND LID COLOR: RECYCLED WATER PURPLE
R2. RECYCLED WATER TAG – ATTACH TO VALVE WITH A PLASTIC ZIP TIE.



ITEM LIST AND INSTALLATION NOTES:
1. QUICK COUPLING VALVE – INSTALL VALVE PERPENDICULAR TO FINISHED GRADE UNLESS FIELD CONDITIONS REQUIRE ADJUSTMENT. INSTALL IN OUT-OF-PLAY OR PEDESTRIAN ACCESS AREAS. UNLESS OTHERWISE NOTED, FITTINGS ARE THE SAME IPT SIZE AS THE VALVE IPT INLET THREAD SIZE.
2. PLASTIC VALVE BOX AND LID, 10" ROUND, BOLT-DOWN LID – INSTALL VALVE BOX FLUSH WITH FINISH GRADE IN TURF AND 1" ABOVE FINISH GRADE IN SHRUB AREAS
3. FINISH GRADE OR TOP OF MULCH
4. PVC SCH 80 NIPPLE (LENGTH AS REQUIRED)
5. CRUSHED GRAVEL BASE, 6" DEEP
6. COMMON BRICK, 2 TOTAL, 180 DEGREES APART
7. SWING JOINT ASSEMBLY:
   A. FINGER TIGHTEN O-RING JOINTS AND BACK-OFF ONE FULL TURN TO ALLOW FOR SWING ACTION.
   B. PROVIDE 12" BETWEEN CENTER LINES OF ELBOWS ON SWING ARM.
   C. INSTALL THE SWING JOINT LAY ARM AT AN ANGLE BETWEEN 30° AND 45° OF THE LATERAL IN ORDER TO ABSORB DOWNWARD IMPACT.
   D. SWING JOINT MANUFACTURER: RAIN BIRD SWJ SERIES, 1" DURA STANDARD UNI-BODY MODEL 1-A2-2-1-12, OR APPROVED EQUAL.
8. TEE, ELBOW OR SADDLE CONNECTION (PER MAIN LINE FITTING SPECIFICATIONS)
9. MAIN LINE PIPE, (MATERIAL AND TYPE PER LEGEND AND SPECIFICATIONS)
10. #4 X 24" REBAR STAKE W/STAINLESS STEEL GEAR CLAMPS OR EQUIVALENT SUPPORT SYSTEM
11. METAL WIRE MESH TO PREVENT GOPHER INTRUSION, 1/2" MESH, 19 GA, GALVANIZED

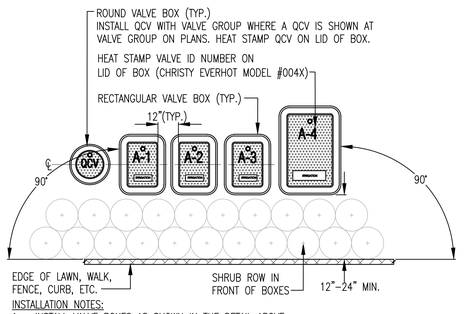
5 QUICK COUPLING VALVE IN LANDSCAPED AREAS
NOT TO SCALE

RECYCLED WATER ITEMS:
R1. VALVE BOX AND LID COLOR: RECYCLED WATER PURPLE
R2. RECYCLED WATER TAG – ATTACH TO VALVE WITH A PLASTIC ZIP TIE.



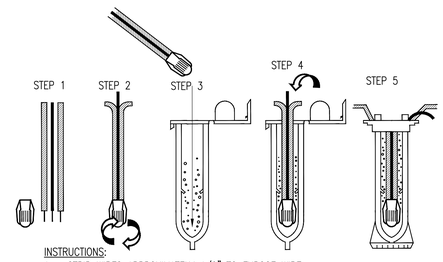
2 EMITTER CONTROL VALVE
NOT TO SCALE

RECYCLED WATER ITEMS:
1. VALVE BOX AND LID COLOR: RECYCLED WATER PURPLE



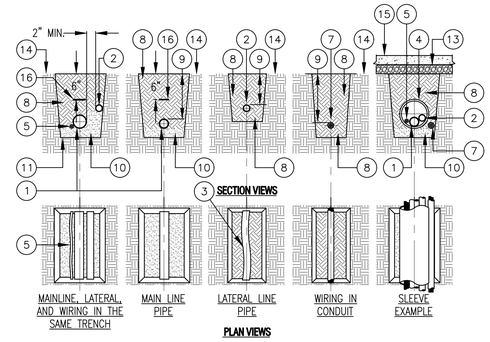
INSTALLATION NOTES:
1. INSTALL VALVE BOXES AS SHOWN IN THE DETAIL ABOVE.
2. INSTALL VALVE BOX ASSEMBLIES IN SHRUB OR GROUND COVER ZONES. VALVE ASSEMBLIES INSTALLED IN A TURF ZONE IS PERMITTED ONLY IF A SHRUB OR GROUND COVER AREA DOES NOT EXIST IN THE PROXIMITY OF THE IRRIGATION ZONE.
3. PLACE THE CENTER OF THE VALVE BOX OVER THE CENTER OF THE REMOTE CONTROL VALVE. INSTALL VALVE BOX IN A WAY TO ENABLE EASY SERVICING OR REMOVAL OF VALVE.
4. INSTALL TOP OF BOX 1" ABOVE FINISHED GRADE IN SHRUB OR GROUND COVER AREAS OR EQUAL TO THE DEPTH OF THE MULCH AND FLUSH WITH GRADE IN TURF ZONES. INSTALL THE TOP OF BOX AT THE SAME ANGLE AS THE FINISHED GRADE.
5. PREVENT THE COLLAPSE AND DEFORMATION OF VALVE BOX SIDES. DO NOT HEAVILY COMPACT SOIL AGAINST THE SIDES OF THE VALVE BOX.
6. INSTALL EXTENSION RISERS TO VALVE BOX AS REQUIRED TO COMPLETELY ENCLOSE VALVE ASSEMBLY. PROVIDE EXTENSION RISER MANUFACTURED BY THE SAME MANUFACTURER OF THE VALVE BOX.
7. PREVENT SOIL INTRUSION INTO THE BOX. USE 20 MIL POLYETHYLENE TAPE AROUND PIPE CUTOUTS AS NEEDED.
8. SAWCUTTING OR MODIFYING THE VALVE BOXES BEYOND WHAT THE MANUFACTURER ALLOWS IS NOT PERMITTED.
11. WHEN ASSEMBLY IS COMPLETE INSTALL THE GRAVEL BELOW THE VALVE. FINISHED GRAVEL SHALL BE CLEAN WITHOUT DEBRIS IN THE VALVE BOX.
12. WHEN WORK IS COMPLETE AND ACCEPTED BY THE DISTRICT OR TO PREVENT VANDALISM, BOLT DOWN THE LIDS.

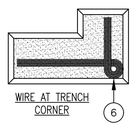
3 BOX INSTALLATION
NOT TO SCALE



INSTRUCTIONS:
1. STRIP WIRES APPROXIMATELY 1/2" TO EXPOSE WIRE.
2. TWIST CONNECTOR AROUND WIRES CLOCKWISE UNTIL HAND TIGHT, DO NOT OVERTIGHTEN.
3. INSERT WIRE ASSEMBLY INTO PLASTIC TUBE UNTIL WIRE CONNECTOR SNAPS PAST LIP IN BOTTOM OF TUBE.
4. PLACE WIRES WHICH EXIT TUBE IN WIRE EXIT HOLES AND CLOSE CAP UNTIL IT SNAPS.
5. INSPECT FINAL SPLICE ASSEMBLY TO BE SECURE AND FINISHED.

4 WIRE SPLICE
NOT TO SCALE

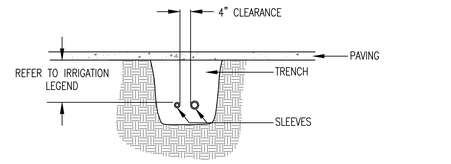


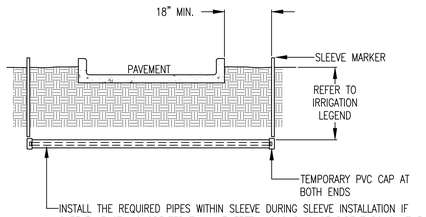


PLAN VIEWS

ITEM LIST AND INSTALLATION NOTES:
1. MAIN LINE PIPE; PROVIDE A MINIMUM OF 2" BETWEEN ALL PIPES.
2. LATERAL LINE PIPE; PROVIDE A MINIMUM OF 2" BETWEEN ALL PIPES.
3. SNAKE SOLVENT WELD PLASTIC PIPING IN TRENCH AS SHOWN.
4. SLEEVE BELOW ALL HARDSCAPE ELEMENTS WITH SLEEVING TWICE THE DIAMETER OF THE PIPE OR WIRE BUNDLE WITHIN.
5. WIRE BUNDLE: INSTALL WIRING BENEATH AND BESIDE MAIN LINE. TAPE AND BUNDLE AT 10-FOOT INTERVALS.
6. TIE A 24-INCH LOOP IN WIRING AT CHANGES OF DIRECTION OF 30° OR GREATER. UNTIE AFTER ALL CONNECTIONS HAVE BEEN MADE.
7. LOW VOLTAGE WIRE CONDUIT (WHERE SPECIFIED).
8. CLEAN BACKFILL PER THE SPECIFICATIONS, TYPICAL.
9. FOR PIPE, SLEEVE AND WIRE BURIAL DEPTHS, REFER TO IRRIGATION LEGEND AND SPECIFICATIONS.
10. PROVIDE A SAND BED FOR PIPE (WHERE SPECIFIED).
11. TRENCH BOTTOM OF UNDISTURBED SOIL, TYPICAL.
12. WHERE BORING UNDER EXISTING PAVEMENT IS REQUIRED – REFER TO DRAWINGS FOR SPECIFIC INFORMATION.
13. PAVEMENT AND SUBGRADE
14. FINISH GRADE
15. PAVED OR CONCRETE SURFACE
16. DETECTABLE WARNING TAPE PER SPECIFICATIONS

6 TRENCH
NOT TO SCALE





NOTES:
1. IRRIGATION SLEEVES TO BE PVC CLASS 200 OR SCH 40 PIPE. USE THE PIPE WITH THE THICKEST WALL DIMENSION.
2. JOINTS TO BE SOLVENT WELDED AND WATERTIGHT.
3. IF PIPING IS TO BE INSTALLED AFTER SLEEVING IS BACKFILLED, MARK SLEEVE LOCATION WITH A T. CHRISTY ENTERPRISES FIBERGLASS COMPOSITE MARKING POST, LABELED "IRRIGATION", EXPOSED AT GRADE, MODEL #ID-SF66-IRR.
4. MECHANICALLY TAMP BACKFILL TO 95% COMPACTION.
5. INSTALL SLEEVES LEVEL AND AFTER PIPE INSTALLATION, SEAL ENDS OF PIPE WITH GROUT TO PREVENT ROOT INTRUSION INTO THE SLEEVE.

7 SLEEVE INSTALLATION
NOT TO SCALE

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ARCH PROJECT NO:	1707.00
DRAWN BY:	ST/JDE
DRAWING SCALE:	AS SHOWN

100% DD
MAY 10, 2018

SHEET TITLE
IRRIGATION DETAILS

SHEET NUMBER
L2.3

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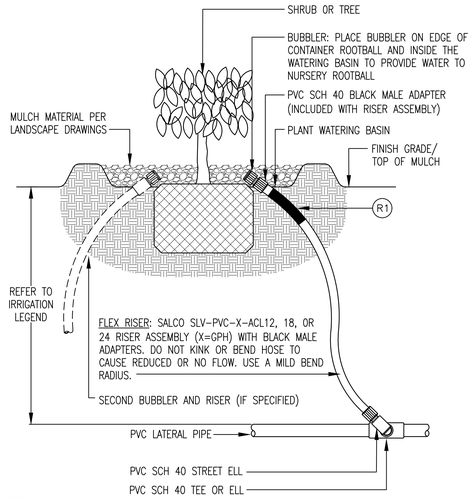
PLANNING -DESIGN -MANAGEMENT
JDE PROJECT NO: 18008

RECYCLED WATER ITEMS:
R1. RECYCLED WATER TAG – ATTACH TO FLEX RISER, USE T. CHRISTY ENTERPRISES RISER MARKER, MODEL #5100 WITH ADHESIVE BACKING.



1 SHRUB BUBBLER, MICRO-BUBBLER, OR TREE BUBBLER RISER
NOT TO SCALE

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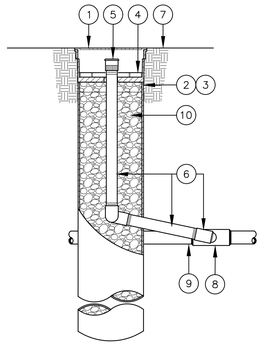
INSTALLATION NOTES:
1. INSTALL QUANTITY OF BUBBLERS PER "TREE BUBBLER QUANTITY CHART" AND LEGEND, SEE SHEET L2.1.
2. INSTALL DEEP WATERING TUBE ADJACENT AND AGAINST THE ROOTBALL.



1. ROOT WATERING SYSTEM: RAIN BIRD RWS-BG (INCLUDES CANISTER, BUBBLER WITH SWING JOINT RISER AND GRATE)
2. 4" BASKET WEAVE CANISTER* –PLACE AGAINST TREE ROOTBALL
3. RAIN BIRD RWS SOCK*
4. 4" GRATE*
5. BUBBLER*
6. RAIN BIRD SWING JOINT RISER ASSEMBLY*
7. FINISH GRADE
8. PVC SCH 40 TEE OR ELL
9. LATERAL PIPE
10. PLACE DRAIN ROCK INSIDE THE CANISTER FROM UNDER THE BUBBLER PLATE TO THE BOTTOM OF THE CANISTER

* RAIN BIRD ROOT WATERING SYSTEM INCLUDES CANISTER, BUBBLER, SWING JOINT RISER, SOCK AND PURPLE GRATE

2 TREE DEEP ROOT WATERING SYSTEM
NOT TO SCALE

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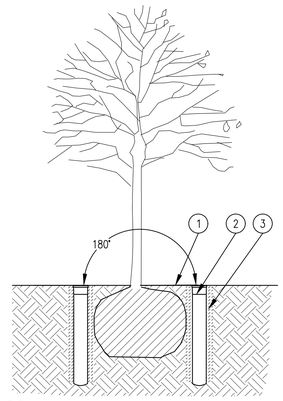

1. FINISH GRADE
2. ROOT WATERING SYSTEM: RAIN BIRD RWS-BCG (INCLUDES BUBBLER, CHECK VALVE AND GRATE)
3. RAIN BIRD RWS SOCK

NOTES:
1. WHERE TWO UNITS ARE SPECIFIED, POSITION UNITS SPACED AT 180 DEGREES AROUND ROOT BALL.
2. INSTALL PRODUCT WITH TOP GRATE EVEN WITH GROUND SURFACE.

3 TREE WATERING SYSTEM
NOT TO SCALE

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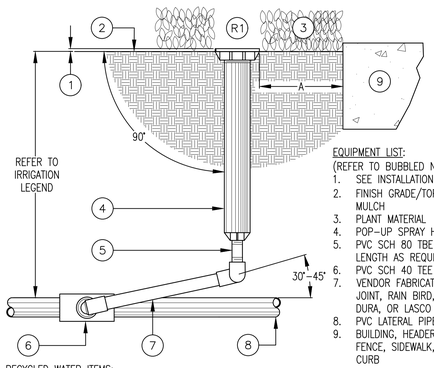

EQUIPMENT LIST:
(REFER TO BUBBLED NUMBERS)
1. SEE INSTALLATION NOTE 1
2. FINISH GRADE/TOP OF MULCH
3. PLANT MATERIAL
4. POP-UP SPRAY HEAD
5. PVC SCH 80 TBE NIPPLE, LENGTH AS REQUIRED
6. PVC SCH 40 TEE OR ELL
7. VENDOR FABRICATED SWING JOINT, RAIN BIRD, TORO, DURA, OR LASCO
8. PVC LATERAL PIPE
9. BUILDING, HEADERBOARD, FENCE, SIDEWALK, OR CURB

RECYCLED WATER ITEMS:
R1. TOP OF HEADS MUST CLEARLY INDICATE THE USE OF RECYCLED WATER.

INSTALLATION NOTES:
1. INSTALL TOP OF HEAD 1" ABOVE FINISH GRADE IN SHRUB AREAS AND FLUSH WITH GRADE IN TURF AREAS. SIDE INLET USE IS NOT PERMITTED.
2. DIMENSION "A": INSTALL HEAD 4" FROM HEADERBOARD OR FENCE AND 24" FROM BUILDINGS AND NON-PERMEABLE PAVED SURFACES.
3. INSTALL HEAD PERPENDICULAR TO FINISHED GRADE.
4. PRIOR TO NOZZLE INSTALLATION, FLUSH HEAD WITH WATER USING MANUFACTURER'S FLUSH NOZZLE TO ELIMINATE DEBRIS FROM WITHIN HEAD AND RISER.
5. INSTALL NOZZLE SCREEN. INSTALL NOZZLE, HAND TIGHT. RATCHET POP-UP RISER AND ADJUST VARIABLE ARC NOZZLES SO NOZZLE SPRAY IS WITHIN PLANTED AREA. NO OVERSPRAY ON WINDOWS, BUILDINGS, STREETS OR PAVEMENT.

4 POP-UP SPRAY
NOT TO SCALE

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DRAWN BY: ST/JDE
DRAWING SCALE: AS SHOWN

100% DD
MAY 10, 2018

SHEET TITLE
IRRIGATION DETAILS

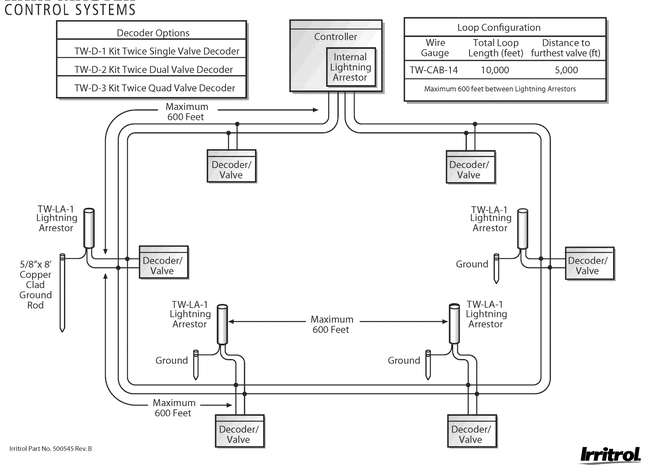
SHEET NUMBER
L2.4

RAIN MASTER® CONTROL SYSTEMS

RAIN MASTER™ TWICE 2-WIRE • LOOP CONFIGURATION

Decoder Options
TW-D-1 Kit Twice Single Valve Decoder
TW-D-2 Kit Twice Dual Valve Decoder
TW-D-3 Kit Twice Quad Valve Decoder

Loop Configuration		
Wire Gauge	Total Loop Length (feet)	Distance to furthest valve (ft)
TW-CAB-14	10,000	5,000
Maximum 600 feet between Lightning Arrestors		

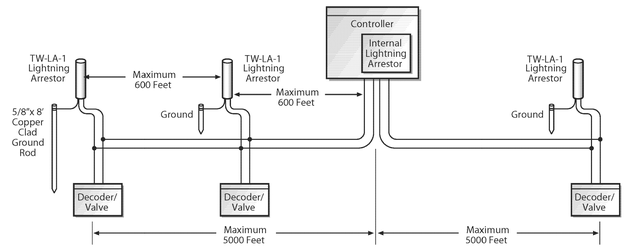


Irritrol Part No. 500545 Rev. B

Irritrol

RAIN MASTER® CONTROL SYSTEMS

RAIN MASTER™ TWICE™ • STRAIGHT LINE CONFIGURATION



Straight Line Configuration	
Wire Gauge	Total Wire Length (feet)
TW-CAB-14	5,000
Maximum 600 feet between Lightning Arrestors	

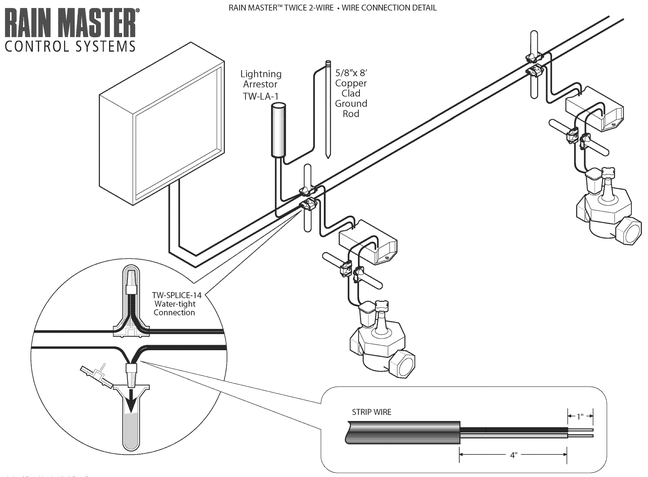
Decoder Options
TW-D-1 Kit Twice Single Valve Decoder
TW-D-2 Kit Twice Dual Valve Decoder
TW-D-3 Kit Twice Quad Valve Decoder

Irritrol Part No. 500544 Rev. B

Irritrol

RAIN MASTER® CONTROL SYSTEMS

RAIN MASTER™ TWICE 2-WIRE • WIRE CONNECTION DETAIL

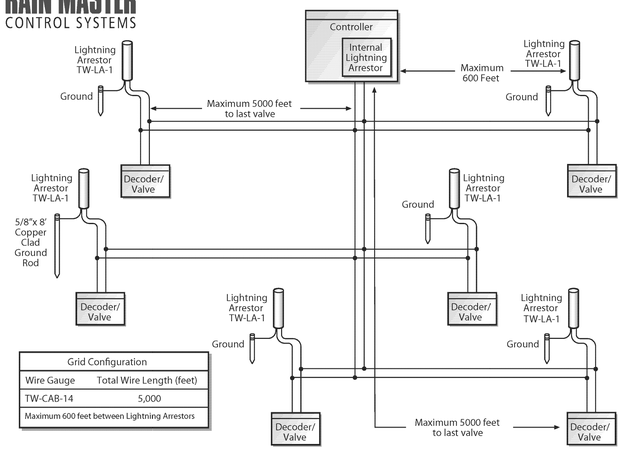


Irritrol Part No. 500547 Rev. B

Irritrol

RAIN MASTER® CONTROL SYSTEMS

RAIN MASTER™ TWICE• GRID CONFIGURATION



Grid Configuration	
Wire Gauge	Total Wire Length (feet)
TW-CAB-14	5,000
Maximum 600 feet between Lightning Arrestors	

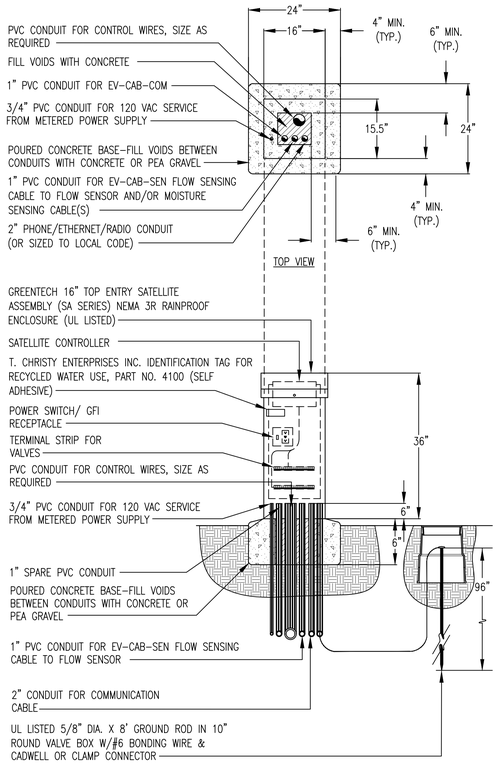
Irritrol Part No. 500546 Rev. B

Irritrol

"SA" ASSEMBLY TO INCLUDE:
SATELLITE MODEL AS SPECIFIED
ENCLOSURE MODEL AS SPECIFIED
OPTIONS AS SPECIFIED
TERMINAL STRIPS
TEMPLATE & BOLTS
UL LISTED 8' COPPER GROUND ROD GROUND ROD CLAMP
GROUND ROD CLAMP OR CADWELD

GROUNDING NOTE:
GROUND ROD SHALL BE LOCATED NO CLOSER THAN 8 FT. AND NO FURTHER THAN 12 FT. FROM THE CONTROLLER UNLESS OTHERWISE SPECIFIED.
INSTALL A 10 IN. ROUND VALVE BOX OVER THE GROUND ROD FOR LOCATION AND MAINTENANCE PURPOSES.

CABLE AND WIRE NOTE:
INSTALL ALL CABLES AND ELECTRICAL WIRES IN CONDUIT.



NOTES:
1. ELECTRIC SERVICE TO CONTROLLER LOCATION IS PROVIDED UNDER THE ELECTRICAL CONTRACT WORK.
2. INSTALL ALL HIGH VOLTAGE CABLES AND ELECTRICAL WIRES IN UL APPROVED CONDUIT.
3. FOR ETHERNET COMMUNICATION FROM SATELLITE TO CENTRAL COMPUTER: CONFER WITH GREENTECH AS TO THE REQUIREMENT FOR THIS COMMUNICATION OPTION.
4. ALTERNATE FOR POURED CONCRETE BASE: VIT PRODUCTS "QUICK PAD", CHOOSE PAD FOR EXACT FIT TO CONTROLLER PEDESTAL.

1 **16" TOP ENTRY CONTROLLER ASSEMBLY**
NOT TO SCALE

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FOR REFERENCE ONLY

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GSM landscape architects, inc.
1700 Soscol Ave. Suite 23
Napa, CA 94559
707-255-4630
www.gsmlainc.com

REGISTERED LANDSCAPE ARCHITECT GRETCHEN STRANZL MANN No. 2790 Exp. 10-31-18 STATE OF CALIFORNIA

IRRIGATION DESIGNER:
JAMES D. EDDY ASSOCIATES, DANVILLE, CALIFORNIA
NOTE: NO LICENSE FOR THE LANDSCAPE IRRIGATION SYSTEM DESIGN PROFESSION IS AVAILABLE IN THE STATE OF CALIFORNIA.
MEMBER: AMERICAN SOCIETY OF IRRIGATION CONSULTANTS

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NEW MAINTENANCE, OPERATIONS & TRANSPORTATION FACILITIES

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94513

LIBERTY UNION HIGH SCHOOL DISTRICT

REVISIONS

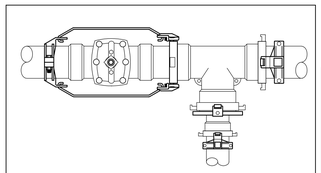
ARCH PROJECT NO: 1707.00
DRAWN BY: ST/JDE
DRAWING SCALE: AS SHOWN

100% DD
MAY 10, 2018

SHEET TITLE
IRRIGATION DETAILS

SHEET NUMBER
L2.5

PRELIMINARY
NOT FOR CONSTRUCTION



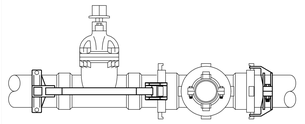


FIG. 1. TOP AND SIDE VIEW OF THE RESTRAINED GATE VALVE. THE SB-LK7 LINKS BOLT ONTO THE LUGS OF THE FITTING. THE RESTRAINT BARS SPAN ACROSS THE VALVE AND ATTACH TO THE JOINT RESTRAINT SECURED TO THE PIPE.

THE ARRANGEMENT ON THE LEFT IS THE METHOD OF RESTRAINING A GATE VALVE. THE SB-LK7 LINK SHOWN BELOW BOLTS ONTO THE LUG OF THE FITTING.

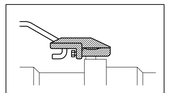


FIG. 2. SB-LK7 LINK BOLTS ONTO THE LUG OF DUCTILE IRON FITTING.

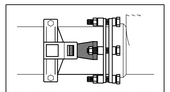


FIG. 3. THE LS-MJ LINK SHOWN HERE IS BE USED TO RESTRAIN ANY FLANGED PRODUCT SUCH AS A FLANGED GLOBE VALVE.

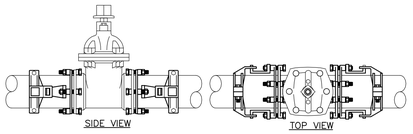


FIG. 4. THE LS-MJ LINKS ATTACH TO THE FLANGE OF AN MJ GATE VALVE OR A FLANGED DEVICE.

1 GATE VALVES, MJ & FLANGED CONNECTIONS
NOT TO SCALE

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NOTES:
1. ALTHOUGH A GATE VALVE ACTS AS A DEAD-END WHEN SHUT-OFF, THE CONNECTING PIPES ON BOTH SIDES OFFER RESISTANCE, ACT AS THRUST BLOCKS AND ELIMINATE THE NEED FOR RESTRAINING ADJACENT JOINTS.
2. THE ADJACENT JOINT TO A GATE VALVE WILL REQUIRE RESTRAINTS, WHEN IT IS WITHIN THE "L" DISTANCE OF A BEND, A REDUCER OR A DEAD END.
3. GATE VALVES LOCATED NEXT TO A TEE: USE LEEMCO LGK SERIES JOINT RESTRAINTS.

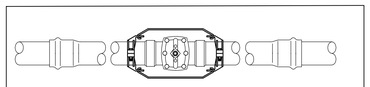

FIG. 1. A GATE VALVE ON A LONG MAIN LINES WITH NO BENDS OR REDUCERS IN CLOSE PROXIMITY DOES NOT REQUIRE THE ADJACENT JOINTS TO BE RESTRAINED.

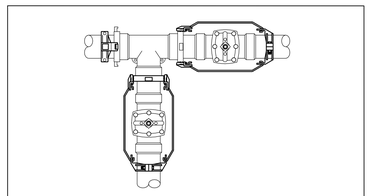

FIG. 2. GATE VALVE INSTALLATION

2 PUSH-ON GATE VALVES
NOT TO SCALE

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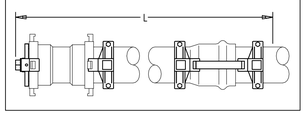
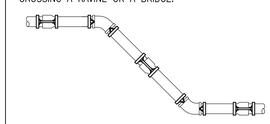
NOTES:
1. A DEAD-END WILL REQUIRE SEVERAL UPSTREAM JOINTS TO BE RESTRAINED. REFER TO DISTANCE CHART FOR NUMBER OF UPSTREAM JOINTS TO BE RESTRAINED.
2. WHEN CROSSING A RAVINE, ROADWAY, OR A STREAM BED, USE JOINT RESTRAINTS ON ALL JOINTS TO PREVENT BUCKLING.

CAPPING, PLUGGING OR TERMINATING A LINE WITH A GATE VALVE CAUSES A DEAD-END.



DEADEND RESTRAINT

RESTRAIN JOINTS IN VERTICAL OFFSETS SUCH AS CROSSING A RAVINE OR A BRIDGE.



VIEWED LEFT TO RIGHT: ROAD OR RAVINE CROSSING.
VIEWED RIGHT TO LEFT: BRIDGE CROSSING.

BRIDGE, RAVINE, ROAD WAY CROSSING RESTRAINT

3 LEEMCO-DEADEND OR CROSSINGS
NOT TO SCALE

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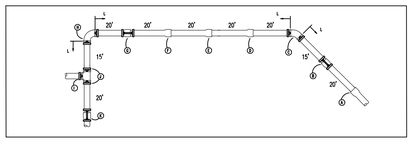
USE DISTANCE TABLES TO DETERMINE NUMBER AND DISTANCE OF JOINT RESTRAINTS



EXAMPLE 1: 8" PIPING SYSTEM
CRITERIA: SANDY-CLAY SOIL, 125 PSI

NOTE: ALL BENDS ARE RESTRAINED; JOINT "B" IS RESTRAINED BECAUSE IT'S DISTANCE OF 15 FEET AWAY FROM JOINT "C" (45 BEND) IS LESS THAN THE "L =15 FEET" (FROM TABLE VALUE). JOINT "D" IS NOT RESTRAINED BECAUSE IT'S DISTANCE OF 20 FEET FROM "C" IS FARTHER THAN TABLE VALUE OF 15 FEET.

JOINTS "J" (15 FEET), "K" (35 FEET), AND "G" (20 FEET) AWAY FROM 90-BEND "H" ARE ALL WITHIN THE 38 FEET ALLOWED DISTANCE "L" TABLE VALUE.

EXAMPLE 2: 12 INCH PIPING SYSTEM: WITH THE "L" TABLE VALUES OF 21 FEET FOR A 45 BEND AND 53 FEET FOR A 90-BEND, RESTRAIN JOINTS AS FOLLOWS:

JOINT A: WON'T REQUIRE A RESTRAINT BECAUSE ITS 35 FEET DISTANCE AWAY IS FURTHER OUT THAN 21-FOOT REQUIREMENT. JOINTS B & D: BOTH WITHIN 21 FEET OF "C" WILL NEED TO BE RESTRAINED.

JOINTS G,J,K ARE ALL WITHIN THE 53 FEET OF THE "H" (90-BEND).

6 WORKING WITH THE DISTANCE TABLES
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LEEMCO JOINT RESTRAINTS DISTANCE TABLES:

SIZE REDUCTION, REDUCERS

TABLES BELOW SHOW "L" DISTANCES IN FEET. WHEN AN ADJACENT JOINT TO A REDUCER OR A REDUCING TEE IS WITHIN THIS DISTANCE, OTHER JOINTS ON THE LARGER DIAMETER END MUST BE RESTRAINED.

TABLE VALUES ARE LISTED FOR 125 PSI LINE PRESSURE.

TABLE VALUES ARE BASED ON TYPE 3 TRENCHING AND COMPACTNESS METHOD, 30" COVER AND A SAFETY FACTOR OF 2. DESIGN COVER IS 36".

BENDS, DEAD ENDS

TABLES BELOW SHOW "L" DISTANCES. WHEN AN ADJACENT JOINT TO A BEND IS WITHIN THIS DISTANCE, THE JOINT MUST BE RESTRAINED. FOR BENDS ADJACENT JOINTS ON BOTH SIDES OF THE BEND REQUIRE RESTRAINTS. USE THE 90-DEGREE BEND VALUES FOR THE SIDE (BRANCH) OUTLET OF TEE'S.

TABLE VALUES ARE LISTED FOR 125 PSI LINE PRESSURES.

TABLE VALUES ARE BASED ON TYPE 3 TRENCHING AND COMPACTNESS METHOD, 30" COVER AND A SAFETY FACTOR OF 2. DESIGN COVER IS 36".

SANDY-CLAY SOIL MIXTURE

TABLE A-125 PSI LINE PRESSURE

PIPE SIZE	DEGREE OF BEND				DEAD END
	11°	22°	45°	90°	
	DISTANCE IN FEET				
3"	2	3	5	11	30
4"	2	4	9	20	45
6"	3	6	13	29	63

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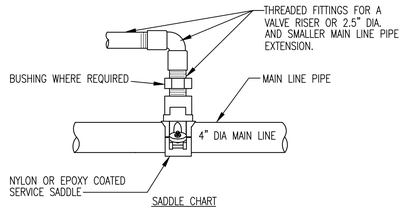
JDE PROJECT NO: 18008



SADDLE CHART

NOMINAL PIPE DIA. (INCHES)	MAIN LINE AVERAGE O.D. (INCHES)	SADDLE MANUFACTURER
4	4.50	LEEMCO LTS SERIES; ROMAC 202N; SMITH-BLAIR 317; TAP SIZE AS REQUIRED TO MATCH TAP SIZE OF VALVE OR PIPE.
RECOMMENDED NUT TORQUE		
NUT SIZE	PVC PIPE	CI, DI, OR OTHER PIPE
1/2"	20 FT-LBS.	40-50 FT-LBS.
5/8"	30-40 FT-LBS.	60-70 FT-LBS.
3/4"		80-90 FT-LBS.

NOTES:
1. TIGHTEN NUT EVENLY UNTIL SADDLE BODY CONFORMS SNUGLY TO PIPE. LOOSEN NUTS AND TORQUE AS INDICATED ABOVE OR BY MANUFACTURER.
2. FOR VALVE CONNECTION, USE TAP SIZE EQUAL TO THE VALVE.
3. FOR QUICK COUPLING VALVE CONNECTION, USE 1" FIPT TAP SIZE.
4. FOR AIR/VACUUM RELIEF VALVE CONNECTION, USE 1" FIPT TAP SIZE.
5. FOR 2.5" OR SMALLER MAIN LINE EXTENSION, USE TAP SIZE EQUAL TO MAIN LINE SIZE.
6. TO PROTECT THREADS FROM DISTORTING, SCREW THE CORPORATION STOP OR OTHER FITTING INTO THE SADDLE BODY PRIOR TO FINAL TIGHTENING.

8 SADDLE CONNECTION - 3" & 4" DIA. MAIN LINE (WHERE REQUIRED)
NOT TO SCALE

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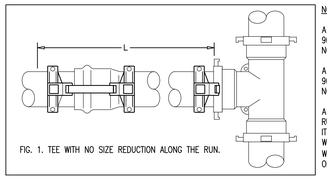

FIG. 1. TEE WITH NO SIZE REDUCTION ALONG THE RUN.

NOTES:

A BRANCH OF A TEE IS TREATED AS A 90-DEGREE BEND. DIRECTION OF FLOW IS NOT RELATIVE TO RESTRAINING A JOINT.

A BRANCH OF A TEE IS TREATED AS A 90-DEGREE BEND. DIRECTION OF FLOW IS NOT RELATIVE TO RESTRAINING A JOINT.

A TEE WITH NO SIZE REDUCTION ALONG THE RUN REQUIRES JOINT RESTRAINTS ONLY ON ITS BRANCH AS IN FIG. 1. JOINT RESTRAINTS WILL BE REQUIRED ALONG THE RUN ONLY WHEN THE TEE IS WITHIN THE "L" DISTANCE OF ANOTHER BEND OR A REDUCER.

USE THE DISTANCE TABLES FOR 90-DEGREE BENDS TO DETERMINE HOW MANY OTHER JOINTS ALONG THE BRANCH REQUIRE RESTRAINTS.

A TEE WITH A SIZE REDUCTION ALONG THE RUN REQUIRES JOINT RESTRAINTS ON THE TEE ITSELF AND ON OTHER JOINTS ALONG THE LARGER DIAMETER RUN AS ILLUSTRATED IN FIG. 2.

USE DISTANCE TABLES FOR REDUCERS TO DETERMINE HOW MANY OTHER JOINTS ALONG THE RUN REQUIRE RESTRAINTS.

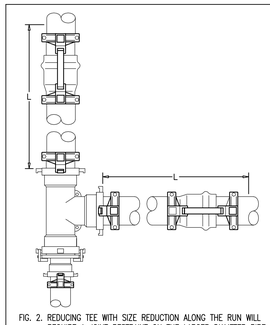

FIG. 2. REDUCING TEE WITH SIZE REDUCTION ALONG THE RUN WILL REQUIRE A JOINT RESTRAINT ON THE LARGER DIAMETER PIPE.

4 TEE RESTRAINTS
NOT TO SCALE

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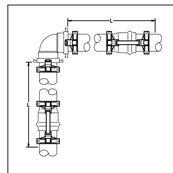

FIG. 1. 90 DEGREE BEND

NOTES:

BESIDES THE FITTING ITSELF, OTHER JOINTS ON BOTH SIDES OF A BEND MAY REQUIRE JOINT RESTRAINTS.

THE LARGER THE PIPE LINE SIZE, THE MORE JOINTS (ON BOTH SIDES) THAT HAVE TO BE RESTRAINED.

EXAMPLE: FOR A 90-BEND (FIG. 1) USING 125 PSI AND SANDY-CLAY SOIL, THE TABLE SHOWS:
- 3 INCH (90): "L"= 11 FEET,
- 6 INCH (90): "L"= 29 FEET,
- 8 INCH (90): "L"= 38 FEET.

WHEN USING 20-FOOT LENGTH PIPE, BECAUSE 20 FEET IS WITHIN THE "L" LENGTHS, ADJACENT JOINTS OF THE 6 INCH AND 8" MUST BE RESTRAINED AS SHOWN IN FIG. 1. THE ADJACENT JOINTS TO THE 3 INCH BEND DO NOT REQUIRE RESTRAINTS BECAUSE THEIR DISTANCE OF 20 FEET IS OUTSIDE THE "L" DIMENSION OF 11 FEET.

AS THE BEND ANGLE GETS SMALLER (FIG. 2 & 3) THE NEED TO RESTRAIN ADJACENT JOINTS DIMINISHES.

USING THE DISTANCE TABLES, ONLY THE 10 FOOT AND 12 FOOT 45-DEGREE BENDS REQUIRE THE ADJACENT JOINTS TO BE RESTRAINED. OTHER SIZES DO NOT REQUIRE THEM (BASED ON THE SAME PARAMETERS AS THE ABOVE EXAMPLE).

DISTANCE TABLES ARE GIVEN IN FEET FROM A BEND OR A REDUCER BECAUSE AT TIMES PIPE MAY BE SPLICED SHORTER THAN 20 FEET.

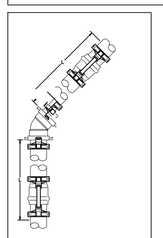

FIG. 2. 45 DEGREE ELBOW - IN SOME CASES THE ADJACENT JOINTS NEED RESTRAINTS.

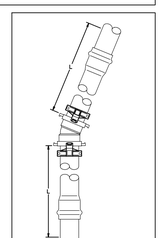

FIG. 3. 22-1/2 DEGREE BEND - NO NEED FOR ADJACENT RESTRAINTS.

5 ELBOW RESTRAINTS
NOT TO SCALE

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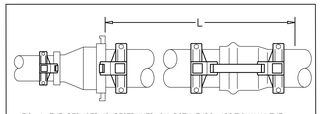

FIG. 1. THE REDUCER IS RESTRAINED ON BOTH ENDS. ADDITIONALLY THE PIPE-TO-PIPE JOINT ON THE LARGER DIAMETER SIDE IS ALSO RESTRAINED (AS SHOWN).

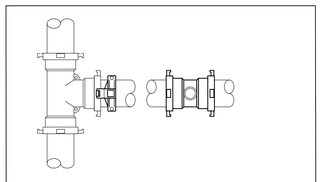

FIG. 2. SERVICE TEES INSTALLED OUTSIDE THE "L"DISTANCE OF A TEE REQUIRES NO JOINT RESTRAINTS.

NOTES:

RESTRAIN IN-LINE REDUCERS AND REDUCING TEE'S (ALONG THE RUN). ADDITIONALLY, THE NEXT JOINTS UPSTREAM (ON THE LARGER DIAMETER SIDE) MAY REQUIRE JOINT RESTRAINTS WHEN THESE JOINTS ARE WITHIN THE "L" DISTANCE OF THE REDUCER. REFER TO AND USE THE DISTANCE TABLE VALUES.

SERVICE TEES INSTALLED ON LONG MAIN LINES, AWAY FROM A BEND OR A REDUCER, DO NOT REQUIRE JOINT RESTRAINTS.

SERVICE TEES REQUIRE JOINT RESTRAINTS ONLY WHEN INSTALLED WITHIN THE "L" DISTANCE OF A BEND OR A REDUCER.

TAPPED (SERVICE) TEE'S DO NOT REQUIRE JOINT RESTRAINTS UNLESS THEY ARE WITHIN THE "L" DISTANCE FROM A RESTRAINED FITTING SUCH AS A BEND OR A REDUCER.

SANDY-CLAY SOIL MIXTURE

SIZE REDUCTION	TABLE A-125 PSI LINE PRESSURE DISTANCE IN FEET
3 x 2	10
3 x 2.5	8
4 x 2	31
4 x 2.5	20
4 x 3	14

7 REDUCERS & TAPPED TEE'S
NOT TO SCALE

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LEEMCO FITTING & JOINT RESTAINT CONSTRUCTION DETAILS (also refer to the Leemco's current guidelines and recommendations)

PRELIMINARY
NOT FOR CONSTRUCTION

FOR REFERENCE ONLY

QUATTROCCHI KWOK ARCHITECTS
636 FIFTH ST.
SANTA ROSA, CA 95404
(707) 576-0829
(707) 576-0295 FAX

GSM landscape architects, inc.
1700 Soscol Ave. Suite 23
Napa, CA 94559
707-255-4630
www.gsmlainc.com

REGISTERED LANDSCAPE ARCHITECT
GRETCHEN STRANZL MANN
No. 2790
Exp. 10-31-18
STATE OF CALIFORNIA

IRRIGATION DESIGNER:
JAMES D. EDDY ASSOCIATES, DANVILLE, CALIFORNIA
NOTE: NO LICENSE FOR THE LANDSCAPE IRRIGATION SYSTEM DESIGN PROFESSION IS AVAILABLE IN THE STATE OF CALIFORNIA.
MEMBER: AMERICAN SOCIETY OF IRRIGATION CONSULTANTS

LIBERTY HIGH SCHOOL

NEW MAINTENANCE, OPERATIONS & TRANSPORTATION FACILITIES

850 2ND STREET
BRENTWOOD, CA
94513

LIBERTY UNION HIGH SCHOOL DISTRICT

REVISIONS

ARCH PROJECT NO: 1707.00
DRAWN BY: ST/JDE
DRAWING SCALE: AS SHOWN

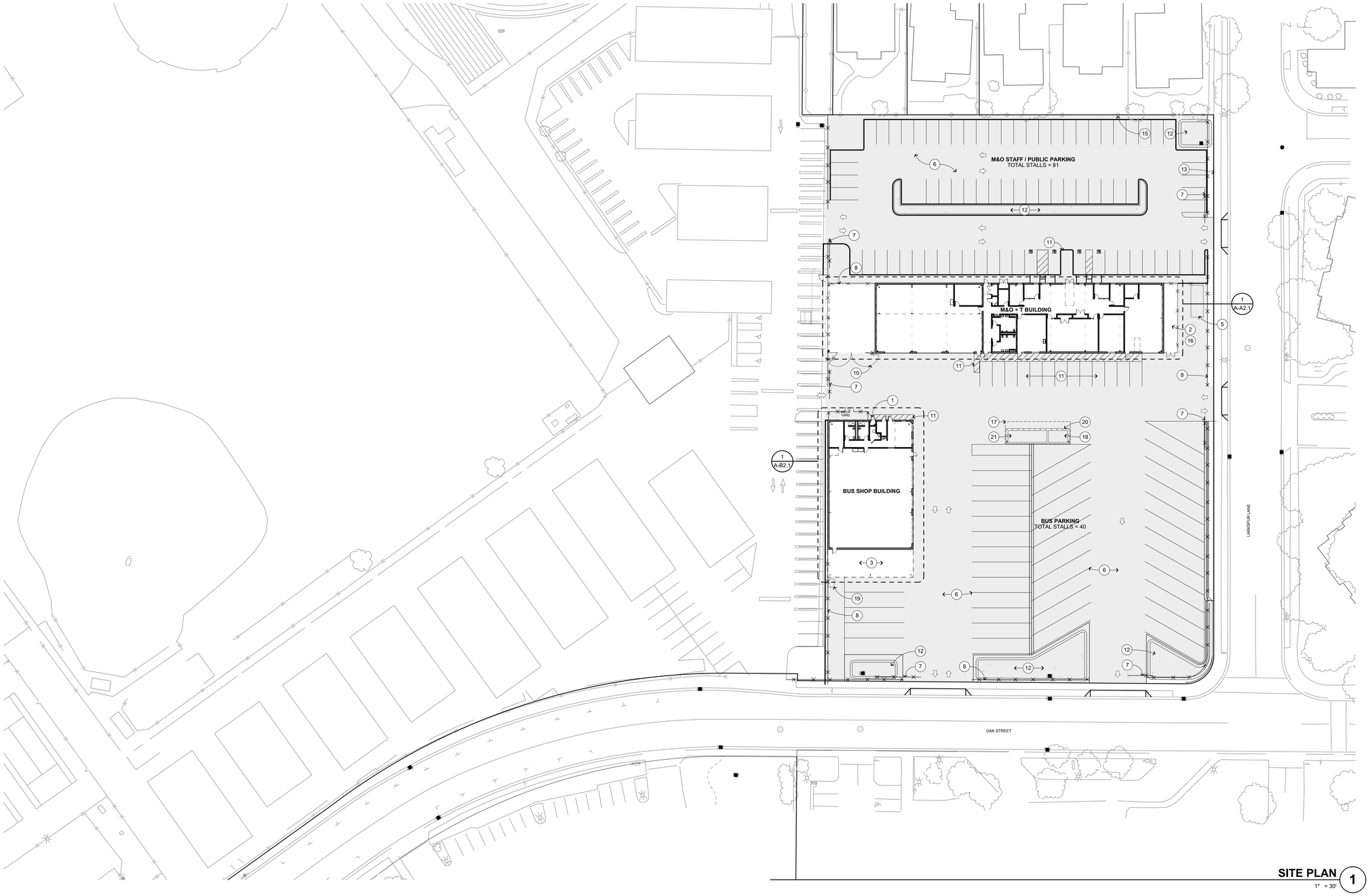
100% DD
MAY 10, 2018

SHEET TITLE

IRRIGATION DETAILS

SHEET NUMBER

L2.6



SITE PLAN 1
1" = 30'

NORTH

FOR REFERENCE ONLY

QUATTROCCHI KWOK ARCHITECTS
Main Office:
636 Fifth Street, Santa Rosa, CA 95404
Pleasanton Office:
600 Main Street, Suite E,
Pleasanton, CA 94566
(707) 576-0829

TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

850 2ND STREET
BRENTWOOD, CA 94513

LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO:	1707.00
DRAWN BY:	
DRAWING SCALE:	AS NOTED
PTN:	61721-0064

100% DD
MAY 25, 2018

SHEET TITLE

SITE PLAN

SHEET NUMBER

A-1.1

KEYPLAN

SITE PLAN LEGEND

SITE PLAN GENERAL NOTES

ADD NOTES FROM Z101004
AT TIME OF DSA SUBMITTAL

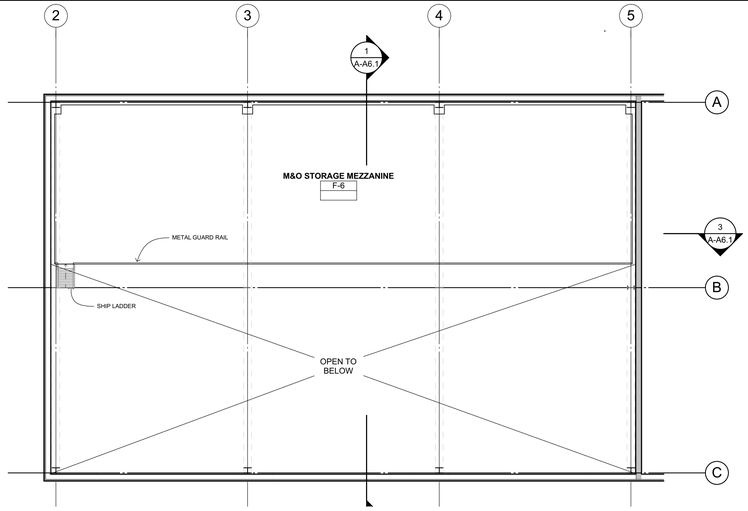
(14) M&O SERVICE TRUCKS AND VEHICLES (8 Trucks, 4 Trailers, 1 Box Van)
(15) (E) FENCE
(16) TRASH BIN YARD
(17) ROOF CANOPY ABOVE
(18) GAS TANK WITH 5,000 GALON CAPCITY
(19) WASTE LIQUID STORORAGE (500 GAL)
(20) 6" CONCRETE PAD W/ BOLLARDS
(21) DIESEL FUEL TANK (10,000 GAL)

SITE PLAN KEYNOTES

NOT ALL KEYNOTES MAY APPLY TO THIS SHEET

(1) FIRE SPRINKLER RISER, S.P.D.
(2) MECHANICAL YARD
(3) BUS WASH BAY, S.P.D.
(4) ELECTRICAL ITEM, S.E.D.
(5) EQUIPMENT ITEM (RECYCLING COMPACTOR)
(6) AC PAVING & PARKING STRIPING TYP.
(7) MOTORIZED CHAINLINK GATE TYP.
(8) 8'-0" HIGH CHAINLINK NON-CLIMBABLE FENCE, TYP.
(10) PAIR OF 10'-0" CHAINLINK GATES, MANUALLY OPERATED
(11) CONCRETE PAVING
(12) BIOSWALE WITH CONCRETE CURB PERIMETER, S.C.D.
(13) (E) CONCRETE SIDEWALK

BIM Server: archiserver - BIM Server 2\1\1707.00 LUHSD TRANS M and O.5/23/2018 8:13:55

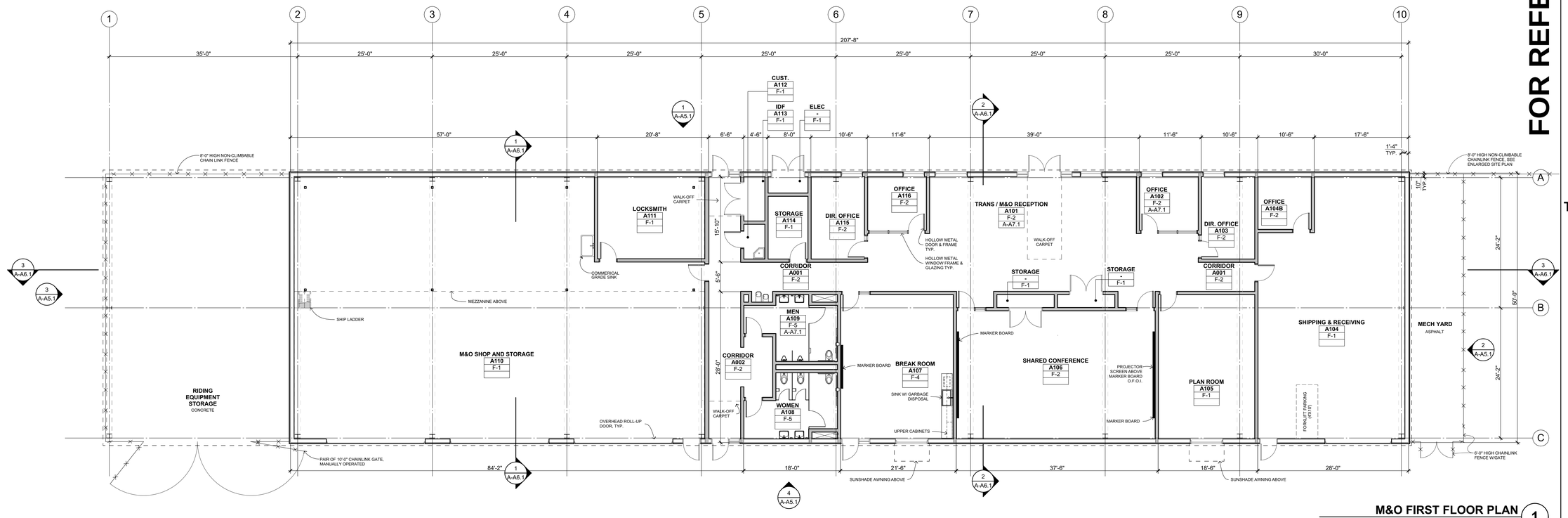


M&O MEZZANINE PLAN 2

1/8" = 1'-0"

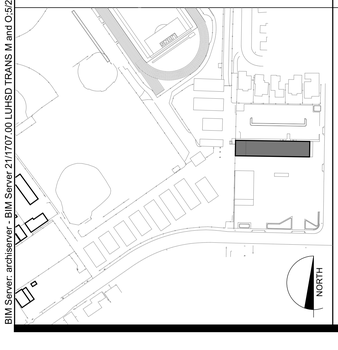
NOTE:
MECHANICAL EQUIPMENT TO BE SUPPORTED BY METAL BUILDING STRUCTURAL FRAMING SYSTEM TYP. SEE MECHANICAL PLANS FOR EQUIPMENT INFORMATION AND WEIGHT.

WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.



M&O FIRST FLOOR PLAN 1

1/8" = 1'-0"

KEYPLAN		WALL TYPE LEGEND	FLOOR FINSH CODES	FLOOR PLAN GENERAL NOTES		FLOOR PLAN KEYNOTES
			F-1 SEALED CONCRETE F-2 CARPET F-3 WALK-OFF CARPET F-4 RESILIENT SHEET FLOORING F-5 EPOXY FLOORING F-6 CDX GRADE PLYWOOD			NOT ALL KEYNOTES MAY APPLY TO THIS SHEET

FOR REFERENCE ONLY

QUATTROCCHI KWOK ARCHITECTS
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(707) 576-0829

TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

850 2ND STREET
BRENTWOOD, CA 94513

LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO: 1707.00
DRAWN BY:
DRAWING SCALE: 1/8" = 1'-0"
PTN: 61721-0064
100% DD
MAY 25, 2018

SHEET TITLE

M&O / TRANS. BLDG "A" FLOOR PLAN

SHEET NUMBER

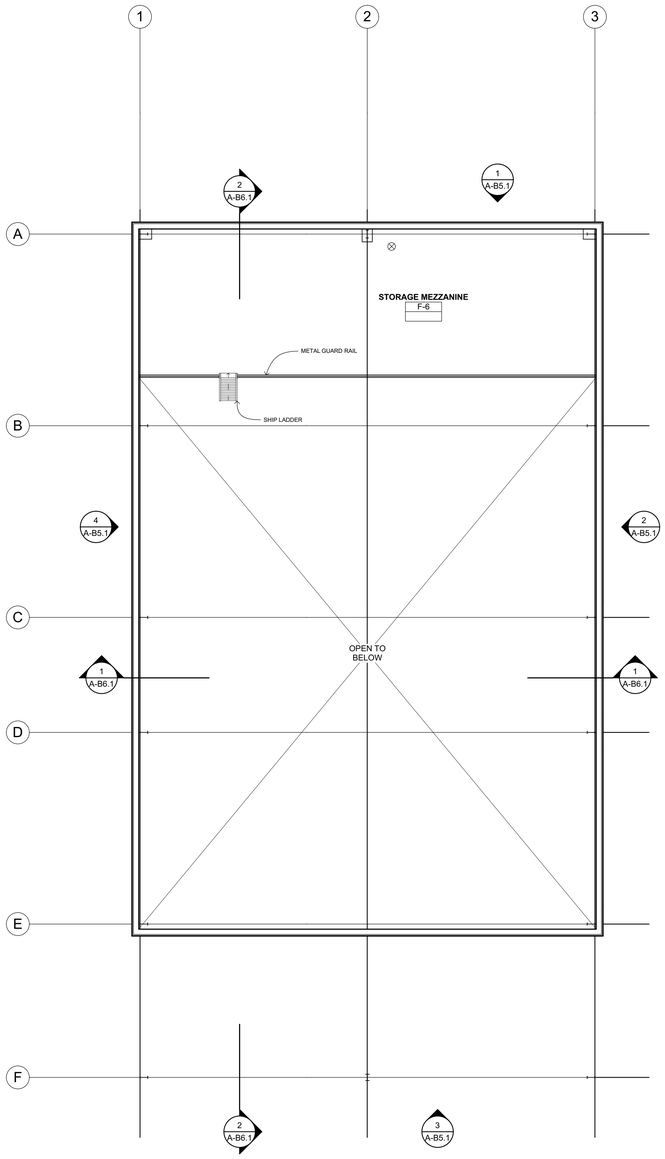
A-A2.1

BIM Server: archiserver - BIM Server 21/1707.00 LUHSD TRANS M and O.5/23/2018,13:55

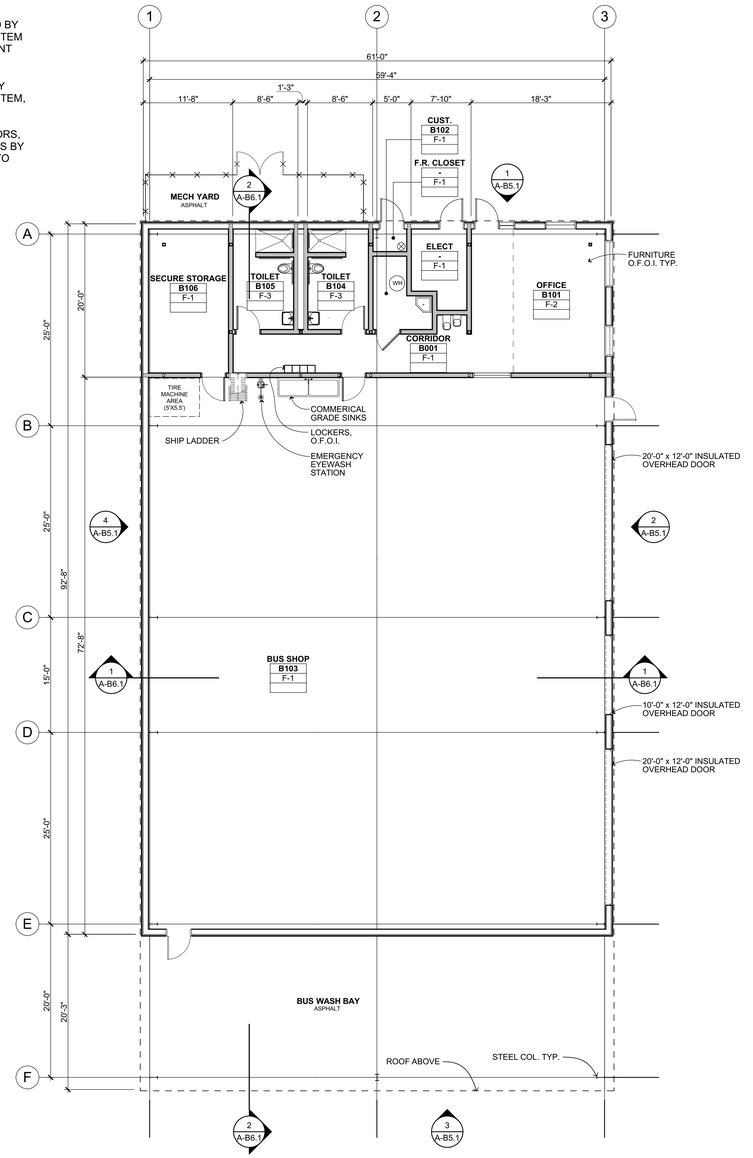
NOTE:
MECHANICAL EQUIPMENT TO BE SUPPORTED BY METAL BUILDING STRUCTURAL FRAMING SYSTEM TYP. SEE MECHANICAL PLANS FOR EQUIPMENT INFORMATION AND WEIGHT.

FIRE SPRINKLER PIPES TO BE SUPPORTED BY METAL BUILDING STRUCTURAL FRAMING SYSTEM, SEE FIRE PROTECTION DRAWINGS.

WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.

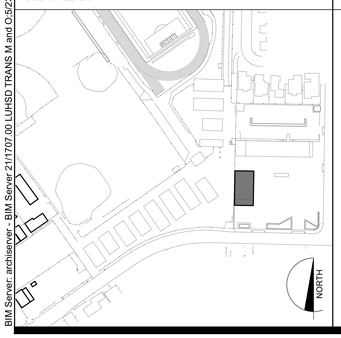


BUS SHOP MEZZANINE FLOOR PLAN 2
1/8" = 1'-0"



BUS SHOP FLOOR PLAN 1
1/8" = 1'-0"

FOR REFERENCE ONLY

KEYPLAN		WALL TYPE LEGEND	FLOOR FINSH CODES	FLOOR PLAN GENERAL NOTES		FLOOR PLAN KEYNOTES
			F-1 SEALED CONCRETE F-2 CARPET F-3 WALK-OFF CARPET F-4 RESILIENT SHEET FLOORING F-5 EPOXY FLOORING F-6 CDX GRADE PLYWOOD			NOT ALL KEYNOTES MAY APPLY TO THIS SHEET

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TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

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BRENTWOOD, CA 94513

LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO: 1707.00
DRAWN BY:
DRAWING SCALE: 1/8" = 1'-0"
PTN: 61721-0064
100% DD
MAY 25, 2018

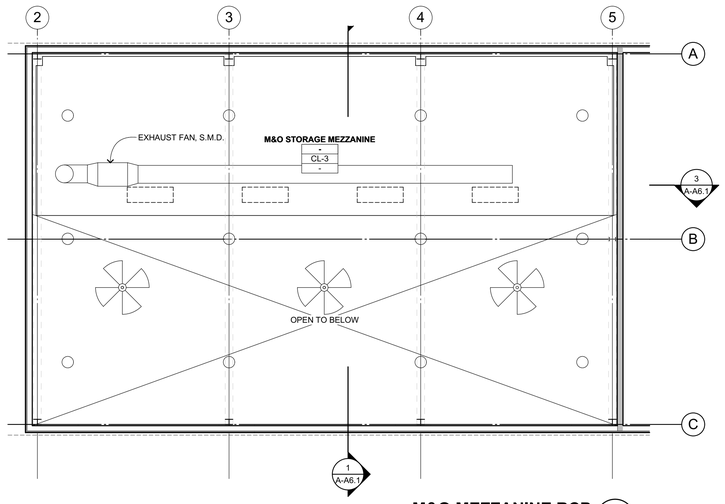
SHEET TITLE

BUS SHOP BLDG "B" FLOOR PLAN

SHEET NUMBER

A-B2.1

BIM Server: archiserver - BIM Server 21\1707.00 LUHSD TRANS M and O.5\23\2018,13:55

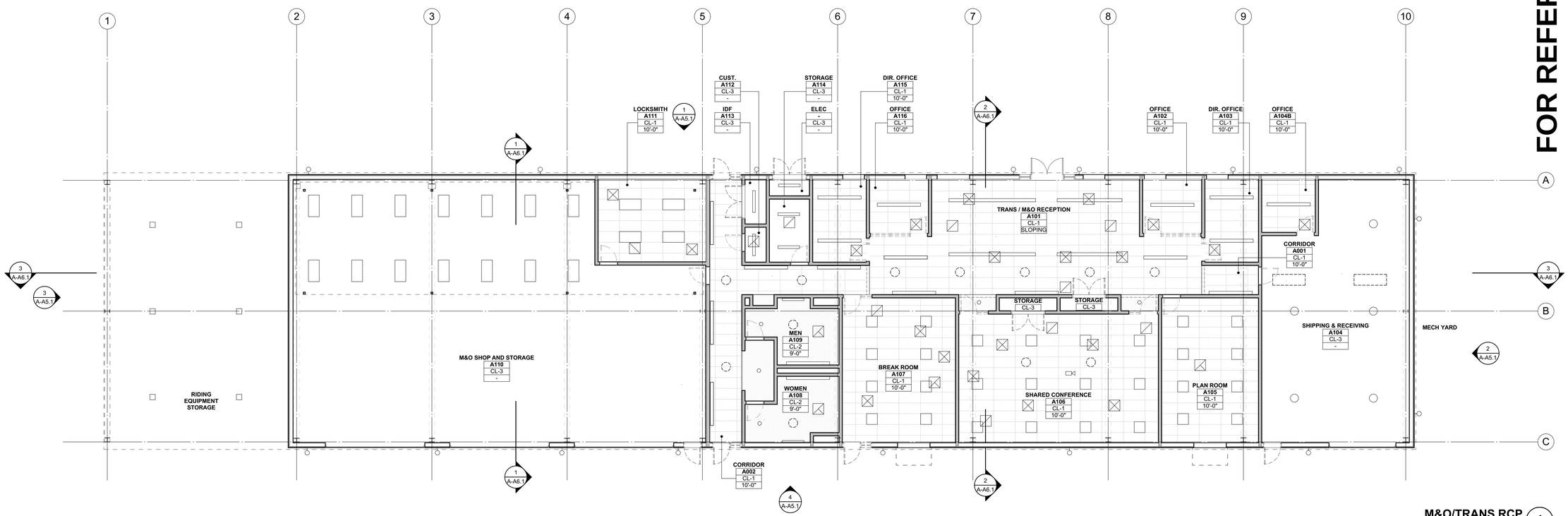


M&O MEZZANINE RCP 2

1/8" = 1'-0"

NOTE:
MECHANICAL EQUIPMENT TO BE SUPPORTED BY METAL BUILDING STRUCTURAL FRAMING SYSTEM TYP. SEE MECHANICAL PLANS FOR EQUIPMENT INFORMATION AND WEIGHT.

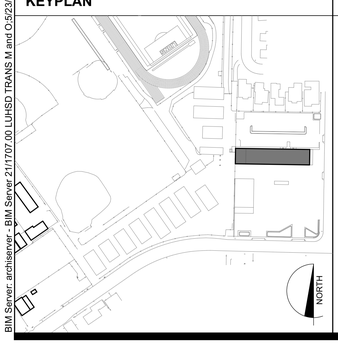
WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.



M&O/TRANS RCP 1

1/8" = 1'-0"

KEYPLAN



REFLECTED CEILING PLAN LEGEND

10'-0"
ROOM NAME
ROOM #
X'-X"

CL-XX REFERS TO CEILING FINISH CODE.
X'-X" REFERS TO FINISHED CEILING HEIGHT AFF.
WHERE CEILING HEIGHT IS INDICATED AS "OPEN" OR " - ", ROOM IS OPEN TO STRUCTURE ABOVE. FOR CEILING CONFIGURATION & HEIGHT WHERE CEILING HEIGHT IS INDICATED AS CURVED, SLOPING, OR VARIES, REFER TO SECTION DRAWINGS.

GYPSUM BOARD, SEE FINISH CODE

2'x4 SUSPENDED CEILING SYSTEM W/ ACOUSTIC TILE, SEE FINISH CODES

DOORS SHOWN DASHED INDICATE DOOR BELOW. FOR DEMO, (E), AND (N) DOOR/FRAME INFORMATION SEE FLOOR PLANS & DOOR SCHEDULE

SKYLIGHT / SOLAR TUBE ABOVE

ELECTRICAL ITEMS, S.E.D.

MECHANICAL ITEMS, S.M.D.

FIRE SPRINKLERS, S.F.P.D.

CEILING FINSH CODES

FOR PAINT FINISHES SEE SEC. 09 9113 (EXTERIOR) & 09 9123 (INTERIOR).

CL-1 2'X4' SUSPENDED CEILING SYSTEM W/ ACOUSTIC TILE - -

CL-2 SUSPENDED GYPSUM BOARD CEILING - -

CL-3 EXPOSED TO STRUCTURE ABOVE - -

REFLECTED CEILING PLAN GENERAL NOTES

NOTE:
WINDOWS, STOREFRONT SYSTEM, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.

REFLECTED CEILING PLAN KEYNOTES

NOT ALL KEYNOTES MAY APPLY TO THIS SHEET

FOR REFERENCE ONLY

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(707) 576-0829

TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

850 2ND STREET
BRENTWOOD, CA 94513

LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO: 1707.00
DRAWN BY:
DRAWING SCALE: 1/8" = 1'-0"
PTN: 61721-0064
100% DD
MAY 25, 2018

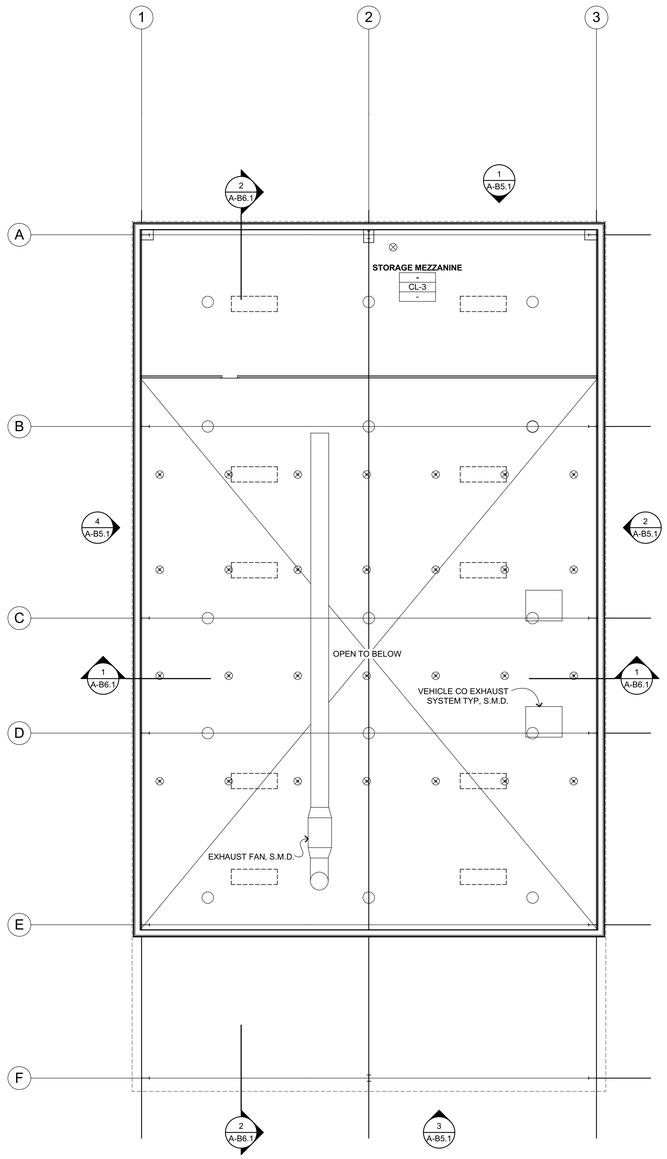
SHEET TITLE

M&O / TRANS. BLDG "A" REFLECTED CEILING PLANS

SHEET NUMBER

A-A3.1

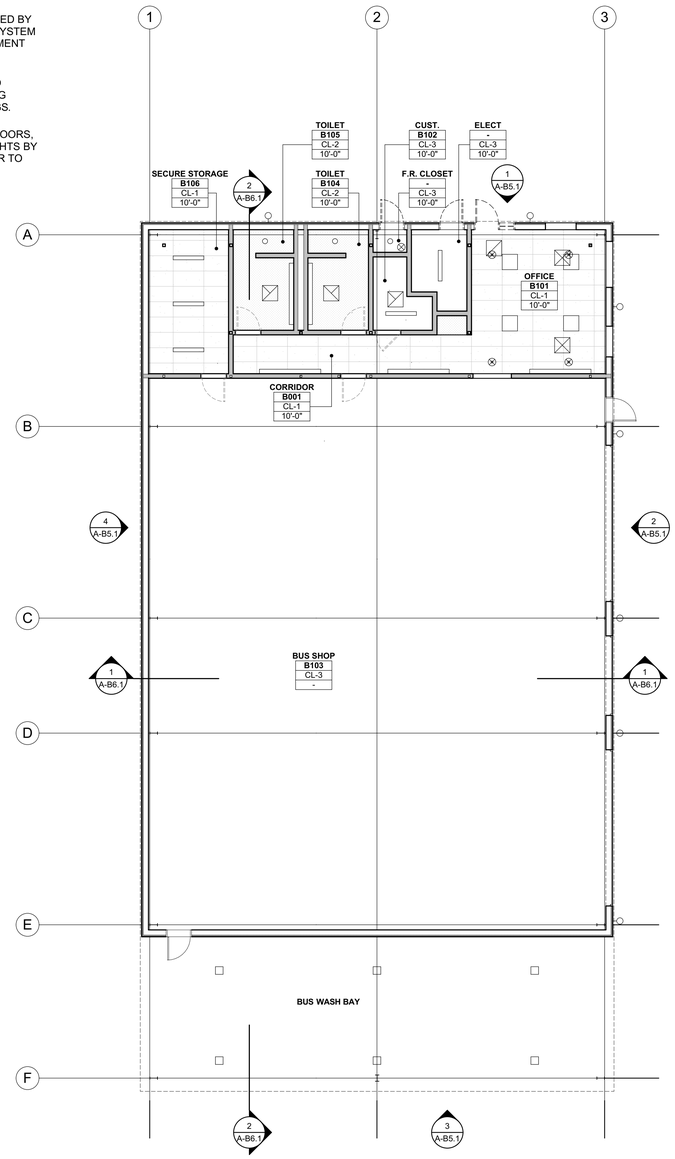
BIM Server: archiserver - BIM Server 21/1707.00 LUHSD TRANS M and O 5/23/2018 8:13:55



NOTE:
MECHANICAL EQUIPMENT TO BE SUPPORTED BY METAL BUILDING STRUCTURAL FRAMING SYSTEM TYP. SEE MECHANICAL PLANS FOR EQUIPMENT INFORMATION AND WEIGHT.

FIRE SPRINKLER PIPES TO BE SUPPORTED BY METAL BUILDING STRUCTURAL FRAMING SYSTEM, SEE FIRE PROTECTION DRAWINGS.

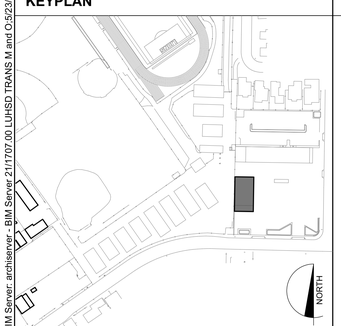
WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.



BUS SHOP MEZZANINE RCP 2
1/8" = 1'-0"

BUS SHOP RCP 1
1/8" = 1'-0"

KEYPLAN



REFLECTED CEILING PLAN LEGEND

10'-0"
ROOM NAME
ROOM #
X'-X"
CL-XX REFERS TO CEILING FINISH CODE. X'-X" REFERS TO FINISHED CEILING HEIGHT AFF. WHERE CEILING HEIGHT IS INDICATED AS "OPEN" OR " - ", ROOM IS OPEN TO STRUCTURE ABOVE. FOR CEILING CONFIGURATION & HEIGHT WHERE CEILING HEIGHT IS INDICATED AS CURVED, SLOPING, OR VARIES, REFER TO SECTION DRAWINGS.

GYPSUM BOARD, SEE FINISH CODE

2'x4 SUSPENDED CEILING SYSTEM W/ ACOUSTIC TILE, SEE FINISH CODES

DOORS SHOWN DASHED INDICATE DOOR BELOW. FOR DEMO, (E), AND (N) DOOR/FRAME INFORMATION SEE FLOOR PLANS & DOOR SCHEDULE

SKYLIGHT / SOLAR TUBE ABOVE

ELECTRICAL ITEMS, S.E.D.

MECHANICAL ITEMS, S.M.D.

FIRE SPRINKLERS, S.F.P.D.

CEILING FINSH CODES

FOR PAINT FINISHES SEE SEC. 09 9113 (EXTERIOR) & 09 9123 (INTERIOR).

CL-1 2'X4' SUSPENDED CEILING SYSTEM W/ ACOUSTIC TILE - / -

CL-2 SUSPENDED GYPSUM BOARD CEILING - / -

CL-3 EXPOSED TO STRUCTURE ABOVE - / -

REFLECTED CEILING PLAN GENERAL NOTES

REFLECTED CEILING PLAN KEYNOTES

NOT ALL KEYNOTES MAY APPLY TO THIS SHEET

FOR REFERENCE ONLY

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(707) 576-0829

TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

850 2ND STREET
BRENTWOOD, CA 94513

LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO: 1707.00
DRAWN BY:
DRAWING SCALE:
PTN: 61721-0064
100% DD
MAY 25, 2018

SHEET TITLE

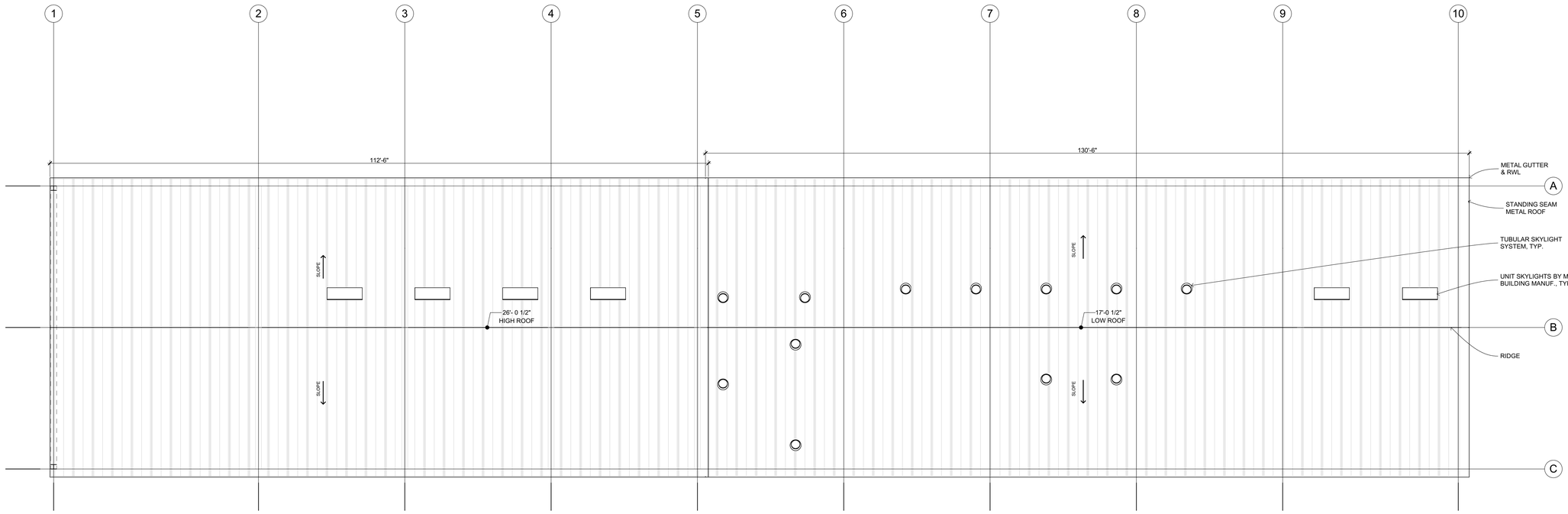
BUS SHOP BLDG "B" REFLECTED CEILING PLANS

SHEET NUMBER

A-B3.1

BIM Server: archiserver - BIM Server 21\1707.00 LUHSD TRANS M and O.5\23\20\18:13:55

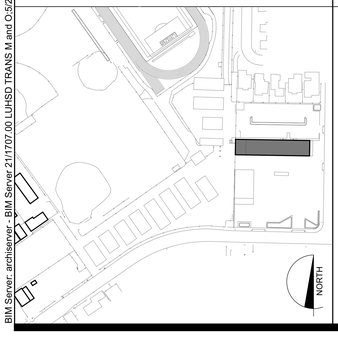
NOTE:
WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.



M&O/TRANS. ROOF PLAN 1

1/8" = 1'-0"

FOR REFERENCE ONLY

KEYPLAN		ROOF PLAN LEGEND		ROOF PLAN GENERAL NOTES		ROOF PLAN KEYNOTES
						NOT ALL KEYNOTES MAY APPLY TO THIS SHEET

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LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO:	1707.00
DRAWN BY:	*HME*
DRAWING SCALE:	1/8" = 1'-0"
PTN:	61721-0064

100% DD

MAY 25, 2018

SHEET TITLE

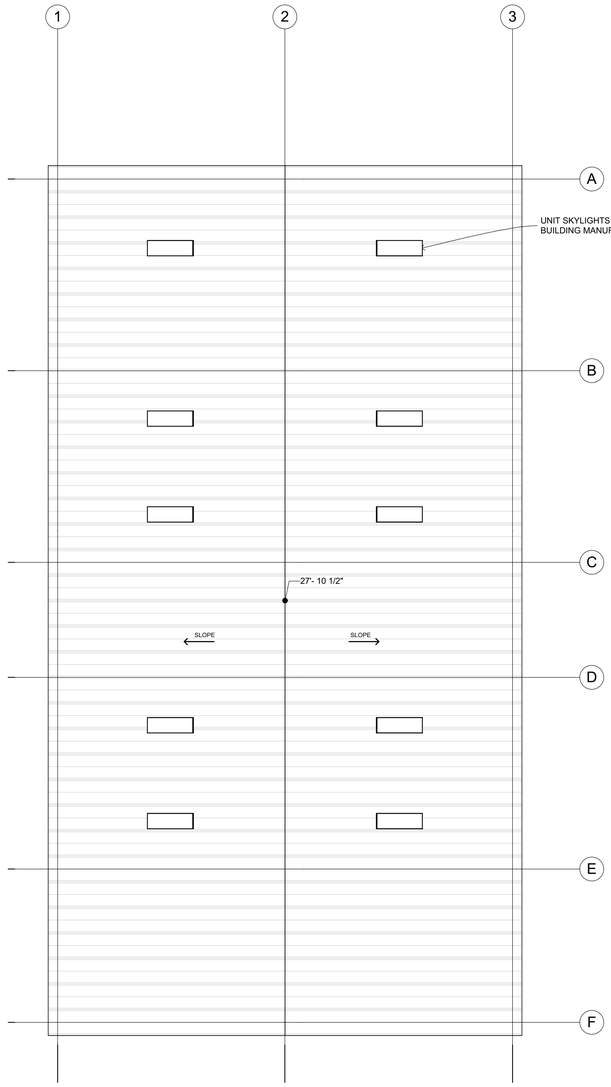
M&O / TRANS. BLDG "A" ROOF PLAN

SHEET NUMBER

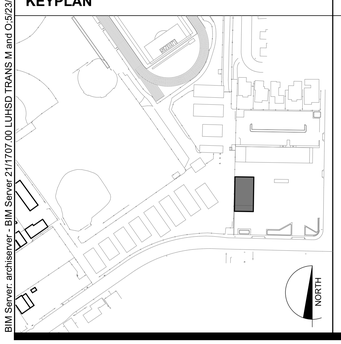
A-A4.1

BIM Server: archiserver - BIM Server 2\1707.00 LUHSD TRANS M and O\5/23/2018 13:56

NOTE:
WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.



BUS SHOP ROOF 1
1/8" = 1'-0"

KEYPLAN		ROOF PLAN LEGEND		ROOF PLAN GENERAL NOTES		ROOF PLAN KEYNOTES
						NOT ALL KEYNOTES MAY APPLY TO THIS SHEET

BIM Server: archiserver - BIM Server 2\1707.00 LUHSD TRANS M and O\5/23/2018 13:56

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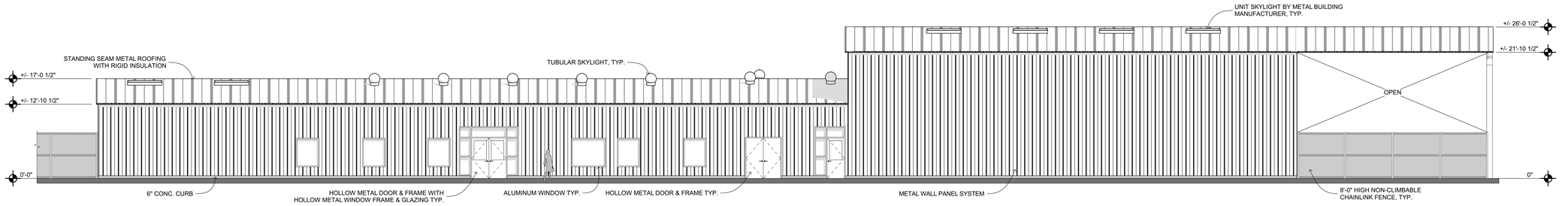
LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO: 1707.00
DRAWN BY:
DRAWING SCALE:
PTN: 61721-0064
100% DD
MAY 25, 2018

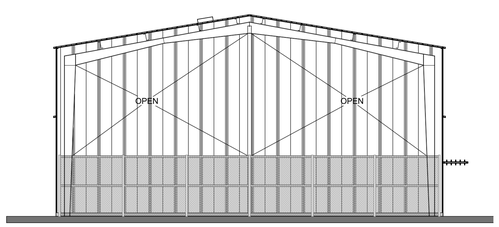
SHEET TITLE
BUS SHOP BLDG "B" ROOF PLAN

SHEET NUMBER
A-B4.1

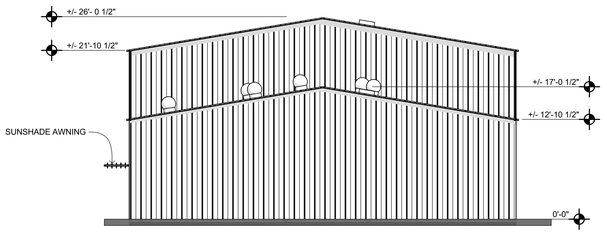
NOTE:
WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.



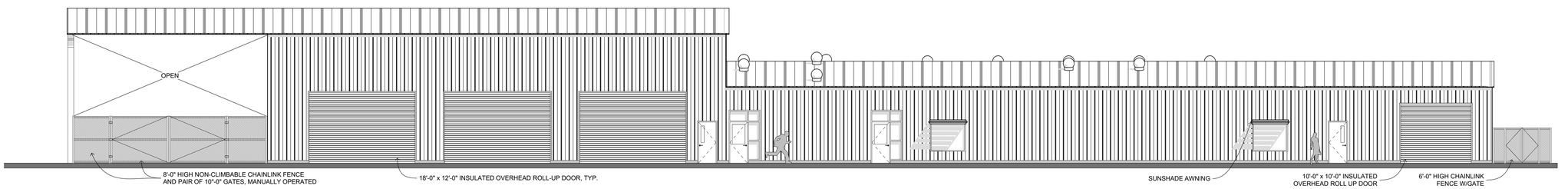
M&O NORTH ELEVATION 1
1/8" = 1'-0"



M&O WEST ELEVATION 3
1/8" = 1'-0"

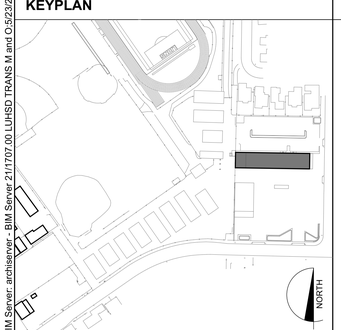


M&O EAST ELEVATION 2
1/8" = 1'-0"



M&O SOUTH ELEVATION 4
1/8" = 1'-0"

FOR REFERENCE ONLY

KEYPLAN		EXTERIOR ELEVATION LEGEND		EXTERIOR ELEVATION GENERAL NOTES		EXTERIOR ELEVATION KEYNOTES
						NOT ALL KEYNOTES MAY BE USED ON ALL SHEETS

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TRANSPORTATION, MAINTENANCE & OPERATIONS FACILITY

850 2ND STREET
BRENTWOOD, CA 94513

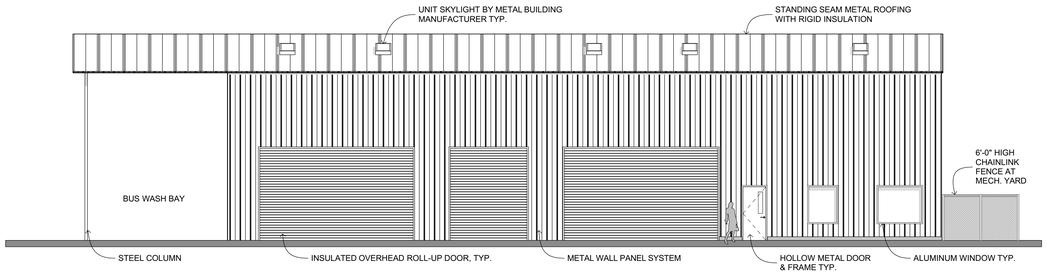
LIBERTY UNION HIGH SCHOOL DISTRICT

ARCH PROJECT NO: 1707.00
DRAWN BY:
DRAWING SCALE:
PTN: 61721-0064
100% DD
MAY 25, 2018

SHEET TITLE
M&O/TRANS. BLDG "A" EXTERIOR ELEVATIONS

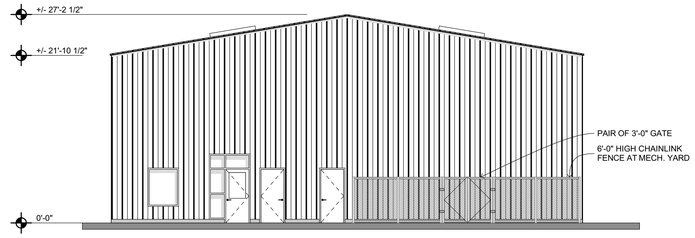
SHEET NUMBER
A-A5.1

BIM Server: archiserver - BIM Server 2\1707.00 LUHSD TRANS M and O\5/23/2018 13:56

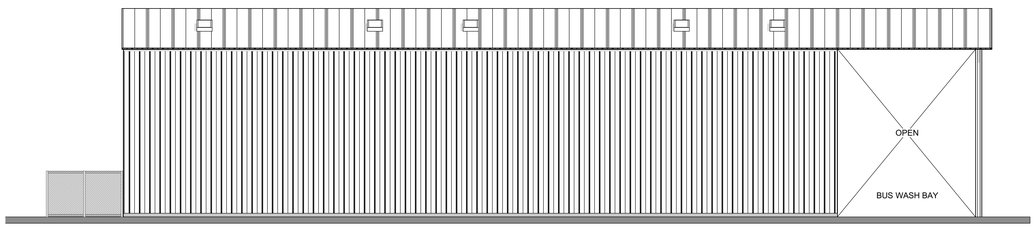


BUILDING "B" EAST 2
1/8" = 1'-0"

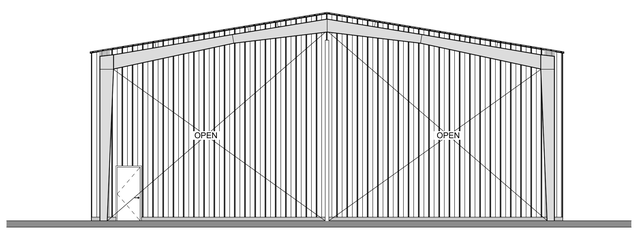
NOTE:
WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.



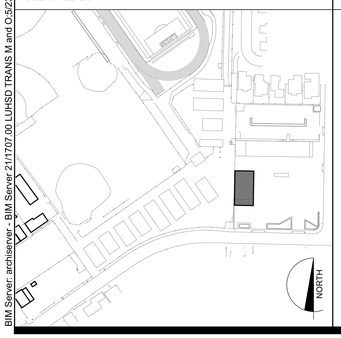
BUILDING "B" NORTH 1
1/8" = 1'-0"



BUILDING "B" WEST 4
1/8" = 1'-0"



BUILDING "B" SOUTH 3
1/8" = 1'-0"

KEYPLAN		EXTERIOR ELEVATION LEGEND		EXTERIOR ELEVATION GENERAL NOTES		EXTERIOR ELEVATION KEYNOTES
						NOT ALL KEYNOTES MAY BE USED ON ALL SHEETS

FOR REFERENCE ONLY

QUATTROCCHI KWOK ARCHITECTS
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Pleasanton Office:
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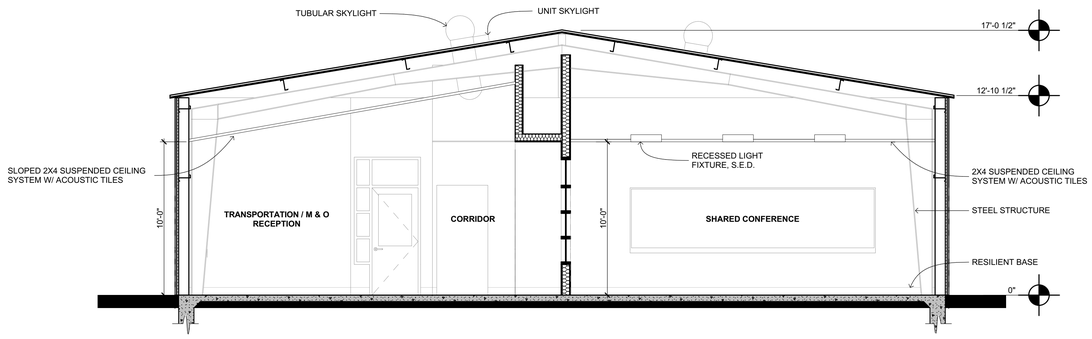
SHEET TITLE

BUS SHOP BLDG "B" EXTERIOR ELEVATIONS

SHEET NUMBER

A-B5.1

BIM Server: archiserver - BIM Server 21/1707.00 LUHSD TRANS M and O 5/23/2018 8:13:56



LOW BAY - RECEPTION & SHARED CONFERENCE 2

1/4" = 1'-0"

NOTE:
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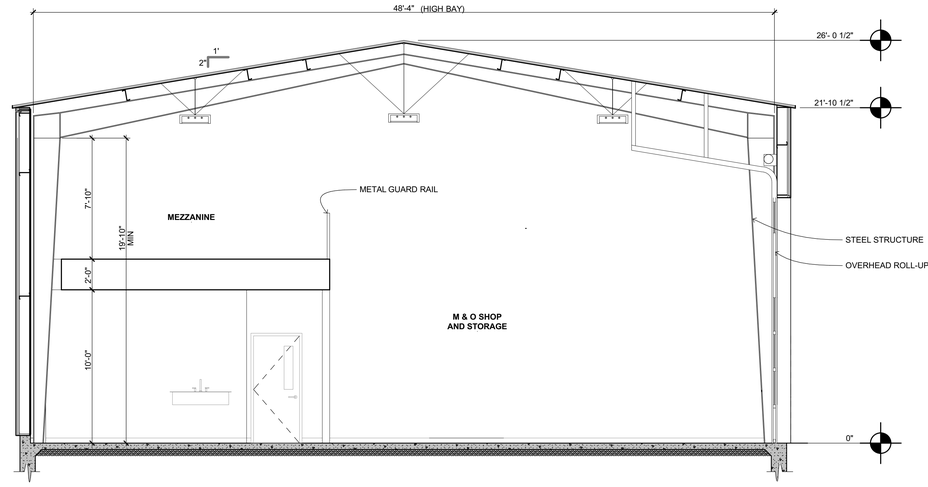
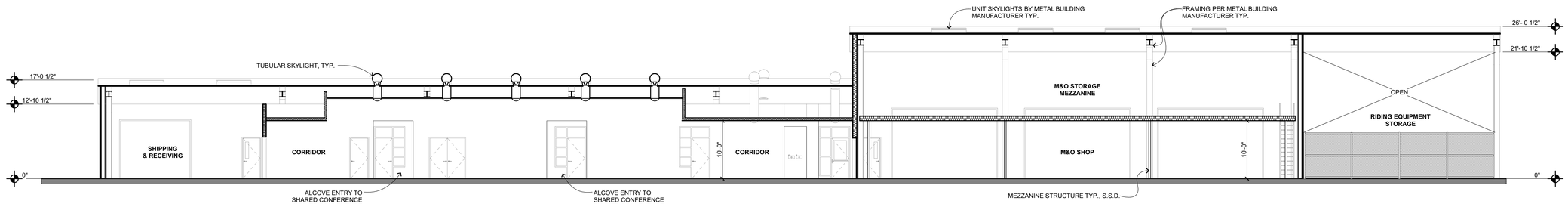


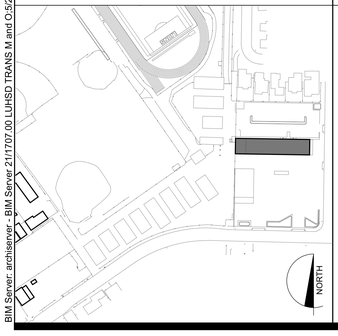
HIGH BAY - M&O SHOP AND MEZZANINE 1

1/4" = 1'-0"



BLDG CROSS SECTION 3

1/8" = 1'-0"

KEYPLAN				SECTION GENERAL NOTES		SECTION KEYNOTES
						NOT ALL KEYNOTES MAY BE USED ON ALL SHEETS

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100% DD	
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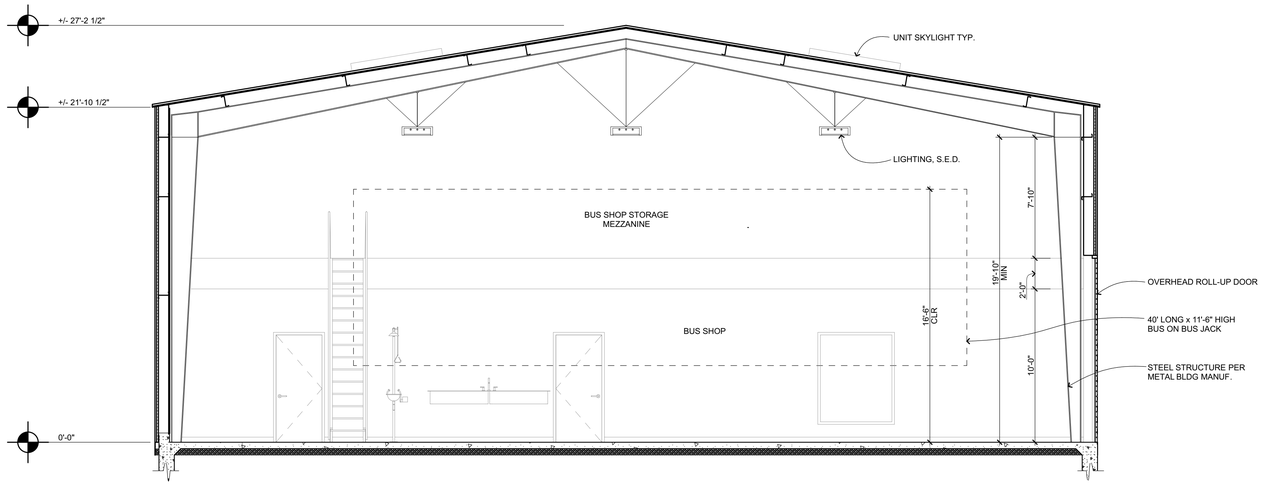
SHEET TITLE

M&O/TRANS. BLDG "A" SECTIONS

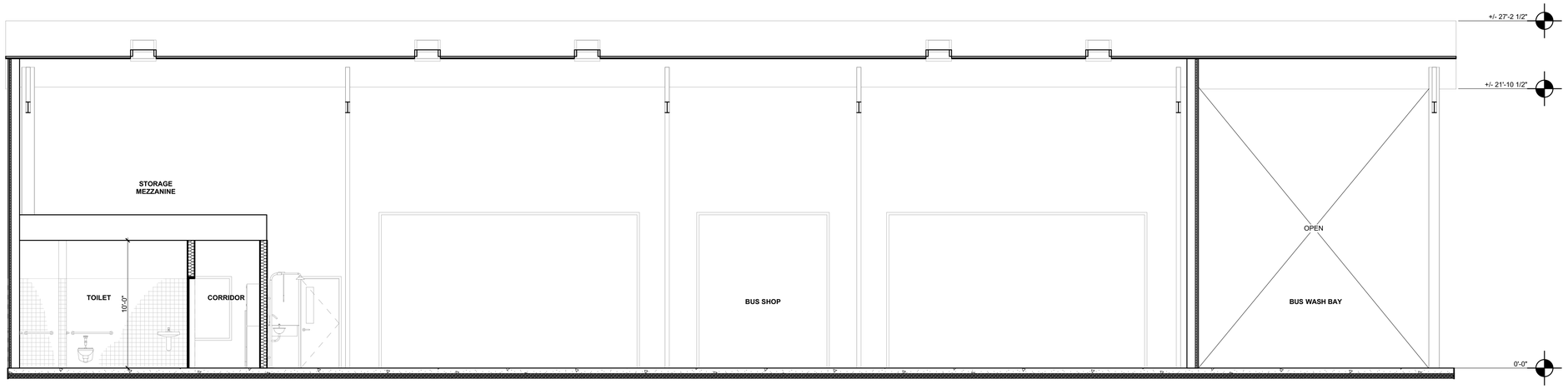
SHEET NUMBER

A-A6.1

NOTE:
WINDOWS, DOORS, OVERHEAD ROLL-UP DOORS, SUNSHADE AWNING AND TUBULAR SKYLIGHTS BY OTHERS. METAL BUILDING MANUFACTURER TO PROVIDE FRAMED OPENINGS.

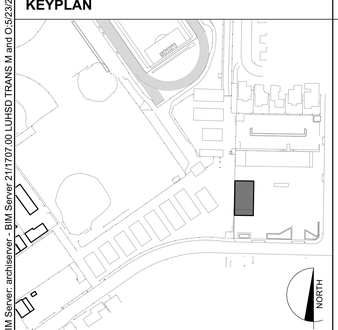


BUS SHOP SECTION 1
1/4" = 1'-0"



BUS SHOP CROSS SECTION 2
1/4" = 1'-0"

FOR REFERENCE ONLY

KEYPLAN				SECTION GENERAL NOTES		SECTION KEYNOTES
						NOT ALL KEYNOTES MAY BE USED ON ALL SHEETS

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SHEET TITLE
BUS SHOP BLDG "B" SECTIONS

SHEET NUMBER
A-B6.1

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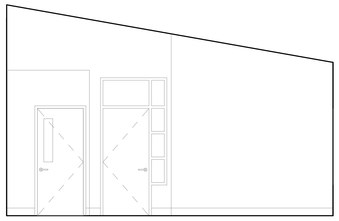

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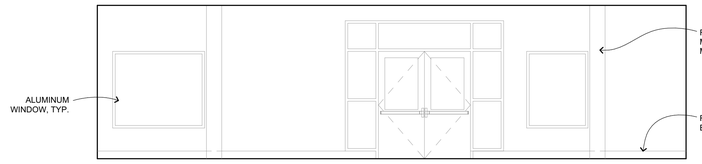
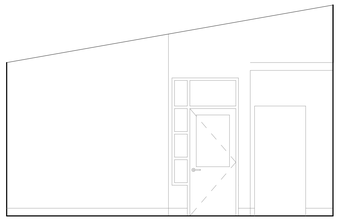
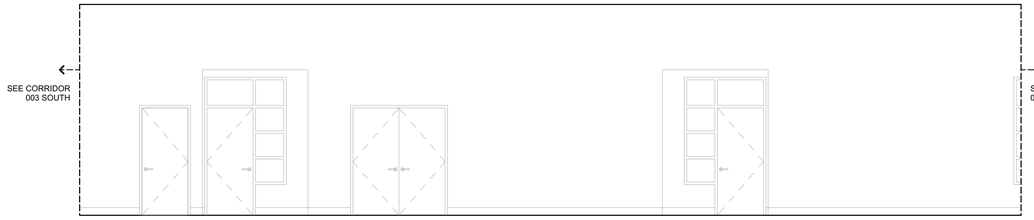


NORTH



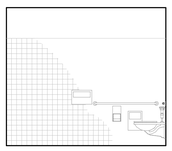
EAST



SOUTH

T / M&O RECEPTION 1

1/4" = 1'-0"



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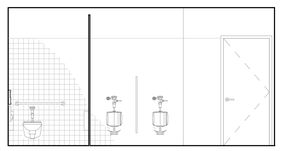

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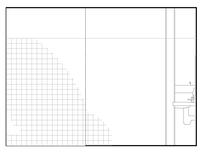

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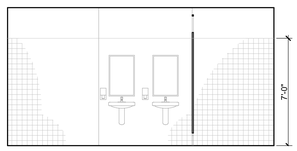
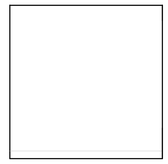


NORTH

MENS RESTROOM 3

1/4" = 1'-0"



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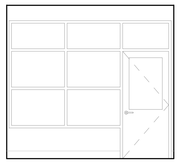
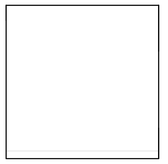


SOUTH



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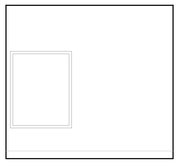

NORTH

M&O OFFICE 2

1/4" = 1'-0"

FOR REFERENCE ONLY

KEYPLAN		TOILET ROOM ACCESSORY SCHEDULE	WALL AND BASE FINISH CODES	INTERIOR ELEVATION GENERAL NOTES		INTERIOR ELEVATION KEYNOTES
						NOT ALL KEYNOTES MAY APPLY TO THIS SHEET

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DRAWING SCALE: 1/4" = 1'-0"
PTN: 61721-0064
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MAY 25, 2018

SHEET TITLE

M&O/TRANS. BLDG "A" INTERIOR ELEVATIONS

SHEET NUMBER

A-A7.1

BIM Server: archiserver - BIM Server 21/1707.00 LUHSD TRANS M and O.5/23/2018,13:56

F WOOD FRAMING NOTES

1. HEADERS, BEAMS, POSTS, TOP PLATE SPLICES, AND ETC., ARE PER 1/S1.2 AND 3/S1.2 WHERE NOT NOTED ON PLAN AND DETAILS. WALLS AT SEISMIC SEPARATIONS SHALL BE CONSIDERED EXTERIOR WALLS.
2. ALL BEAMS AND JOISTS (EXCLUDING I JOISTS) SHALL BE SEAT CUT FOR FULL UNIFORM BEARING AT SUPPORTS, INCLUDING BEAM SEATS AND COLUMN CAPS.
3. THE GENERAL CONTRACTOR SHALL MEASURE GLULAM BEAM SIZES AND CAMBERS AS DELIVERED TO THE JOB SITE AND SHALL REPORT FINDINGS TO THE ENGINEER PRIOR TO ERECTION. PROVIDE 3,500 FT. RADIUS CAMBER ON ALL SIMPLE SPAN GLULAM BEAMS UNO. WHERE INDICATED ON PLAN, C = ¾" INDICATES MIDSPAN CAMBER IN INCHES.
4. SEE 11/S1.2 FOR SHEATHING NAILING REQUIREMENTS. ALL NAILING NOT NOTED OR DETAILED OTHERWISE SHALL BE PER 10/S1.2. NAIL LENGTH TO BE SUFFICIENT TO MEET CBC PENETRATION REQUIREMENTS.
5. EXTERIOR STUD WALL SHALL BE 2x6 @ 16"oc UNLESS NOTED OTHERWISE. INTERIOR BEARING WALLS AND SHEAR WALLS SHALL BE 2x6 @ 16"oc UNLESS NOTED OTHERWISE. SEE ARCHITECTURAL DRAWINGS FOR OTHER INTERIOR WALL FRAMING SIZES. COORDINATE STUD AND PLATE SIZES WITH THE REQUIREMENTS OF THE SHEAR WALL SCHEDULE.
6. WOOD POST SIZES ARE TO MATCH BEAM AND STUD WIDTH, UNO. WHERE POST OCCURS ABOVE RAISED FLOOR, PROVIDE SOLID BLOCKING AT FLOOR FRAMING TO MATCH WIDTH OF POST. PEN PER G/S0.1TO POSTS AT ALL EXTERIOR WALLS AND INTERIOR SHEAR WALLS. POSTS AT HOLDOWNS TO BE FULL HEIGHT AND PER 8/S1.2.
7. FOR ROOF DRAINAGE, TOP OF FRAMING BETWEEN NOTED POINTS IS A STRAIGHT LINE.
8. ALL MECHANICAL SUPPLY AND RETURN OPENINGS TO BE BETWEEN FRAMING UNO.
9. HSS OR PIPE COLUMNS IN STUD WALLS ARE TO BE TRIMMED PER 6/S1.3. REFER TO PLANS AND DETAILS FOR OTHER REQUIREMENTS.
10. JOISTS AND RAFTERS ARE PER PLAN. UNLESS NOTED OTHERWISE, PROVIDE "LU" HANGER AT FLUSH FRAMING AND "HU" HANGER WHERE HANGER IS SHOWN SKEWED PER PLAN AND/OR HANGER SEAT IS INDICATED TO BE SLOPED. HANGER SIZE TO BE CORRECT FULL SIZE FOR JOIST SIZE (I.E. LU210 FOR 2x10). HANGERS FOR PANELIZED ROOF CONSTRUCTION ARE PER PLAN.
11. PROVIDE SOLID BLOCKING @ 8'-0"oc MAX FOR ALL 2x12 REPETITIVE FRAMING. PROVIDE SOLID BLOCKING OR SIMPSON TB X-BRIDGING @ 8'-0"oc MAX FOR ALL 1⅞" LSL AND 1¾" LVL REPETITIVE FRAMING WITH A DEPTH OF 11¼" OR GREATER.
12. PROVIDE ADDITIONAL JOIST BELOW ALL OR ADJACENT TO NON-STRUCTURAL WALLS PARALLEL TO FRAMING, UNO.
13. ROUND HOLES IN STEEL PLATES TO BE 1/16" OVERSIZE. SLOTTED HOLES IN STEEL PLATES SHALL BE 5/16" WIDER THAN THE BOLT DIAMETER AND HAVE A LENGTH OF 2 TIMES THE BOLT DIAMETER. THE DIRECTION OF THE SLOTTED LENGTH IS INDICATED ON THE DETAILS (VSH OR HSH). INSTALL BOLT AT THE CENTER LINE OF THE HOLE. BOLT HOLES IN WOOD SHALL BE ROUND AND 1/16" OVERSIZE. CUT OFF BOLT THREADED END FLUSH WITH NUT WHEN REQUIRED BY FINISHES AND 1" MAXIMUM FROM NUT OTHERWISE. PROVIDE STANDARD CUT WASHERS UNDER HEAD AND NUT WHERE BOLT BEARS ON WOOD. USE PLATE OR MALLEABLE IRON WASHERS AT EXPOSED CONDITIONS OR AS INDICATED.
14. ALL BOLTED OR NAILED STRAP CONNECTIONS SHALL HAVE AN EQUAL NUMBER OF BOLTS OR NAILS EACH SIDE OF THE SPLICE JOINT. THE FIRST BOLT OR NAIL FROM EACH SIDE OF THE SPLICED OR STRAPPED MEMBER SHALL BE EQUIDISTANT FROM THE SPLICE. STRAPS USING 16d NAILS ON 2x MATERIAL TO BE INSTALLED ON THE 1½" EDGE OF THE MEMBER.
15. THE CONTRACTOR SHALL VERIFY THAT THE MOISTURE CONTENT OF ALL FRAMING LUMBER AND SHEATHING MEET THE REQUIREMENTS OF THE SPECIFICATIONS AT THE TIME OF INSTALLATION AND AT CLOSE-IN. THE CONTRACTOR SHALL PROVIDE ALLOWANCE FOR DIFFERENTIAL SHRINKAGE BETWEEN FLOORS, ETC.
16. VENTING IS REQUIRED IN ENCLOSED FRAMING AREAS, SAD. DRILL BLOCKING AND LEDGERS AND PROVIDE SKIP BLOCKING AS DETAILED.
17. SAD FOR CEILING INFO. WHERE REQUIRED PROVIDE CEILING JOISTS PER 4/S1.3, UNO.
18. ALL SHEATHING SHALL HAVE 1/8" GAP AT ALL EDGES AND JOINTS. TYPICAL SHEATHING:
    A. FLAT ROOF SHEATHING (SLOPE 2:12 OR LESS): 15/32" T&G APA RATED SHEATHING (40/20) EXP 1 WITH 10d @ 6"oc EDGES (PEN) AND 12"oc FIELD UNO ON PLANS. LAY PERPENDICULAR TO FRAMING MEMBERS. BLOCK EDGES WITH 2x4 LAID FLAT WHERE NOTED ON THE PLANS AND DETAILS. NO PANELS LESS THAN 24" WIDE SHALL BE USED. STAGGER SHEETS.
    B. SLOPING ROOF SHEATHING (SLOPE GREATER THAN 2:12): 15/32" APA RATED SHEATHING (32/16) EXP 1 WITH 10d @ 6"oc EDGES (PEN) AND 12"oc FIELD UNO ON PLANS. LAY PERPENDICULAR TO FRAMING MEMBERS. PROVIDE SHTG CLIPS AT UNSUPPORTED EDGES UNLESS NOTED TO BE BLOCKED ON PLANS. NO PANELS LESS THAN 24" WIDE SHALL BE USED. STAGGER SHEETS.
    C. FLOOR SHEATHING: 23/32" T&G APA RATED SHEATHING (48/24) EXP 1 WITH 10d @ 6"oc EDGES (PEN) AND 12"oc FIELD UNO ON PLANS. LAY PERPENDICULAR TO & GLUE TO FRAMING MEMBERS IMMEDIATELY PRIOR TO FULL NAILING (DO NOT SPOT NAIL). BLOCK EDGES WITH 2x4 LAID FLAT AS NOTED ON THE PLANS AND DETAILS. NO PANELS LESS THAN 24" WIDE SHALL BE USED. STAGGER SHEETS.

D FOUNDATION NOTES

1. FOUNDATION DESIGN PRESSURES ARE:

   SHALLOW FOOTINGS:
   DEAD LOAD + LIVE LOAD = 3,000 PSF
   DEAD LOAD + LIVE LOAD + LATERAL = 4,000 PSF
2. ALL SOILS WORK SHALL BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS AND THE REQUIREMENTS OF THE GEOTECHNICAL REPORT NOTED BELOW, AND CHAPTER 18 OF THE CBC. ALL FOUNDATIONS SHALL BEAR ON FIRM, UNDISTURBED, NATIVE SOILS OR ENGINEERED FILL AT OR EXCEEDING DEPTHS SHOWN ON THE DRAWINGS. ENGINEERED FILL TO BE COMPACTED PER GEOTECHNICAL REPORT. INCREASE FILL AND OR FOOTING DEPTH AS REQUIRED BY GEOTECHNICAL ENGINEER. ALL FOOTING EXCAVATIONS SHALL BE AS NEAT AS PRACTICABLE. MAXIMUM OVER EXCAVATION IN WIDTH SHALL BE LESS THAN 12 INCHES OR 25% OF FOOTING WIDTH, WHICH EVER IS LESS. 6 INCHES MAXIMUM PER SIDE. LARGER OVER-EXCAVATIONS IN WIDTH SHALL BE FILLED WITH ADDITIONAL REINFORCED CONCRETE AS DIRECTED BY THE ENGINEER, OR FORMWORK SHALL BE PROVIDED. OVER-EXCAVATIONS IN DEPTH MAY BE FILLED WITH LEAN CONCRETE OR COMPACTED APPROVED BACKFILL. ALL LOOSE SOILS SHALL BE REMOVED FROM EXCAVATIONS PRIOR TO PLACEMENT OF REINFORCING OR CONCRETE. GEOTECHNICAL REPORT BY:

   GEOTECHNICAL
   REPORT NO. XX-XX
   DATED: XX-XX
3. WHERE BOTTOM OF ADJACENT FOOTINGS ARE DIFFERENT PROVIDE STEPPED FOOTING PER 5/S1.1.
4. USE 5/8" DIAMETER x 12" (18" AT CURBS) ANCHOR BOLTS (AB) AT 48"oc WHERE NOT OTHERWISE NOTED. MINIMUM EMBEDMENT INTO CONCRETE IS 7" (EXCLUDING CURB) UNLESS DETAILED OTHERWISE. ANCHOR BOLTS ARE TO BE TIED IN PLACE PRIOR TO PLACEMENT OF CONCRETE. SEE SHEAR WALL SCHEDULE FOR ADDITIONAL REQUIREMENTS. MINIMUM TWO ANCHOR BOLTS PER SILL PIECE.
5. INTERIOR SLAB: 5" CONCRETE REINFORCED WITH #3 @ 16"oc EACH WAY AT MID-DEPTH OVER VAPOR RETARDER (PER SPECIFICATIONS) AND 6" MINIMUM FREE DRAINING COMPACTED CRUSHED ROCK ON SUBGRADE PER THE GEOTECHNICAL RECOMMENDATIONS, AND AS APPROVED BY THE GEOTECHNICAL ENGINEER. DO NOT DRIVE CONCRETE TRUCKS OR LARGE SCREED MACHINES ON VAPOR RETARDER WITHOUT ADDITIONAL BUFFER MATERIAL AND APPROVAL FROM THE STRUCTURAL ENGINEER.
6. MAINTENANCE SLAB: 8" CONCRETE REINFORCED WITH #4 @ 12"oc EACH WAY AT MID-DEPTH OVER VAPOR RETARDER (PER SPECIFICATIONS) AND 6" MINIMUM FREE DRAINING COMPACTED CRUSHED ROCK ON SUBGRADE PER THE GEOTECHNICAL RECOMMENDATIONS, AND AS APPROVED BY THE GEOTECHNICAL ENGINEER. DO NOT DRIVE CONCRETE TRUCKS OR LARGE SCREED MACHINES ON VAPOR RETARDER WITHOUT ADDITIONAL BUFFER MATERIAL AND APPROVAL FROM THE STRUCTURAL ENGINEER.
7. REFER TO ARCHITECTURAL AND PLUMBING DRAWINGS FOR DEPRESSED SLABS FOR ARCHITECTURAL FLOORING OR INSERTS, SLOPED SLABS TO DRAIN AND PIPES OR CONDUITS AT SLAB. SEE 8/S1.1& 9/S1.1 AT DEPRESSED SLAB & 7/S1.1FOR PIPES AND CONDUITS.
8. PROVIDE CONTROL JOINTS PER 6/S1.1 (OR CONSTRUCTION/DOWEL JOINTS AT CONTRACTOR'S OPTION) AS SHOWN ON PLAN AND AS REQUIRED TO MEET A MAXIMUM SPACING IN FEET OF 3 TIMES THE SLAB DEPTH IN INCHES (FOR EXAMPLE 3x4" = 12'-0"oc MAX) AND 15'-0"oc MAX. INSTALL JOINTS TO DIVIDE SLAB INTO RECTANGULAR AREAS WITH LONG DIMENSION LESS THAN 1.5 x SHORT DIMENSION. INSTALL JOINTS AT FACE OF STUDS OF WALL WHERE POSSIBLE. SUBMIT JOINT LAYOUT PLAN FOR REVIEW PRIOR TO PLACEMENT.
9. TOP OF FOOTING ELEVATIONS TO BE DETERMINED BY THE CONTRACTOR BASED ON INFORMATION FROM THE CIVIL DRAWINGS, GEOTECHNICAL REPORT, LANDSCAPE, ETC.

E MATERIAL DATA

(INFORMATION SHOWN IS FOR STRUCTURAL DESIGN REFERENCE ONLY. SEE THE PROJECT SPECIFICATIONS FOR ALL MATERIAL SPECIFICATIONS.)

CONCRETE 28-DAY ULTIMATE COMPRESSIVE STRENGTH:
- F'_c = 3,000 PSI FOUNDATIONS (DESIGNED FOR 2,500 PSI)
- F'_c = 3,000 PSI INTERIOR SLAB ON GRADE (4,000 PSI AT 56 DAYS)
- F'_c = 3,000 PSI TILT-UP WALLS, COLUMNS

REINFORCING STEEL YIELD STRENGTH:
- F_y = 40,000 PSI AT #3 AND SMALLER
- F_y = 60,000 PSI AT #4 AND LARGER

STEEL YIELD STRENGTH (UNO):
- F_y = 50,000 PSI W SHAPES
- F_y = 36,000 PSI ANGLES, CHANNELS, AND PLATES
- F_y = 50,000 PSI PLATES AT MOMENT FRAME CONNECTIONS
- F_y = 46,000 PSI RECTANGULAR HSS
- F_y = 42,000 PSI ROUND HSS
- F_y = 35,000 PSI PIPES

FASTENERS:
MACHINE BOLTS SHALL BE ASTM A307
HIGH STRENGTH BOLTS SHALL BE ASTM F3125 GRADE A325 OR F1852 UNO
ANCHOR RODS SHALL BE ASTM F1554 GR.36 UNO
ARC-WELDING ELECTRODES SHALL BE E70

COLD FORMED METAL FRAMING YIELD STRENGTH:
- F_y = 33,000 PSI 33 & 43 MILS (20 & 18 GAUGE)
- F_y = 50,000 PSI 54, 68, & 97 MILS (16, 14, & 12 GAUGE)

WOOD BASE DESIGN STRESSES (UNO):

SAWN LUMBER MEMBER	SPECIES AND MINIMUM GRADE, UNO	F_b (PSI)	F_v (PSI)	E (PSI)
6x POSTS	DOUGLAS FIR - #1	1200	170	$1.6x10^6$
6x BEAMS	DOUGLAS FIR - #1	1350	170	$1.6x10^6$
4x POSTS & BEAMS	DOUGLAS FIR - #1	1000	180	$1.7x10^6$
2x JOISTS, RAFTERS	DOUGLAS FIR - #2	900	180	$1.7x10^6$
2" MATERIAL	DOUGLAS FIR - #2	900	180	$1.6x10^6$
2x STUDS	DOUGLAS FIR - #2	900	180	$1.6x10^6$

GLUE-LAMINATED WOOD DESIGN STRESSES:
- F_b = 2,400 PSI, F_v = 265 PSI FOR SIMPLE SPAN BEAMS.

MANUFACTURED WOOD PRODUCTS:

LVL (JOISTS)	F_b = 2,600 PSI	E = $1.9x10^6$ PSI
LSL (BLOCKING, LEDGERS)	F_b = 1,700 PSI	E = $1.3x10^6$ PSI
PSL (BEAMS, JOISTS)	F_b = 2,900 PSI	E = $2.0x10^6$ PSI
PSL (POSTS)	F_c = 2,500 PSI (PARALLEL)	E = $1.8x10^6$ PSI

FOR METAL CONNECTOR DESIGNATION REFER TO SIMPSON STRONG-TIE PER SPECIFICATIONS.

G SHEAR WALL NOTES

1. PEN = PLYWOOD/OSB SHEATHING EDGE NAILING. BLOCK ALL UNSUPPORTED EDGES WITH 2x MATERIAL UNO. BLOCK EDGES WITH 3x MATERIAL WHERE NAILING IS 4"oc OR LESS. SEE 11/S1.2 FOR NAIL STAGGER AT ALL 3x.
2. FIELD NAILING TO BE 12"oc UNO.
3. ALL SHEATHING NAILS TO BE COMMON WIRE. SEE F/S0.1 NOTE #4 AND SPECIFICATIONS FOR OTHER NAIL REQUIREMENTS.
4. ALL EXTERIOR WALLS NOT DESIGNATED AS SHEAR WALLS ON PLANS TO HAVE SHEATHING AND PEN NAILING PER SHEAR WALL TYPE 'A'.
5. SHEAR WALL LENGTHS, WHERE NOTED, ARE MINIMUM. DO NOT LOCATE HOLDOWNS FROM THESE DIMENSIONS. SAD FOR ACTUAL WALL LENGTHS.
6. HOLDOWN REFERS TO SIMPSON STRONG TIE CO. HOLDOWNS. INSTALL HOLDOWNS AND REQUIRED POSTS PER 8/S1.2 AND 9/S1.2. SEE PLANS FOR OTHER REQUIREMENTS.
7. EDGE NAIL WALL SHEATHING TO STUDS OR POSTS WITH HOLDOWNS.
8. PORTIONS OF INTERIOR WALL SURFACES ADJACENT TO SPECIFIED SHEAR WALLS SHALL BE SHEATHED FOR THE FULL, UNINTERRUPTED LENGTH PER NOTE #4 OR WITH GYPSUM BOARD OF THE SAME THICKNESS TO PROVIDE AN EVEN WALL SURFACE FOR FINISH MATERIALS.
9. SHEAR WALLS MORE THAN ONE VERTICAL PANEL IN HEIGHT SHALL HAVE STAGGERED HORIZONTAL OR VERTICAL SPLICE JOINTS.
10. WHERE PANELS ARE APPLIED ON BOTH FACES OF A WALL AND NAIL SPACING IS LESS THAN 6"oc ON EITHER SIDE, PANEL JOINTS SHALL BE OFFSET TO FALL ON DIFFERENT FRAMING MEMBERS OR FRAMING SHALL BE 3x OR THICKER AND NAILS ON EACH SIDE SHALL BE STAGGERED.
11. ANCHOR BOLTS (AB) FOR SHEAR WALLS SHALL INCLUDE STEEL PLATE WASHERS, A MINIMUM OF 0.229 INCH BY 3 INCHES SQUARE IN SIZE, BETWEEN THE SILL PLATE AND NUT. THE HOLE IN THE PLATE WASHER IS PERMITTED TO BE DIAGONALLY SLOTTED WITH A WIDTH OF UP TO 3/16" LARGER THAN THE AB DIAMETER AND A SLOT LENGTH NOT TO EXCEED 1¾". PROVIDED A STANDARD CUT WASHER IS PLACED BETWEEN THE PLATE WASHER AND THE NUT. PLATE WASHER TO EXTEND WITHIN ½" OF SHEAR WALL SHEATHING UNO. PROVIDE OVERSIZED PLATE WASHER OR OFFSET AB AS REQUIRED. AT DOUBLE-SIDED SHEAR WALLS, STAGGER AB AS REQUIRED. AB TO BE PLACED A MINIMUM OF 4½" AND A MAXIMUM OF 12" FROM ENDS OF ALL SILL PLATES AND AT NOTCHES IN SILL PLATES.
12. NO OPENINGS ARE ALLOWED IN SHEAR WALLS UNLESS SHOWN ON THE STRUCTURAL PLANS. OPENINGS NOTED ARE PER 6/S1.2. COORDINATE ANY OPENINGS NOT SHOWN WITH THE STRUCTURAL ENGINEER.

A DESIGN CRITERIA

DESIGN CRITERIA: 2016 CALIFORNIA CODE OF REGULATIONS, TITLE 24, PART 2 (CBC)
FLOOR LIVE LOAD: 60 PSF (REDUCIBLE) + 15 PSF PARTITION
ROOF LIVE LOAD: 20 PSF (REDUCIBLE)
RISK CATEGORY: II
WIND DATA: ULTIMATE WIND SPEED (3 SEC GUST) IN MPH: 110
WIND EXPOSURE: C
SEE METAL BUILDING DRAWINGS
SEISMIC IMPORTANCE FACTOR, I_e: 1.0
MAPPED SPECTRAL RESPONSE ACCELERATIONS: S_S = 1.50; S_1 = 0.51
SITE CLASS: D
SPECTRAL RESPONSE COEFFICIENTS: S_{DS} = 1.00; S_{D1} = 0.51
SEISMIC DESIGN CATEGORY: D
MEZZANINE
SEISMIC FORCE RESISTING SYSTEM: WOOD FRAMED SHEAR WALLS
RESPONSE MODIFICATION FACTOR(S): R = 6.5
DESIGN BASE SHEAR: 7.57KIPS (ASD)
SEISMIC RESPONSE COEFFICIENT(S), C_S = 0.108 (ASD)
ANALYSIS PROCEDURE USED: EQUIVALENT LATERAL FORCE
METAL BUILDING
SEISMIC FORCE RESISTING SYSTEM(S): PER MBM

EARTHQUAKE DATA:

B GENERAL NOTES

1. REFER TO SHEETS S1.1, S1.2 AND S1.3 FOR STANDARD DETAILS OF CONSTRUCTION. REFER TO THE PROJECT SPECIFICATIONS FOR MATERIALS AND METHODS.
2. BUILDING DIMENSIONS SHOWN ARE FOR GENERAL REFERENCE ONLY. SEE ARCHITECTURAL DRAWINGS (SAD) FOR ALL ACTUAL BUILDING DIMENSIONS. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE ARCHITECT/ENGINEER SO CLARIFICATION CAN BE MADE PRIOR TO COMMENCING WORK.
3. STRUCTURAL DRAWINGS SHALL NOT BE SCALED. ALL DIMENSIONS AND FIT SHALL BE DETERMINED AND VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCING WORK.
4. DETAILS NOT FULLY OR SPECIFICALLY SHOWN SHALL BE OF SAME NATURE AS OTHER SIMILAR CONDITIONS.
5. REFER TO ARCHITECTURAL DRAWINGS FOR SIDEWALK SLABS AND DIMENSIONS.
6. COORDINATION OF MECHANICAL, ELECTRICAL, PLUMBING, AND SITE UTILITY SYSTEMS WITH THE STRUCTURAL SYSTEM IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR. USE DETAILS 2/S1.1 3/S1.1 7/S1.1 2/S1.2 5/S1.2 AND 6/S1.2. AT CONDITIONS WHERE THESE DETAILS DO NOT APPEAR TO APPLY, NOTIFY THE STRUCTURAL ENGINEER PRIOR TO INSTALLATION. AT CONDITIONS WHERE FIELD MODIFICATIONS OF MECHANICAL, ELECTRICAL, PLUMBING, OR SITE UTILITIES AFFECT STRUCTURAL SYSTEMS, NOTIFY STRUCTURAL ENGINEER PRIOR TO INSTALLATION.
7. VERIFY WEIGHTS AND LOCATIONS OF MECHANICAL UNITS WITH MECHANICAL ENGINEER PRIOR TO PLACEMENT. UNITS VARYING OVER 10% IN WEIGHT SHALL BE REVIEWED BY THE STRUCTURAL ENGINEER PRIOR TO INSTALLATION (MECHANICAL WEIGHTS SHOWN ARE MAXIMUM). CONTRACTOR TO VERIFY MECHANICAL UNIT SIZES AND WEIGHTS AS INSTALLED PRIOR TO INSTALLATION OF SPECIAL FRAMING TO ENSURE CORRECT PLACEMENT UNDER CURBS, ETC. SEE 6/S1.3 AND 9/S1.3 .
8. SHORING AND BRACING DESIGN, MATERIALS AND INSTALLATION SHALL BE PROVIDED BY THE GENERAL CONTRACTOR, AND SHALL BE ADEQUATE FOR ALL LOADS. LEAVE IN PLACE AS LONG AS MAY BE REQUIRED FOR SAFETY AND UNTIL FINAL STRUCTURAL CONSTRUCTION IS COMPLETED. THE CONTRACTOR SHALL ENGAGE A LICENSED CIVIL OR STRUCTURAL ENGINEER TO PROVIDE SHORING.
9. SPECIAL INSPECTIONS ARE REQUIRED PER C/S0.1 AND THE TESTING AND INSPECTION FORM.
10. VEHICULAR TRAFFIC, HEAVY EQUIPMENT AND MATERIAL STAGING SHALL NOT BE ALLOWED ADJACENT TO ANY RETAINING/BASEMENT WALL, NEW OR EXISTING WITHIN A HORIZONTAL DISTANCE EQUAL TO THE WALL HEIGHT MEASURED FROM THE BOTTOM OF FOOTING OR 5'-0" WHICHEVER IS GREATER, UNLESS APPROVED BY THE STRUCTURAL ENGINEER OR NOTED OTHERWISE. WITHIN THIS ZONE, ONLY HAND-OPERATED EQUIPMENT ("WHACKERS", VIBRATORY PLATES, OR PNEUMATIC COMPACTORS) SHALL BE USED TO COMPACT THE BACKFILL SOILS.
11. STRUCTURAL OBSERVATION PER CBC SECTION 1704.6 IS NOT REQUIRED. NOTIFY ZFA FOR GENERAL REVIEW OF:
    - MINIMUM FOOTING SIZE AND REINFORCING STEEL.
    - RETAINING WALLS AND REINFORCING.
    - WOOD SHEAR WALLS, SHEAR PANELS AND FLOOR/ROOF DIAPHRAGMS, INCLUDING NAILING, BOLTING, ANCHORAGE AND OTHER FASTENING TO OTHER COMPONENTS OF THE SEISMIC FORCE RESISTING SYSTEM.
    - STRUCTURAL WOOD FRAMING.

    NOTIFY ZFA FOR REVIEW PRIOR TO COVERING ABOVE LISTED WORK. PROVIDE 2 WORKING DAYS MINIMUM SCHEDULING NOTICE PRIOR TO REVIEW DATE.

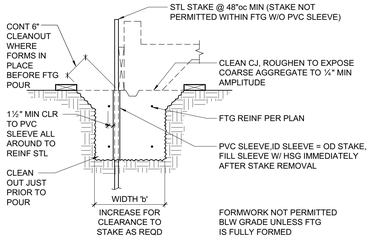
C SPECIAL INSPECTION BY OWNERS TESTING AGENCY

SPECIAL INSPECTIONS AND TESTING SHALL BE PERFORMED BY AN APPROVED AGENCY IN ACCORDANCE WITH CBC CHAPTER 17 AND THE STATEMENT OF SPECIAL INSPECTIONS AS REQUIRED BY CBC SECTIONS 1704.2.3 AND 1704.3 FOR BUILDING STRUCTURAL ELEMENTS SUMMARIZED AS FOLLOWS:

1. **SHOP FABRICATION OF STRUCTURAL LOAD-BEARING MEMBERS AND ASSEMBLIES** PER CBC SECTION 1704.2.5 OR ALTERNATIVELY, APPROVED FABRICATORS SHALL SUBMIT A CERTIFICATE OF COMPLIANCE PER CBC SECTION 1704.2.5.1 INCLUDING GLULAM BEAM INSPECTION CERTIFICATES.
2. **CONCRETE CONSTRUCTION** PER CBC SECTIONS 1705.3, AND TABLE 1705.3 INCLUDING FORMWORK, REINFORCING STEEL, CAST-IN-PLACE BOLTS, MIX DESIGNS, CONCRETE SAMPLES, AND PLACEMENT FOR ALL CONCRETE. REINFORCING DOWELS FROM FOOTINGS TO RETAINING WALLS SHALL BE INSPECTED PRIOR TO PLACEMENT OF FOOTING CONCRETE AND WALL GROUT OR CONCRETE. CONTINUOUS OR ISOLATED SPREAD FOOTINGS WITH DESIGN STRENGTH NO GREATER THAN 2500 PSI, NON-STRUCTURAL SLABS ON GRADE, AND EXTERIOR FLATWORK DO NOT REQUIRE SPECIAL INSPECTION PER CBC SECTION 1705.3.
3. **WOOD CONSTRUCTION** PER CBC SECTIONS 1705.5, 1705.11.1, AND 1505.12.2 INCLUDING NAILING, BOLTING, AND ANCHORING OF ALL DRAG STRUTS; TOP PLATE SPLICES, LEDGER SPLICES, SIMPSON HARDWARE, BRACES, AND HOLDOWNS; AND NAILING, BOLTING, AND ANCHORING OF ALL SHEAR WALLS, SHEAR PANELS, AND DIAPHRAGMS WHERE THE FASTENER SPACING OF THE SHEATHING IS 4" APART OR LESS.
4. **SOILS** PER CBC SECTION 1705.6, TABLE 1705.6, AND THE APPROVED SOILS REPORT INCLUDING SUBGRADE PREPARATION, FOUNDATION BEARING MATERIALS AND DEPTH OF EXCAVATIONS, AND VERIFICATION, PLACEMENT AND TESTING OF CONTROLLED FILL.
5. **SPECIAL CASES** PER CBC SECTION 1705.1.1 AND PRODUCT ICC REPORTS FOR ALL STRUCTURAL MATERIALS AND SYSTEMS REQUIRED TO BE INSTALLED IN ACCORDANCE WITH ADDITIONAL MANUFACTURER'S INSTRUCTIONS THAT PRESCRIBE REQUIREMENTS NOT CONTAINED IN THE CBC OR REFERENCED STANDARDS INCLUDING POST-INSTALLED ANCHOR BOLTS IN CONCRETE AND CMU, AND PRE-MANUFACTURED SHEAR PANELS AND BRACED FRAMES.

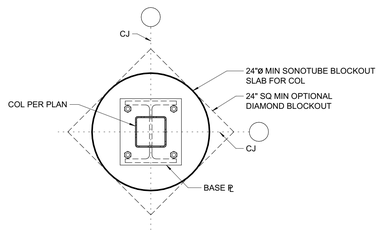
ABBREVIATIONS

AB	ANCHOR BOLT	GB	GRADE BEAM	PTDF	PRESSURE TREATED DOUGLAS FIR
ABV	ABOVE	GLB	GLUE LAMINATED BEAM	PT	POINT
AC	AIR CONDITIONING	GR	GRADE	PTS	PRESS
ADJ	ADJUSTABLE	GU	GLUE-DOWN	RBS	REDUCED BEAM SECTION
ADDL	ADDITIONAL	HDG	HOT-DIP GALVANIZED	RFTR	RAFTER
ALT	ALTERNATE	HDR	HEADER	REF	REFERENCE
ALUM	ALUMINUM	HGR	HANGER	REINF	REINFORCING
ARCH	ARCHITECT	HK	HOOK	REQD	REQUIRED
@	AT	HORIZ	HORIZONTAL	RET	RETAINING
BLDG	BUILDING	HS	HIGH STRENGTH	REV	REVISION
BLK/BLKG	BLOCK/BLOCKING	HSB	HIGH STRENGTH BOLT	RF	ROOF
BLW	BELOW	HSFB	HIGH STRENGTH FRICTION BOLT	RWD	REDWOOD
BM	BEAM	HSG	HIGH STRENGTH GROUT	S	AMERICAN STANDARD BEAM
BOT	BOTTOM	HSH	HORIZONTAL SLOTTED HOLE	SAD	SEE ARCHITECTURAL DRAWINGS
BRG	BEARING	HSS	HOLLOW STRUCTURAL SECTION	SB	SOLID BLOCK
BTWN	BETWEEN			SC	SLIP CRITICAL
BU	BUILT-UP			SCBF	SPECIAL CONCENTRIC BRACED FRAME
BYND	BEYOND	HT	HEIGHT		
C	AMERICAN STANDARD CHANNEL	ID	INSIDE DIAMETER	SCD	SEE CIVIL DRAWINGS
CANT	CANTILEVER	IJ	I SHAPED WOOD BUILT UP JOIST	SCRD	SCREED
CB	CARRIAGE BOLT	INT	INTERIOR	SED	SEE ELECTRICAL DRAWINGS
CIP	CAST IN PLACE	JST	JOIST	SEOR	STRUCTURAL ENGINEER OF RECORD
CGL	CERTIFIED GLUED LUMBER	JT	JOINT	SFRS	SEISMIC FORCE RESISTING SYSTEM
CJ	CONTROL JOINT	KP	KING POST	SHTG	SHEATHING
℄	CENTERLINE	L	STEEL ANGLE	SIM	SIMILAR
∠UP	COMPLETE JOINT PENETRATION	Lb or #	POUND(s)	SKYLT	SKYLIGHT
CLG	CEILING	LGMF	LIGHT-GAGE METAL FRAMING	SMF	SPECIAL MOMENT FRAME
CLR	CLEAR	LGMFC	LIGHT-GAGE METAL FRAMING CONTRACTOR	SMS	SHEET METAL SCREW
COL	COLUMN	LL	LIVE LOAD	SMD	SEE MECHANICAL DRAWINGS
COLL	COLLECTOR	LLH	LONG LEG HORIZONTAL	SOG	SLAB ON GRADE
CONC	CONCRETE	LLV	LONG LEG VERTICAL	SPCG	SPACING
CONN	CONNECTION	LOC	LOCATION	SPD	SEE PLUMBING DRAWINGS
CONT	CONTINUOUS	LS	LAG SCREW	SPEC	SPECIFICATION
COORD	COORDINATE	LSL	LAMINATED STRAND LUMBER	SQ	SQUARE
CMU	COORDINATION CONCRETE MASONRY UNIT	LVL	LAMINATED VENEER LUMBER	SS	SELECT STRUCTURAL
CSK	COUNTERSINK	MAX	MAXIMUM		STAINLESS STEEL
CW	CUT WASHER	MB	MACHINE BOLT	STGR	STAGGERED
DBL	DOUBLE	MBM	METAL BUILDING MANUFACTURER	STD	STANDARD
DCW	DEMAND CRITICAL WELD	MC	MISCELLANEOUS CHANNEL	STIFF	STIFFENER
DF	DOUGLAS FIR	MECH	MECHANICAL	STL	STEEL
DIA or ⌀	DIAMETER	MEZZ	MEZZANINE	STRUCT	STRUCTURAL
DIAG	DIAGONAL	MF	MOMENT FRAME	SW	SHEAR WALL
DIM	DIMENSION	MFR	MANUFACTURER	SYM	SYMMETRICAL
DJ	DOWEL JOINT	MIN	MINIMUM	T&B	TOP AND BOTTOM
DL	DEAD LOAD	MISC	MISCELLANEOUS	T&G	TONGUE AND GROOVE
DN	DOWN	MW	MALLEABLE IRON WASHER	THDR	THREADED
DO	DITTO	MTL	METAL	THRU	THROUGH
DWG	DRAWING	(N)	NEW	TL	TOTAL LOAD
DWL	DOWEL	NIC	NOT IN CONTRACT	TN	TOE NAIL
EA	EACH	NO or #	NUMBER	TOC	TOP OF CONCRETE
EE	EACH END	NS	NEAR SIDE	TOF	TOP OF FRAMING
EF	EACH FACE	NSG	NON-SHRINK GROUT	TOM	TOP OF MASONRY
ELEC	ELECTRICAL	NTS	NOT TO SCALE	TOP	TOP OF PLYWOOD
ELEV	ELEVATOR/ELEVATION	OC	ON CENTER	TOS	TOP OF STEEL
EMBED	EMBEDMENT	oc	ON CENTER	TOT	TOTAL
EQ	EQUAL	OD	OUTSIDE DIAMETER	TU	TILT UP
EQUIP	EQUIPMENT	OH	OPPOSITE HAND	TYP.	TYPICAL
ES	EACH SIDE	OPNG	OPENING	UNO	UNLESS NOTED OTHERWISE
EW	EACH WAY	OPP	OPPOSITE	VERT	VERTICAL
EXIST or (E)	EXISTING	OW	OTHERWISE	VIF	VERIFY IN FIELD
EXP	EXPANSION	OWT	OPEN WEB TRUSS	VSH	VERTICAL SLOTTED HOLE
EXT	EXTERIOR	PL	PLATE OR PROPERTY LINE	W	WIDE FLANGE STEEL BEAM
FDN	FOUNDATION	PA	POST ABOVE	W/	WITH
FG	FINISH GRADE	PDP	POWDER DRIVEN PINS	W/O	WITHOUT
FLI	FERRULE LOOP INSERT	PEN	PANEL EDGE NAIL	WD	WOOD
FLR	FLOOR	PERP	PERPENDICULAR	WHS	WELDED HEADED STUD
FN	FACE NAIL	PES	PANEL EDGE SCREWS	WLD	WELDED
FOC	FACE OF CONCRETE	p.pt	PARTIAL JOINT PENETRATION	WP	WORK POINT/WATERPROOF
FOM	FACE OF MASONRY	PLF	POUNDS PER LINEAR FOOT	WS	WOOD SCREW
FOS	FACE OF STUD	PNL	PANEL	WT	WEIGHT
FRMG	FRAMING	PSF	POUNDS PER SQUARE FOOT	WTS	WELDED THREADED STUD
FW	FAR WALL	PSI	POUNDS PER SQU



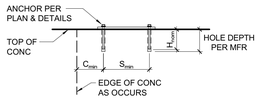
NOTE:
FOUNDATION CONCRETE MAY BE PLACED DIRECTLY INTO NEAT EXCAVATIONS PROVIDED THE FOUNDATION TRENCH WALLS ARE STABLE AS DETERMINED BY THE GEOTECHNICAL ENGINEER SUBJECT TO THE APPROVAL OF THE AUTHORITY HAVING JURISDICTION.

17 FORMWORK STAKES AT FOOTING
3/4" = 1'-0"



14 SLAB BLOCKOUT
1" = 1'-0"

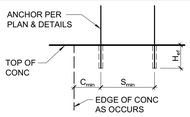
SCREW ANCHOR IN 2500 PSI MIN CONCRETE							
ANCHOR TYPE	ANCHOR AND PILOT HOLE DIA	MINIMUM EMBEDMENT H_{nom}	MINIMUM EDGE DIST C_{min}	MINIMUM SPCG S_{min}	MINIMUM CONCRETE DEPTH H_{min}	INSTALL TORQUE (FT-LB)	MAX INSTALL TORQUE (FT-LB)
SIMPSON TITEN HD (ICC-ESR 2713)	⅜"	2½"	1¾"	3"	4"	10	50
	½"	3¼"	1¾"	3"	5"	10	65
	⅝"	4"	1¾"	3"	6"	10	100
	¾"	5½"	1¾"	3"	8¾"	20	150
HILTI KH-EZ (ICC-ESR 3027)	⅜"	2½"	1½"	3"	4"	10	40
	½"	3"	1¾"	3"	4¾"	10	45
	⅝"	3¼"	1¾"	4"	5"	10	85
	¾"	4"	1¾"	4"	6"	20	115



NOTES:
1. INSTALL SCREW ANCHORS PER MANUFACTURER'S INFORMATION AND ICC REPORT INSTRUCTIONS. SPECIAL INSPECTION IS REQUIRED PER SECTION 1705A OF THE CBC AND THE REQUIREMENTS OF THE ICC REPORTS. INSTALLED ANCHORS SHALL BRING CONNECTED PLIES INTO FIRM CONTACT, MEETING THE INSTALL TORQUE BUT NOT EXCEEDING THE MAXIMUM INSTALL TORQUE.
2. CONTRACTOR TO VERIFY MINIMUM EDGE DISTANCES, SPACING AND THICKNESS ARE IN ACCORDANCE W/ SCHEDULE PRIOR TO INSTALLING ANCHOR.
3. HOLES TO BE DRILLED W/ ROTARY DRILL ONLY. WHEN INSTALLING DRILLED-IN ANCHORS IN EXISTING REINFORCED CONCRETE, USE CARE AND CAUTION TO AVOID CUTTING OR DAMAGING THE EXISTING REINFORCING BARS. MAINTAIN A REASONABLE CLEARANCE BETWEEN REINFORCEMENT AND THE DRILLED-IN ANCHOR. FILL ABANDONED HOLES W/ HIGH STRENGTH GROUT.
4. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE PERIODICALLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE CLEANLINESS, EMBEDMENT DEPTH, CONCRETE TYPE, CONCRETE COMPRESSIVE STRENGTH, DRILL BIT DIAMETER, HOLE DEPTH, EDGE DISTANCE(S), ANCHOR SPACING(S), CONCRETE THICKNESS, AND TIGHTENING TORQUE.
5. TEST ANCHORS IN ACCORDANCE W/ CBC SECTION 1910A.5.

15 SCREW ANCHOR IN CONCRETE
3/4" = 1'-0"

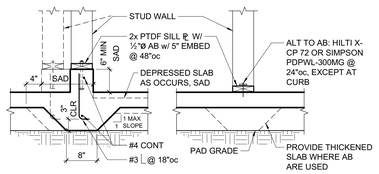
ADHESIVE ANCHOR IN 2500 PSI MIN CONCRETE							
ADHESIVE TYPE	ANCHOR THRD ROD	ANCHOR REBAR	PILOT HOLE	MIN EMBED UNO H_{nr}	MIN EDGE DISTANCE C_{min}	MIN SPCG S_{min}	MIN CONC DEPTH H_{min}
SIMPSON SET-XP (ICC-ESR 2508)	⅜"ø	#3	½"ø	3"	1¾"	3"	5"
	½"ø	#4	⅝"ø	4"	1¾"	3"	6½"
	⅝"ø	#5	¾"ø	5"	1¾"	3"	8¼"
	¾"ø	#6	⅞"ø	6"	1¾"	3"	9¾"
	⅞"ø	#7	1"ø	7"	1¾"	3"	11½"
	1"ø	#8	1⅛"ø	8"	1¾"	3"	13"
	1¼"ø	#10	1⅜"ø	10"	2½"	6"	16¼"
HILTI HIT-HY 200R (ICC-ESR 3187)	⅜"ø	N/A	⅞"ø	3"	1½"	1½"	4½"
	N/A	#3	½"ø	3"	1¾"	1⅛"	4¼"
	½"ø	N/A	⅞"ø	4"	1¾"	2½"	5½"
	N/A	#4	⅝"ø	4"	1¾"	2½"	5¼"
	⅝"ø	#5	¾"ø	5"	1¾"	3¼"	6½"
	¾"ø	#6	⅞"ø	6"	1¾"	3¾"	7¾"
	⅞"ø	#7	1"ø	7"	1¾"	4¾"	9"
	1"ø	#8	1⅛"ø	8"	1¾"	5"	10¼"
	N/A	#9	1⅜"ø	9"	1¾"	5⅝"	11⅜"
	1¼"ø	N/A	1⅜"ø	10"	1¾"	6¼"	12¾"
	N/A	#10	1½"ø	10"	1¾"	6¼"	13"

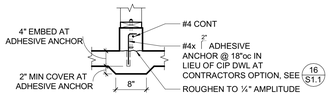


NOTES:
1. INSTALL ADHESIVE ANCHORS PER MANUFACTURER'S INFORMATION AND ICC REPORT.
2. CONTRACTOR TO VERIFY MINIMUM EDGE DISTANCES, SPACING, AND THICKNESS ARE IN ACCORDANCE W/ SCHEDULE PRIOR TO INSTALLING ANCHOR.
3. HOLES TO BE DRILLED W/ ROTARY DRILL ONLY. WHEN DRILLING HOLES IN EXISTING CONCRETE, USE CARE AND CAUTION TO AVOID CUTTING OR DAMAGING THE EXISTING REINFORCING BARS. MAINTAIN A REASONABLE CLEARANCE BETWEEN REINFORCEMENT AND THE DRILLED-IN ANCHOR. FILL ABANDONED HOLES W/ HIGH STRENGTH GROUT.
4. SPECIAL INSPECTION IS REQUIRED PER SECTION 1705A AND THE REQUIREMENTS OF THE ICC REPORTS. THE SPECIAL INSPECTOR MUST BE ON THE JOB SITE PERIODICALLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE CLEANLINESS, EMBEDMENT DEPTH, CONCRETE TYPE, CONCRETE COMPRESSIVE STRENGTH, DRILL BIT DIAMETER, HOLE DEPTH, EDGE DISTANCE(S), ANCHOR SPACING(S), CONCRETE THICKNESS, AND ADHESIVE INJECTION. TEST ANCHORS IN ACCORDANCE W/ CBC SECTION 1910A.5. SEE DRAWINGS FOR SPECIFIC TENSION TEST LOADS FOR ANCHORS.

16 ADHESIVE ANCHOR IN CONCRETE
3/4" = 1'-0"

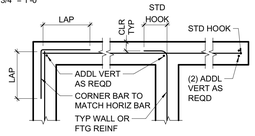
9 DETAIL NOT USED
3/4" = 1'-0"



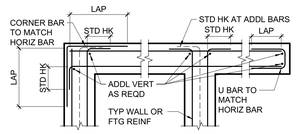


ALT CURB OPTION

10 NON-BEARING STUD WALL AT SLAB
3/4" = 1'-0"



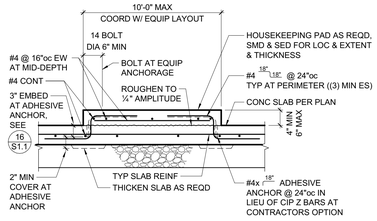
PLAN VIEW - SINGLE LAYER



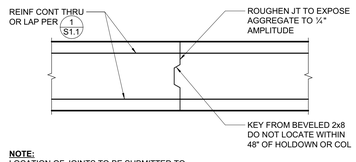
PLAN VIEW - 2 OR MORE LAYERS

NOTE:
FOOTING REINFORCING AT CORNER AND INTERSECTION TO BE SIMILAR

11 TYPICAL CORNER, INTERSECTION AND END REINFORCING
3/4" = 1'-0"

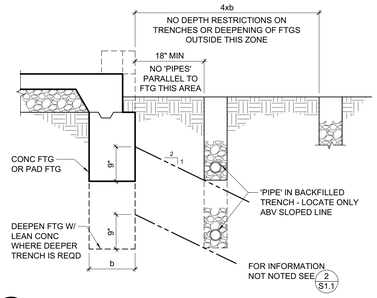


12 TYPICAL HOUSEKEEPING PAD AT SLAB ON GRADE
3/4" = 1'-0"

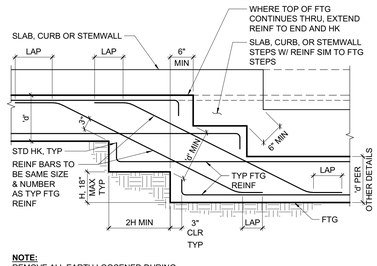


NOTE:
LOCATION OF JOINTS TO BE SUBMITTED TO ARCHITECT/ENGINEER FOR REVIEW PRIOR TO PLACEMENT OF CONCRETE

13 FOOTING CONSTRUCTION JOINT
3/4" = 1'-0"

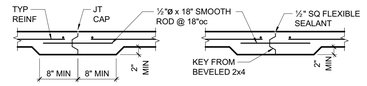


4 TRENCHING ADJACENT TO FOOTING
3/4" = 1'-0"



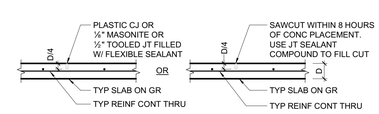
NOTE:
REMOVE ALL EARTH LOOSENED DURING EXCAVATION AND FILL W/ CONCRETE.

5 STEPPED FOOTING
3/4" = 1'-0"



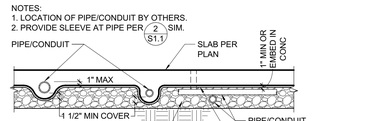
METAL JOINT **FORMED JOINT**

A CONSTRUCTION/DOWEL JOINT



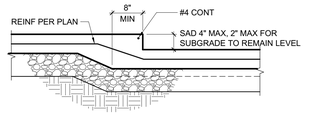
B CONTROL JOINT

6 SLAB ON GRADE JOINTS
3/4" = 1'-0"



PIPE/CONDUIT REQUIRING EMBEDMENT IN CONC **PIPE/CONDUIT IN COMPACTED ROCK**

7 CONDUIT & PIPE AT SLAB ON GRADE
3/4" = 1'-0"



8 DEPRESSED SLAB - 4" MAX
3/4" = 1'-0"

MINIMUM BAR LAPS FOR REINFORCING STEEL CONCRETE STRENGTH: 2500 PSI OR GREATER (STAGGER SPLICES)					
SIZE	LAP LENGTH	SIZE	LAP LENGTH	SIZE	LAP LENGTH
#3	14"	#6	38"	#9	94"
#4	24"	#7	60"	#10	112"
#5	36"✳	#8	76"	#11	132"

(CLASS B TOP BAR)
BAR SPCG SHALL NOT BE LESS THAN 4x BAR DIA OR 4".
✳ WHERE COVER NOT LESS THAN 1½", #5 LAP LENGTH = 30"

CONC COVER FOR REINF STL ..... 'CLR'

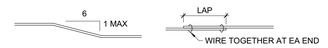
CAST AGAINST EARTH OR GR ..... 3"

EXPOSED TO EARTH (FORMED) OR WEATHER
#5 & SMALLER ..... 1½"
#6 & LARGER ..... 2"

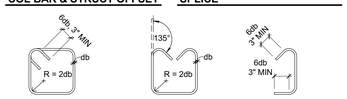
NOT EXPOSED TO EARTH OR WEATHER
#5 & SMALLER ..... 1"
#6 & LARGER, & ALL BM STIRRUPS, COL TIES & SPIRALS ..... 1½"

ALL REINF BARS SHALL EXTEND AS FAR AS POSSIBLE & END IN A STD 90° OR 180° HK UNLESS DETAILED OTHERWISE

STANDARD HOOKS & BENDS

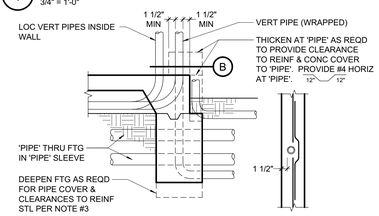


COL BAR & STRUCT OFFSET **SPLICE**

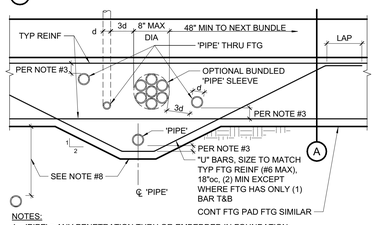


135° STIRRUP TIES #3, #4, #5 **STIRRUP #3, #4, #5** **CROSSTIE #3, #4, #5**

1 TYPICAL REINFORCING DETAILS (f'c = 2500psi MIN)
3/4" = 1'-0"

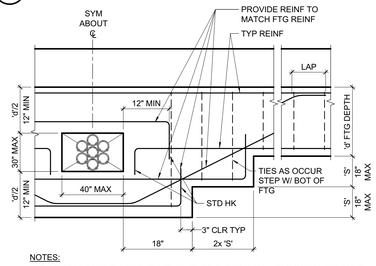


B PLAN VIEW



NOTES:
1. 'PIPE' = ANY PENETRATION THRU OR EMBEDDED IN FOUNDATION.
2. ALL PIPES THROUGH FOOTINGS TO BE WRAPPED OR SLEEVED AS FOLLOWS:
   a. SLEEVES: PROVIDE 1" MIN CLEAR ALL AROUND O.D. PIPE TO I.D. SLEEVE, UNO. SEAL SLEEVE ENDS W/ MASTIC OR PLASTIC BITUMINOUS CEMENT.
   b. WRAPPED VERTICAL PIPES: PROVIDE ¼" NOMINAL SHEET FOAM W/ (3) WRAPS MINIMUM, UNO.
   c. WRAPPED HORIZONTAL PIPES: PROVIDE ¼" NOMINAL SHEET FOAM W/ (8) WRAPS MINIMUM, UNO.
   d. UNDERGROUND FIRE LINES 4" AND LARGER:
      1. SLEEVES: PROVIDE 2" MIN CLEAR ALL AROUND O.D. PIPE TO I.D. SLEEVE. SEAL ENDS PER ABOVE.
      2. WRAPPED: PROVIDE ¼" NOMINAL SHEET FOAM W/ (16) WRAPS MINIMUM.
3. WRAPPED AND SLEEVED PIPES SHALL HAVE 1½" MIN CLEAR TO REINF STEEL. MINIMUM CONCRETE COVER AT PIPES TO BE 3".
4. CLEARANCE BETWEEN 'PIPES' TO BE 3d MIN TYP W/ A MAXIMUM OF (8) PIPES PER 48". GROUPS OF PIPES MAY BE BUNDLED AS SHOWN, EXCEPT IN PAD FOOTINGS.
5. NO 'PIPE' TO RUN PARALLEL IN FOOTINGS, STEM OR CURB.
6. PVC CONDUIT ('PIPE') EMBEDDED IN CURB/STEM MAY BE WIRE TIED TO HORIZONTAL REINF.
7. NO HORIZONTAL PIPES ALLOWED THROUGH FOOTING WITHIN 2'-0" EACH SIDE OF HOLDOWNS OR STEEL COLUMNS. NO VERTICAL PIPES ALLOWED IN FOOTINGS AT BRACED FRAMES.
8. PROVIDE 18" MIN OF COMPACTED FILL ABOVE PIPES UP TO 12"ø, FOR LARGER PIPES INCREASE COMPACTED FILL DEPTH 1'-0" OF FOR EACH 6" INCREASE IN PIPE DIAMETER. OTHERWISE DEEPEN FOOTING AS SHOWN.

2 PIPES THRU FOOTING
3/4" = 1'-0"



NOTES:
1. DO NOT LOCATE BLOCKOUT WITHIN 48" OF SHEAR WALL HOLD DOWN, IN FRAME FOUNDATIONS OR COLUMN PAD FOOTINGS.
2. MINIMUM DISTANCE BETWEEN BLOCKOUTS OR OTHER PIPES TO BE 48".

3 FOUNDATION BLOCKOUT
3/4" = 1'-0"

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636 FIFTH ST.
SANTA ROSA, CA 95404
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LIBERTY HIGH SCHOOL

NEW MAINTENANCE OPERATIONS & TRANSPORTATION FACILITIES

850 2ND STREET
BRENTWOOD, CA
94513
LIBERTY UNION HIGH SCHOOL DISTRICT

FOR REFERENCE ONLY

-	-	-

ARCH PROJECT NO:	1707.00
ENGINEER:	KPB
PROJECT MANAGER:	AIZ
PTN:	
	100% DD
	MAY 11, 2018

SHEET TITLE

TYPICAL CONCRETE DETAILS

SHEET NUMBER

S1.1

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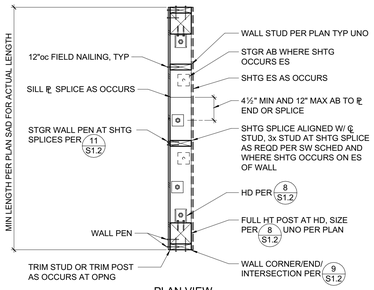
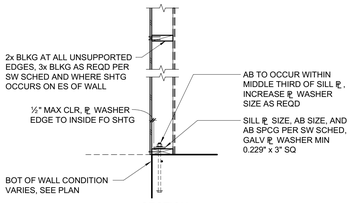


PLAN VIEW



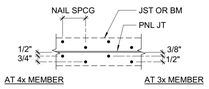
SECTION

NOTES:
1. PEN = PLYWOOD/OSB EDGE NAILING PER SW SCHED.
2. SILL ℄ AB WASHER HOLE MAY BE OVERSIZED UP TO 3/16". WASHER MAY BE DIAG SLOTTED UP TO 1¼" IN LENGTH. WHERE HOLE IS OVERSIZED OR SLOTTED, PROVIDE STD CUT WASHER.

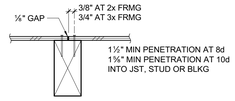
7 SCHEMATIC SHEAR WALL CONSTRUCTION
3/4" = 1'-0"

RIM JOIST TO TOP ℄, TOE NAIL	10d @ 6"oc
TRUSSES, JOISTS OR RAFTERS AT ALL BEARING POINTS TOE NAILS EACH SIDE	(2) 10d
TRUSSES, JOISTS OR RAFTERS TO SIDE OF STUDS EIGHT (8) INCH JOISTS OR LESS	(3) 16d
FOR EACH ADDITIONAL 4 INCHES OF DEPTH OF JOIST	(1) 16d
BLOCKING BETWEEN JOISTS OR RAFTERS: TO JOIST OR RAFTERS - TOE NAILS EA SIDE, EA END	(2) 10d
TO JOIST OR RAFTER BEARINGS - TOE NAILS EA SIDE	(2) 10d
BLOCKING BETWEEN STUDS, EACH END TOE NAILS	(2) 10d OR (2) 16d
BRIDGING TO JOIST, TOE NAIL EACH END	(2) 8d
2" SUBFLOOR TO JOIST OR GIRDER, BLIND & FACE NAIL	(2) 16d
SOLE PLATE TO JOIST OR BLOCKING, FACE NAIL	16d @ 16"oc
SOLE PLATE TO JOIST OR BLOCKING AT BRACED WALL PANELS	(3) 16d @ 16"oc
TOP PLATE TO STUD, END NAIL	(2) 16d
STUD TO SOLE PLATE, TOE NAIL	(4) 8d
DOUBLE STUDS AT EXTERIOR WALLS, FACE NAIL	16d @ 12"oc
DOUBLE STUDS, FACE NAIL	16d @ 24"oc
DOUBLE TOP PLATES, FACE NAIL	16d @ 12"oc
TOP PLATES, LAPS & INTERSECTIONS, FACE NAIL	(3) 16d
CONTINUOUS HEADER, TWO PIECES	16d @ 16"oc ALONG EACH EDGE
DOUBLE TOP PLATE LAP AT CORNER	(3) 16d
CONTINUOUS HEADER TO STUD, TOE NAIL	(4) 8d
CEILING JOISTS, LAPS OVER PARTITIONS, FACE NAIL	(3) 16d
CEILING JOISTS TO PARALLEL RAFTERS, FACE NAIL	(3) 16d
BUILT-UP CORNER STUDS	16d @ 12"oc
POST TO SILL/SOLE/TOP PLATE, EACH SIDE TOE NAIL	(4) 10d

10 NAILING SCHEDULE
3/4" = 1'-0"



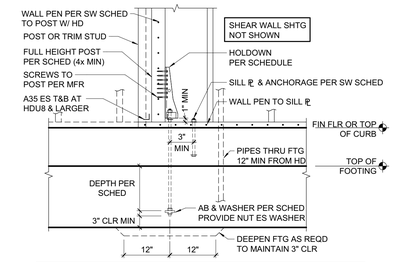
PLAN VIEW AT CLOSE NAIL SPACING
(3"oc OR LESS SPACING AT FLOOR OR ROOF)
(4"oc OR LESS SPACING AT SHEAR WALL)



SECTION AT TYP NAIL SPACING

NOTE:
SHEATHING SHEETS ARE TO BE AS LARGE AS POSSIBLE. STAGGER SHEETS. JOINTS ARE TO BE CENTERED OVER BEARING. NAIL HEADS SHALL BE DRIVEN FLUSH W/ SHEATHING. MINIMUM SHEATHING SIZE IS 24" WIDTH x 48" LENGTH AT FLOOR AND ROOF, AND 12"x48" AT WALLS.

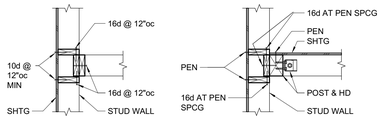
11 SHEATHING NAILING
1 1/2" = 1'-0"



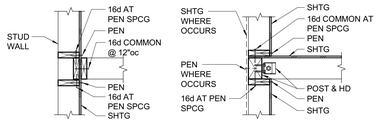
HOLDOWN	AB OR THRD ROD	WASHER AT AB	DEPTH	MIN FTG WIDTH	MIN POST SIZE UNO ON PLANS
HDU2	⅝"ø	3"x3" SQ	12"	12"	4x
HDU4	⅝"ø	3"x3" SQ	12"	12"	4x
HDU5	⅝"ø	3"x3" SQ	12"	12"	4x
HDU8	⅞"ø	3"x2½" SQ	15"	18"	6x6
HDU11	1"ø	3"x2½" SQ	15"	18"	6x6
HDU14*	1"ø	3"x3" SQ	21"	24"	6x6

*NUTS AT ANCHOR ROD TO BE HEAVY HEX

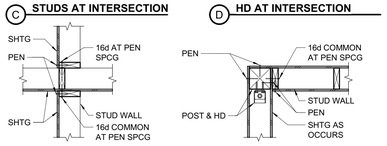
8 TYPICAL HOLDOWN
3/4" = 1'-0"



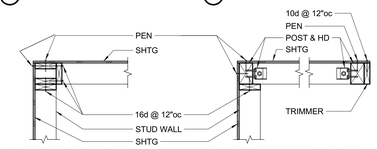
A STUDS AT INTERSECTION
B HD AT INTERSECTION



C STUDS AT INTERSECTION
D HD AT INTERSECTION

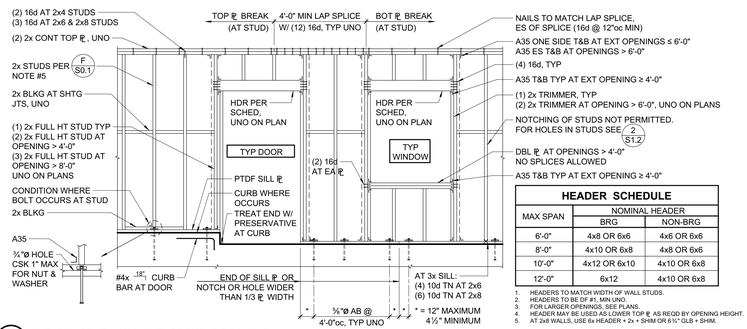


E STUDS AT INTERSECTION
F HD AT CORNER



G STUDS AT CORNER
H HD AT CORNER AND END

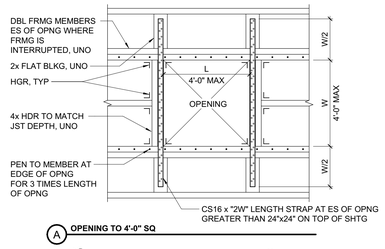
9 TYPICAL PLAN VIEW OF STUD WALL INTERSECTIONS
3/4" = 1'-0"



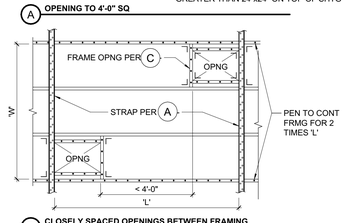
HEADER SCHEDULE		
MAX SPAN	NOMINAL HEADER	
	BRG	NON-BRG
6'-0"	4x8 OR 6x6	4x6 OR 6x6
8'-0"	4x10 OR 6x8	4x8 OR 6x6
10'-0"	4x12 OR 6x10	4x10 OR 6x8
12'-0"	6x12	4x10 OR 6x8

1. HEADERS TO MATCH WIDTH OF WALL STUDS.
2. HEADERS TO BE DF #1, MIN UNO.
3. FOR LARGER OPENINGS, SEE PLANS.
4. HEADER MAY BE USED AS LOWER TOP ℄ AS REQD BY OPENING HEIGHT.
5. AT 2x8 WALLS, USE 6x HEADER + 2x + SHIM OR 6¼" GLB + SHIM.

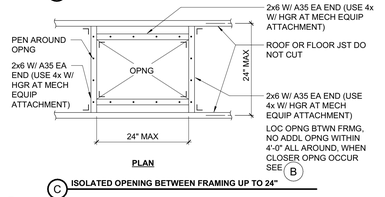
1 TYPICAL STUD WALL AND OPENING FRAMING
3/8" = 1'-0"



A OPENING TO 4'-0" SQ



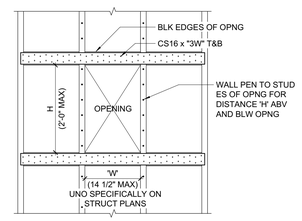
B CLOSELY SPACED OPENINGS BETWEEN FRAMING



PLAN

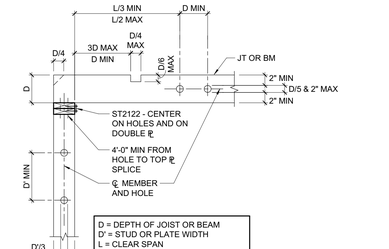
C ISOLATED OPENING BETWEEN FRAMING UP TO 24"

5 OPENING IN DIAPHRAGM
3/4" = 1'-0"



NOTES:
1. OPENINGS < 6" SQ DO NOT REQUIRE BLOCKING AND STRAPPING.
2. NO ADDITIONAL OPENINGS WITHIN 4'-0" ALL AROUND.
3. NO OPENINGS PERMITTED IN SHEAR WALL (C) OR HIGHER OR IN SHEAR WALLS LESS THAN 10'-0" LONG UNLESS SPECIFICALLY DETAILED ON STRUCTURAL PLANS. CONTACT STRUCTURAL ENGINEER FOR ASSISTANCE.
4. FRAME OPENINGS PER **1/S1.2** WHERE STUDS ARE INTERRUPTED.

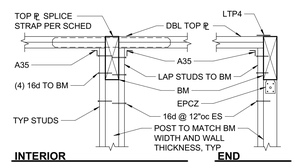
6 SMALL OPENINGS IN SHEARWALLS
3/4" = 1'-0"



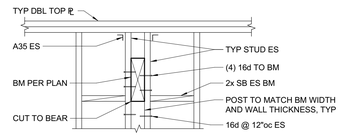
D = DEPTH OF JOIST OR BEAM
D' = STUD OR PLATE WIDTH
L = CLEAR SPAN

NOTE: DO NOT NOTCH OR DRILL STUDS AND JOISTS WITHIN D' OR D OF KNOTS IN WOOD

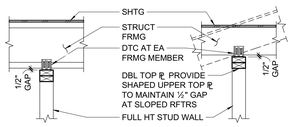
2 HOLES AND NOTCHES IN WOOD STUDS, JOISTS, AND PLATES
3/4" = 1'-0"



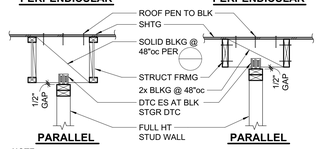
INTERIOR END



3 TYPICAL BEAM IN AND THRU STUD WALL
3/4" = 1'-0"



PERPENDICULAR PERPENDICULAR



PARALLEL PARALLEL

NOTE:
INSTALL SLOT NAILS AT ℄ OF SLOT W/ ⅛" GAP BTWN NAIL HEAD & CLIP

4 TYPICAL NON-STRUCTURAL STUD WALL DETAILS
3/4" = 1'-0"

FOR REFERENCE ONLY

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LIBERTY UNION HIGH SCHOOL DISTRICT

-	-	-

ARCH PROJECT NO: 1707.00
ENGINEER: KPB
PROJECT MANAGER: AIZ
PTN:
100% DD
MAY 11, 2018

SHEET TITLE

TYPICAL WOOD DETAILS

SHEET NUMBER

S1.2

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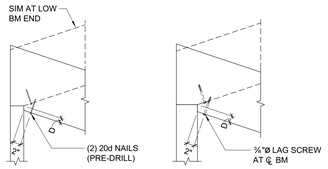
9 DETAIL NOT USED
1 1/2" = 1'-0"

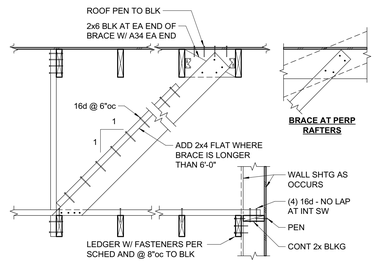


A CASE 1 (WHERE D IS LESS THAN OR EQUAL TO 1½")

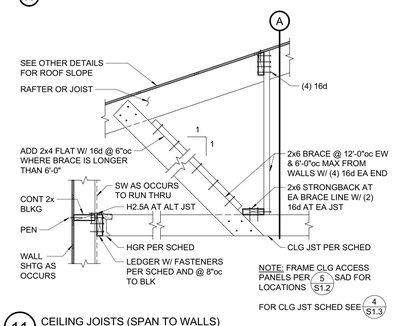
B CASE 2 (WHERE D IS GREATER THAN 1½")

NOTES:
1. DO NOT OVERCUT NOTCHES OR SEAT CUTS.
2. SEE OTHER DETAILS FOR MAXIMUM NOTCH OR SEAT CUT SIZE.

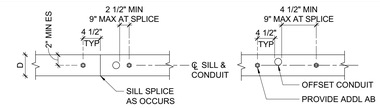
10 BEAM SEAT CUT/NOTCH REINFORCEMENT
3/4" = 1'-0"



A AT END WALL OR FULL HEIGHT PARTITION

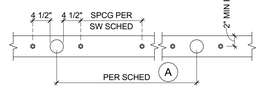


11 CEILING JOISTS (SPAN TO WALLS)
3/4" = 1'-0"

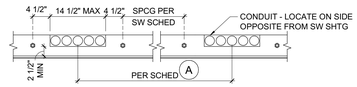


CASE 1 - SINGLE, CONDUIT DIAMETER ≤ D/3, MAX SPCG = 16"oc

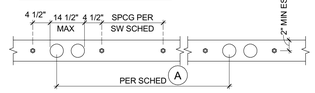
CASE 2 - SPLIT IN SILL



CASE 3 - SINGLE, CONDUIT DIAMETER > D/3



CASE 4 - NOTCH FOR CONDUIT

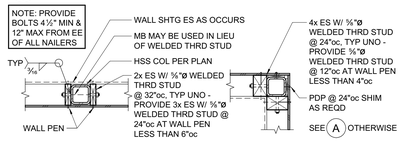


CASE 5 - MULTI CONDUIT, DIAMETER > D/3

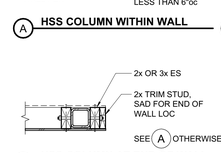
SCHEDULE A			
	CASE 3	CASE 4	CASE 5
SW (A)	48"	32"	48"
SW (B)	64"	48"	64"
SW (C)	80"	64"	N/A
SW (D)	N/A	N/A	N/A

NOTE:
1. ALL PENETRATIONS THROUGH SHEAR WALL SILL PLATE SHALL CONFORM TO THE REQUIREMENTS OF THIS DETAIL OR BE REROUTED PRIOR TO INSTALLATION OF SILL.
2. ADDITIONAL ANCHOR BOLTS TO BE INSTALLED PER **15|S1.1** WHERE NECESSARY.

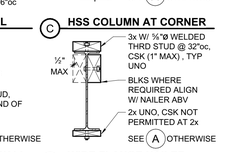
5 HOLES IN PLATES AT SHEAR WALLS
3/4" = 1'-0"



A HSS COLUMN WITHIN WALL



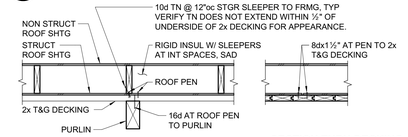
C HSS COLUMN AT CORNER



B HSS COLUMN AT END OF WALL (EDGE OF OPNG SIM)

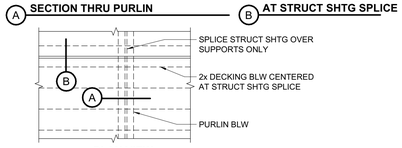
D WIDE FLANGE NAILER (CHANNEL & HSS SIM)

6 TYPICAL STEEL BEAM/COLUMN NAILERS
3/4" = 1'-0"



A SECTION THRU PURLIN

B SECTION THRU DECKING AT STRUCT SHTG SPLICE



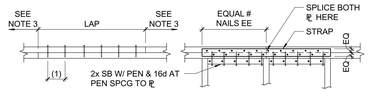
PLAN VIEW

7 RIGID INSULATION OVER 2x T&G DECKING W/ SLEEPERS
3/4" = 1'-0"

8 DETAIL NOT USED
1 1/2" = 1'-0"

TOP PLATE SPLICE SCHEDULE		
MARK	LAP SPLICE (CASE 1)	STRAP SPLICE (CASE 2)
A	(12) 16d PER 4'-0" MIN LAP	MSTC28
B	(22) 16d PER 4'-0" MIN LAP	MSTC40
C	(26) 16d PER 6'-0" MIN LAP	MSTC52
D	(32) 16d PER 6'-0" MIN LAP	MSTC66
E	(36) 16d PER 8'-0" MIN LAP	MSTC28 EA SIDE
F	(44) 16d PER 8'-0" MIN LAP	MSTC40 EA SIDE
G	(50) 16d PER 10'-0" MIN LAP	MSTC52 EA SIDE

NOTES:
1. AT LAP SPLICES, SPACE NAILS @ 3"oc MIN (MAX 12"oc). STAGGER AT 2½" GAGE.
2. USE STRAP SPLICE WHERE BM INTERSECTS TOP ℄.
3. NAILS TO MATCH LAP SPLICE ES OF SPLICE (16d @ 12"oc MIN)
4. USE SPLICE TYPE A UNO.

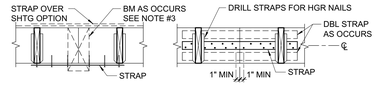


CASE 1 **CASE 2**

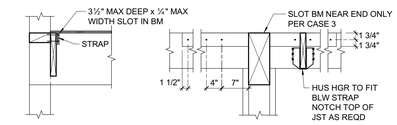
1 TOP PLATE SPLICE SCHEDULE AND DETAILS
3/4" = 1'-0"

LEDGER SPLICE SCHEDULE					
MARK	CASE	STRAP/PLATE	CASE	STRAP/PLATE	
A	1	MSTA24	1		
B	1	MSTA30	1		
C	2	MSTI48	3	MSTI60	
D	2	CMST14x5'-6"	3	CMST14x6'-0"	
E	2	(2) MSTI48	4	℄ ¼" W/ (6) 1"ø MB ES OF SPLICE	

SPLICE NOTES:
1. PROVIDE 3x OR (2) 2x STUDS AT SPLICE
2. ALL NAILS TO BE 10d NAIL ALL HOLES
3. FOR CASE 1, SPLICE W/ MSTA36 AT BM
4. USE SPLICE TYPE "**A**" UNO

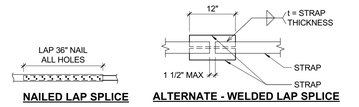


CASE 1 **CASE 2**



CASE 3 **CASE 4**

2 LEDGER OR RIM SPLICE SCHEDULE
3/4" = 1'-0"



NAILED LAP SPLICE **ALTERNATE - WELDED LAP SPLICE**

TIE STRAP SCHEDULE							
MARK	STRAP	MIN. NAILING ES OF ◆	MAX. NAIL SPACING (SEE NOTES #1 & #2)			MIN. END LENGTH (EL)	CAPACITY (lbs) (160)
			CASE 1	CASE 2 EL	CASE 2 RL		
A	CS16	(10) 10d	10d @ 4"oc STGR	FILL ALL NAIL HOLES	10d @ 4"oc STGR	12"	1705
B	CS14	(13) 10d	10d @ 4"oc STGR	FILL ALL NAIL HOLES	10d @ 4"oc STGR	16"	2490
C	CMSTC16	(25) 10d	10d @ 3"oc STGR	FILL ALL NAIL HOLES	10d @ 3"oc STGR	24"	4565
D	CMST14	(33) 10d	10d @ 3½"oc STGR	FILL ALL NAIL HOLES	10d @ 3½"oc STGR	32"	6490
E	CMST12	(43) 10d	10d @ 3½"oc STGR	FILL ALL NAIL HOLES	10d @ 3½"oc STGR	48"	9215

1. CASE 1 APPLIES UNLESS END LENGTH (EL) IS NOTED ON PLANS. WHERE END LENGTH (EL) IS NOTED, SEE CASE 2.

CASE 1 **CASE 2**

2. AS REQUIRED, PROVIDE CLOSER NAIL SPACING TO MEET MINIMUM NAILING EACH SIDE OF ◆ .
3. LOCATE STRAPS OVER SHEATHING AND BLOCK UNDER STRAP W/ FLAT 2x6 WHERE NO FRAMING OCCURS, UNO.
4. SEE PLANS FOR STRAP LENGTHS, LOCATIONS AND DETAILS, UNO.
5. SPLICE STRAPS AS SHOWN WHERE LENGTH PER PLAN EXCEEDS AVAILABLE PRODUCT LENGTH

3 TIE STRAP SCHEDULE
3/4" = 1'-0"

CEILING JOIST SCHEDULE			
MAX SPAN	JOIST SIZE	HANGER IF REQUIRED	LEDGER IF REQUIRED
9'-0"	2x4 @ 16"oc	LU24	2x4 W/ (2) 16d @ 16"oc
12'-6"	2x6 @ 16"oc	LU26	2x6 W/ (3) 16d @ 16"oc
14'-0"	2x8 @ 16"oc	LU28	2x8 W/ (4) 16d @ 16"oc
19'-0"	2x10 @ 16"oc	LU210	2x10 W/ (5) 16d @ 16"oc

NOTES:
1. CEILING JOIST SCHEDULE IS BASED ON LL = 10 psf.
2. WHERE LEDGERS ARE NAILED THROUGH WALL SHTG, USE 20d NAILS IN LIEU OF 16d NAILS.
3. PROVIDE MIDSPAN BLOCKING AT 2x10 JOISTS.

4 CEILING JOIST SCHEDULE
3/4" = 1'-0"

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ARCH PROJECT NO: 1707.00
ENGINEER: KPB
PROJECT MANAGER: AIZ
PTN:
100% DD
MAY 11, 2018

SHEET TITLE

TYPICAL WOOD DETAILS

SHEET NUMBER

S1.3

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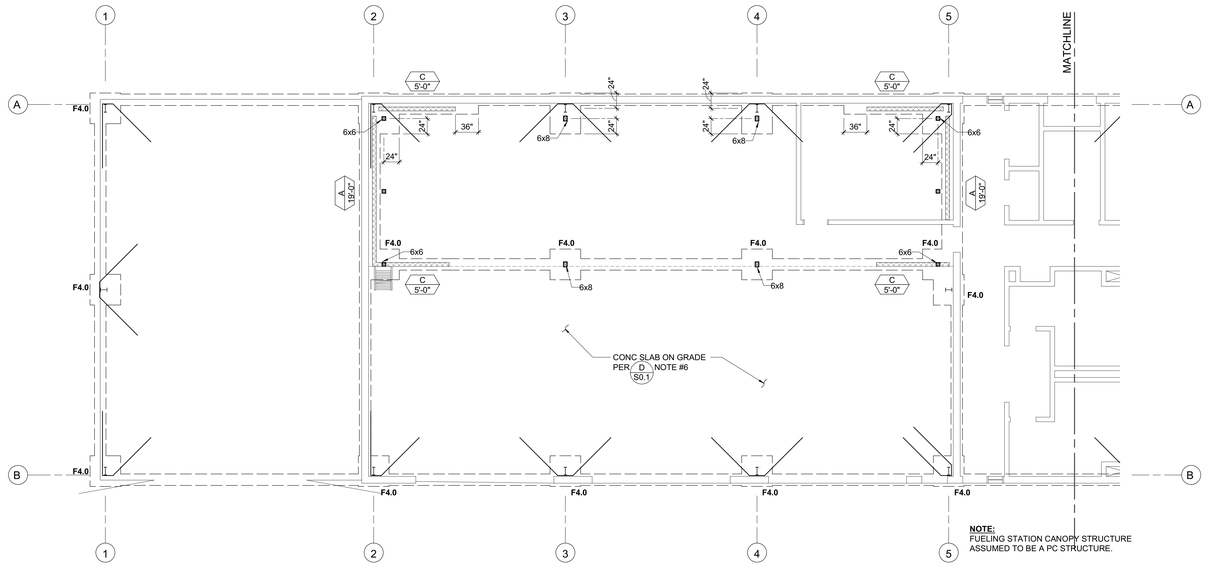


NOTE:
FUELING STATION CANOPY STRUCTURE ASSUMED TO BE A PC STRUCTURE.

M&O SHOP AND STORAGE FOUNDATION PLAN

1/8" = 1'-0"

FOUNDATION PLAN NOTES:

1. REFER TO SHEETS **S0.1**, **S1.1**, **S1.2**, **S1.3**, **S1.4** AND **S4.1** FOR GENERAL NOTES AND TYPICAL DETAILS. THE FOLLOWING DETAIL REFERENCES ARE PROVIDED FOR THE CONTRACTOR'S CONVENIENCE ONLY. ALL GENERAL NOTES AND TYPICAL DETAILS NOTED ABOVE ARE APPLICABLE AND SHALL BE FOLLOWED.
2. COORDINATE ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS PRIOR TO CONSTRUCTION. NOTIFY ARCHITECT/ENGINEER OF ANY DISCREPANCIES.
3. SEE DETAILS OR CURB PLAN FOR CURB LOCATIONS. COORDINATE WITH ARCHITECTURAL DRAWINGS PRIOR TO CONSTRUCTION. NOTIFY ARCHITECT/ENGINEER OF ANY DISCREPANCIES. PROVIDE LONGER ANCHOR BOLTS AT CURBS PER **G/S0.1**.
4. PLUMBING AND ELECTRICAL CONDUIT AND GROUND STRAP SHALL NOT BE LAID WITHIN FOUNDATIONS. NO UTILITY PIPES OR CONDUITS SHALL BE LOCATED THRU COLUMN FOOTINGS OR FRAME FOOTINGS. NO VERTICAL OR HORIZONTAL PIPES OR CONDUITS SHALL BE LOCATED THROUGH STEEL FRAMES, STEEL COLUMNS, OR STEEL BASE PLATES. PROVIDE FURRING AND/OR THICKENED CONCRETE WHERE REQUIRED TO CLEAR UTILITY SYSTEMS. NOTIFY STRUCTURAL ENGINEER/ARCHITECT PRIOR TO ANY INSTALLATION NOT CONFORMING TO THESE DETAILS.
5. PLUMBING AND ELECTRICAL CONDUIT AND GROUND STRAP SHALL NOT BE LAID WITHIN FOUNDATIONS. NO UTILITY PIPES OR CONDUITS SHALL BE LOCATED THRU COLUMN FOOTINGS OR FRAME FOOTINGS. NO PIPES OR CONDUITS THRU SILL PLATES SHALL BE WITHIN 12" OF HOLDOWN BOLTS. NO MECHANICAL, ELECTRICAL, OR PLUMBING OPENINGS SHALL BE LOCATED IN SHEAR WALLS UNLESS SHOWN AND DETAILED ON THE STRUCTURAL DRAWINGS. NO VERTICAL OR HORIZONTAL PIPES OR CONDUITS SHALL BE LOCATED THROUGH STEEL FRAMES, STEEL COLUMNS, OR STEEL BASE PLATES. PROVIDE FURRING AND/OR THICKENED CONCRETE WHERE REQUIRED TO CLEAR UTILITY SYSTEMS. NOTIFY STRUCTURAL ENGINEER/ARCHITECT PRIOR TO ANY INSTALLATION NOT CONFORMING TO THESE DETAILS.

   PIPES THROUGH FOOTINGS SHALL BE PER **2/S1.1** AND **3/S1.1** .

   PIPES PARALLEL TO FOOTINGS SHALL BE PER **4/S1.1** .

   PIPES AT SLAB ON GRADE SHALL BE PER **7/S1.1**.

   PIPES THROUGH WOOD FRAMING SHALL BE PER **2/S1.2** AND **5/S1.3** .
6. CONTRACTOR SHALL DETERMINE FOUNDATION STEP LOCATIONS BASED ON GEOTECHNICAL REPORT, CIVIL, ARCHITECTURAL AND LANDSCAPE DRAWINGS. STEP FOOTING PER **5/S1.1**.
7. SEISMIC GAPS WHERE NOTED ARE DIMENSIONED CLEAR BETWEEN WALL FINISHES. THIS GAP TO BE MAINTAINED ENTIRELY CLEAR TO ALLOW FOR DIFFERENTIAL BUILDING MOVEMENT. NO PIPES, CONDUITS, ETCETERA SHALL BE LOCATED WITHIN THE GAP. PROVIDE FLEXIBLE COUPLINGS AT ALL UTILITIES CROSSING SEISMIC GAPS.

PLAN LEGEND

SYMBOL	REFERENCE DETAIL	DESCRIPTION
	1/S1.2	INDICATES STRUCTURAL WALL.
	7/S1.2	INDICATES SHEAR WALL TYPE AND MINIMUM WALL LENGTH. SYMBOL LOCATION INDICATES SHEATHED FACE OF WALL UNLESS NOTED OTHERWISE.
A 10'-0"	G/S0.1	
	F/S0.1	INDICATES WOOD POST.
•	8/S1.2	INDICATES POST WITH HOLDOWN. POSTS WITH HOLDOWN ARE FULL HEIGHT FROM SILL TO TOP PLATE.
	6/S1.3	INDICATES STEEL COLUMN.
		INDICATES FOUNDATION.
CF2		INDICATES CONTINUOUS FOOTING SIZE AND REINFORCING PER SCHEDULE.
F2		INDICATES PAD FOOTING SIZE AND REINFORCING PER SCHEDULE.
DS	8/S1.1 9/S1.1	INDICATES DEPRESSED SLAB, SEE ARCHITECTURAL AND PLUMBING DRAWINGS FOR COMPLETE LOCATIONS, DEPTH AND SLOPE INFORMATION.
		INDICATES STEP IN ELEVATION, SEE ARCHITECTURAL DRAWINGS.
88		INDICATES GRIDLINE AT CENTERLINE OF COLUMN.
1 S3.1		INDICATES ELEVATION.
		INDICATES EXISTING FOUNDATION.
		INDICATES EXISTING FRAMING.

CONTINUOUS FOOTING SCHEDULE

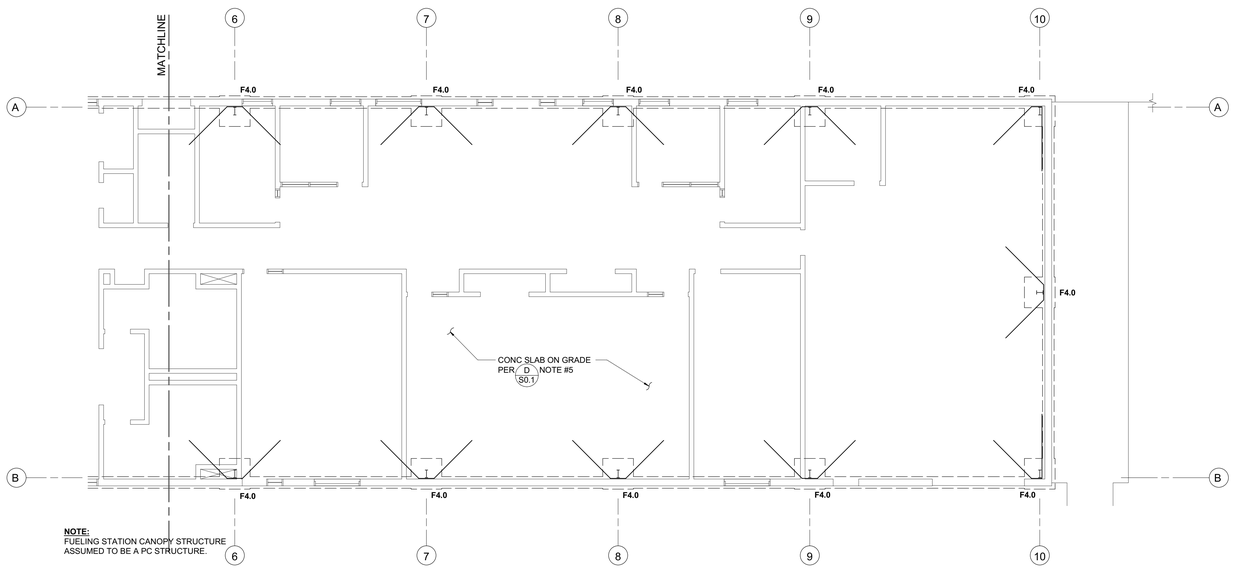
MARK	'b'	'd'	REINF 'a'	NOTES
CF18	18"	18"	(2) #5 T&B	PROVIDE #3 TIES @ 24"oc

PAD FOOTING SCHEDULE

MARK	SIZE	REINFORCING
F4.0	4'-0" SQ x 18" DEEP	(5) #5 T&B

SHEAR WALL SCHEDULE

SW	APA RATED SHEATHING	NAILING (PEN)	ANCHORAGE 7x/8 BOLT FDN		REMARKS
			2x SILL	3x SILL	
A	15/32 " (32/16) EXP 1	10d @ 6"oc	32"oc	48"oc	
B	15/32 " (32/16) EXP 1	10d @ 4"oc	24"oc	32"oc	3x MIN AT ALL ADJOINING PANEL EDGES
C	15/32 " (32/16) EXP 1	10d @ 3"oc	16"oc	24"oc	
D	15/32 " (32/16) EXP 1	10d @ 2"oc	-	16"oc	
E	15/32 " (32/16) EXP 1 **BOTH SIDES**	10d @ 3"oc	-	12"oc	



NOTE:
FUELING STATION CANOPY STRUCTURE ASSUMED TO BE A PC STRUCTURE.

M&O SHOP AND STORAGE FOUNDATION PLAN

1/8" = 1'-0"

FOUNDATION SIZES SUBJECT TO CHANGE BASED ON LOADS FROM METAL BUILDING MANUFACTURER

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BRENTWOOD, CA
94513

LIBERTY UNION HIGH SCHOOL DISTRICT

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ARCH PROJECT NO: 1707.00
ENGINEER: KPB
PROJECT MANAGER: AIZ
PTN:

100% DD

MAY 11, 2018

SHEET TITLE
M&O SHOP AND STORAGE FOUNDATION PLAN

SHEET NUMBER
S2.1

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FRAMING PLAN NOTES:

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3. MECHANICAL, ELECTRICAL AND PLUMBING PENETRATIONS THROUGH WALLS, ROOFS OR FLOORS SHALL BE PER REFERENCES BELOW UNLESS SHOWN AND DETAILED OTHERWISE ON THE STRUCTURAL PLANS. NOTIFY ARCHITECT/ENGINEER PRIOR TO ANY INSTALLATION NOT CONFORMING TO THESE DETAILS.

   PENETRATIONS THROUGH SHEAR WALLS SHALL BE PER **6/S1.2** .

   PENETRATIONS THROUGH FLOORS/ROOFS SHALL BE PER **5/S1.2** .
4. ALL EXTERIOR WALLS NOT DESIGNATED AS SHEAR WALLS ON PLANS (INCLUDING WALLS ADJACENT TO SEISMIC GAPS) SHALL BE SHEATHED AS SHEAR WALL TYPE **'A'** PER SHEAR WALL SCHEDULE, UNLESS NOTED OTHERWISE.
5. SEISMIC GAPS WHERE NOTED ARE DIMENSIONED CLEAR BETWEEN WALL FINISHES. THIS GAP TO BE MAINTAINED ENTIRELY CLEAR TO ALLOW FOR DIFFERENTIAL BUILDING MOVEMENT. NO PIPES, CONDUITS, ETCETERA SHALL BE LOCATED WITHIN THE GAP. PROVIDE FLEXIBLE COUPLINGS AT ALL UTILITIES CROSSING SEISMIC GAPS.

PLAN LEGEND

SYMBOL	REFERENCE DETAIL	DESCRIPTION
	1/S1.2	INDICATES STRUCTURAL WALL.
	F/S0.1	INDICATES WOOD POST.
	6/S1.3	INDICATES STEEL COLUMN.
3½x12 GLB C=1"	F/S0.1	INDICATES GLULAM BEAM SIZE AND CAMBER. WHERE NO CAMBER IS SPECIFIED SEE WOOD FRAMING NOTES FOR TYPICAL GLULAM BEAM CAMBER.
	11/S1.2	INDICATES PANEL EDGE NAILING ALONG FULL LENGTH OF MEMBER.
	F/S0.1	INDICATES HANGER.
88		INDICATES GRIDLINE AT CENTERLINE OF COLUMN.
MU 1,000#	8/S1.3 9/S1.3	INDICATES APPROXIMATE LOCATION, SIZE AND MAXIMUM WEIGHT OF MECHANICAL UNIT. SEE MECHANICAL DRAWINGS FOR ANCHORAGE AND ADDITIONAL INFORMATION.
		INDICATES STEP IN ELEVATION, SEE ARCHITECTURAL DRAWINGS.
A	1/S1.3	INDICATES TOP PLATE SPLICE. SPLICE TYPE SHALL OCCUR ALONG THE ENTIRE LENGTH OF THE WALL, UNO. PROVIDE SPLICE TYPE **'A'** IF NOT NOTED ON PLANS.
A	2/S1.3	INDICATES LEDGER/RIM SPLICE. SPLICE TYPE SHALL OCCUR ALONG THE ENTIRE LENGTH OF THE WALL, UNO. PROVIDE SPLICE TYPE **'A'** IF NOT NOTED ON PLANS.
A 4'-0"	3/S1.3	INDICATES TIE STRAP. SEE SCHEDULE FOR STRAP, NAILING AND LENGTH.

TIE STRAP SCHEDULE

MARK	STRAP	MIN. NAILING ES OF ▾	MAX. NAIL SPACING (SEE NOTES #1 & #2) CASE 1	CASE 2 EL	CASE 2 RL	MIN. END LENGTH (EL)	CAPACITY (lbs) (1920)
Ⓐ	CS16	(10) 10d	10d @ 4"oc STGR	FILL ALL NAIL HOLES	10d @ 4"oc STGR	12"	1705
Ⓑ	CS14	(13) 10d	10d @ 4"oc STGR	FILL ALL NAIL HOLES	10d @ 4"oc STGR	16"	2490
Ⓒ	CMSTC16	(25) 10d	10d @ 3"oc STGR	FILL ALL NAIL HOLES	10d @ 3"oc STGR	24"	4585
Ⓓ	CMST14	(33) 10d	10d @ 3½"oc STGR	FILL ALL NAIL HOLES	10d @ 3½"oc STGR	32"	6490
Ⓔ	CMST12	(43) 10d	10d @ 3½"oc STGR	FILL ALL NAIL HOLES	10d @ 3½"oc STGR	48"	9215

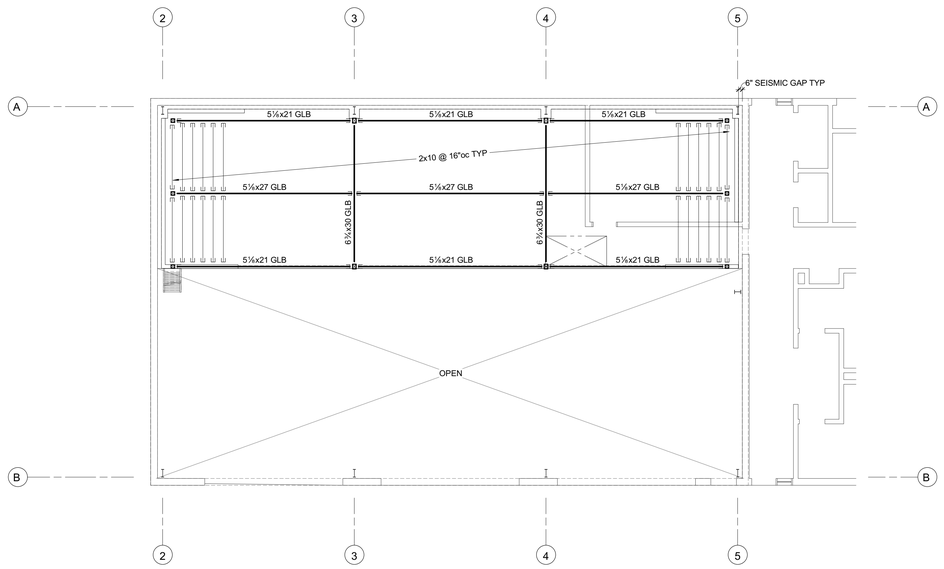
1. CASE 1 APPLIES UNLESS END LENGTH (EL) IS NOTED ON PLANS. WHERE END LENGTH (EL) IS NOTED, SEE CASE 2.

TOP PLATE SPLICE SCHEDULE

MARK	LAP SPLICE (CASE 1)	STRAP SPLICE (CASE 2)
A	(12) 16d PER 4'-0" MIN LAP	MSTC28
B	(22) 16d PER 4'-0" MIN LAP	MSTC40
C	(26) 16d PER 6'-0" MIN LAP	MSTC52
D	(32) 16d PER 6'-0" MIN LAP	MSTC66
E	(36) 16d PER 8'-0" MIN LAP	MSTC28 EA SIDE
F	(44) 16d PER 8'-0" MIN LAP	MSTC40 EA SIDE
G	(50) 16d PER 10'-0" MIN LAP	MSTC52 EA SIDE

LEDGER SPLICE SCHEDULE

MARK	CASE	STRAP/PLATE	CASE	STRAP/PLATE
Ⓐ	1	MSTA24	1	
Ⓑ	1	MSTA30	1	
Ⓒ	2	MSTI48	3	MSTI60
Ⓓ	2	CMST14x5'-6"	3	CMST14x6'-0"
Ⓔ	2	(2) MSTI48	4	@ ¼" W/ (6) 1"ø MB ES OF SPLICE



M&O SHOP AND STORAGE MEZZANINE FRAMING PLAN

1/8" = 1'-0"

MEZZANINE FRAMING SUBJECT TO CHANGE IF I-JOIST ALTERNATE IS CHOSEN

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PTN:

100% DD
MAY 11, 2018

SHEET TITLE
M&O SHOP AND STORAGE MEZZANINE FRAMING PLAN

SHEET NUMBER
S2.2

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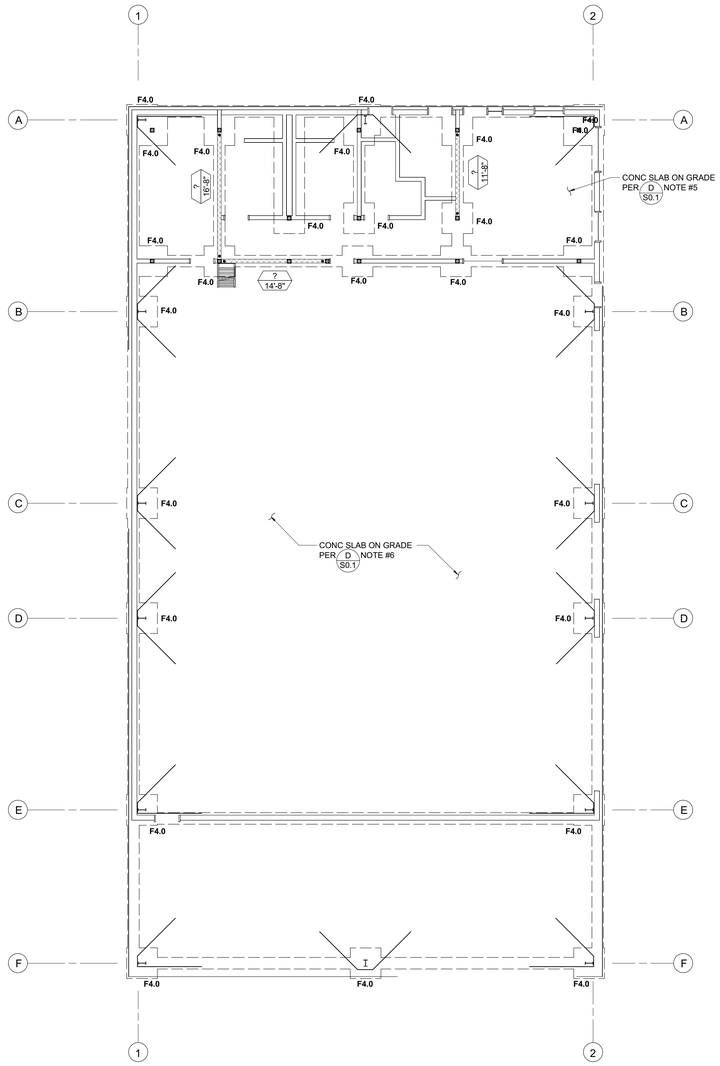

BUS SHOP FOUNDATION PLAN

1/8" = 1'-0"

FRAMING PLAN NOTES:

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PLAN LEGEND

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	F/S0.1	INDICATES WOOD POST.
	6/S1.3	INDICATES STEEL COLUMN.
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CONTINUOUS FOOTING SCHEDULE

MARK	'b'	'd'	REINF 'a'	NOTES
CF18	18"	18"	(2) #5 T&B	PROVIDE #3 TIES @ 24"oc

PAD FOOTING SCHEDULE

MARK	SIZE	REINFORCING
F4.0	4'-0" SQ x 18" DEEP	(5) #5 T&B

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ARCH PROJECT NO: 1707.00
ENGINEER: KPB
PROJECT MANAGER: AIZ
PTN:
100% DD
MAY 11, 2018

SHEET TITLE

BUS SHOP FOUNDATION PLAN

SHEET NUMBER

S2.3

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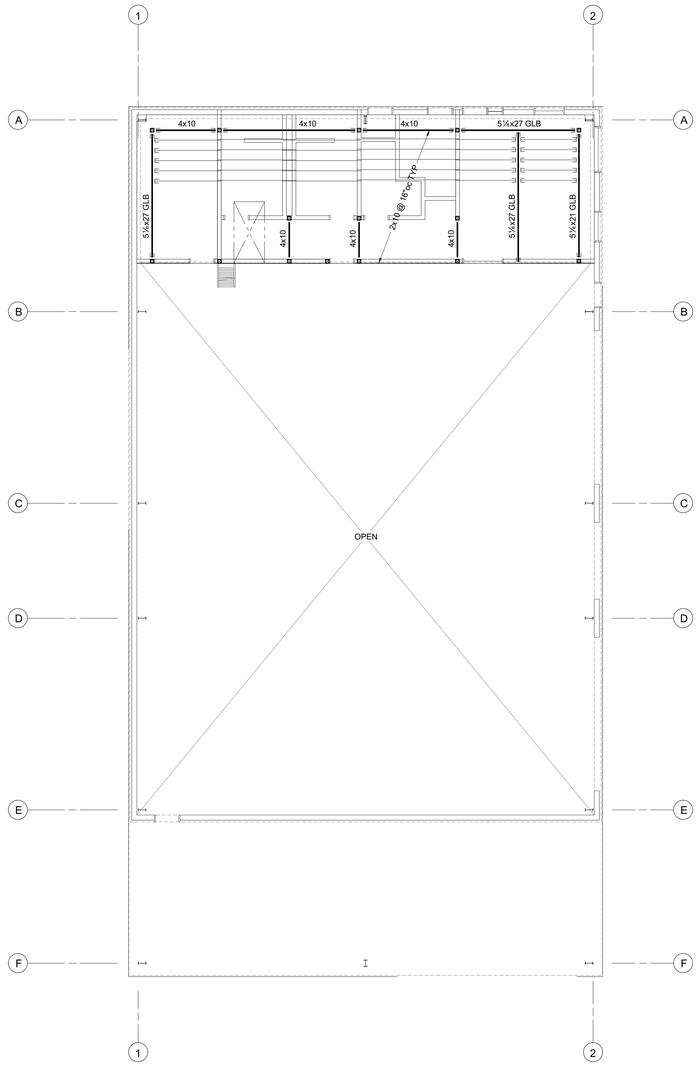

BUS SHOP MEZZANINE FRAMING PLAN

1/8" = 1'-0"

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PTN:

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SHEET TITLE

BUS SHOP MEZZANINE FRAMING PLAN

SHEET NUMBER

S2.4

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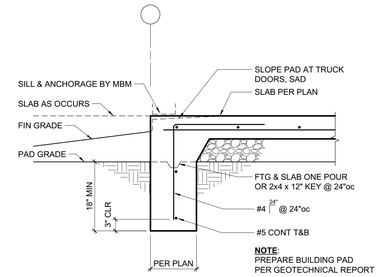
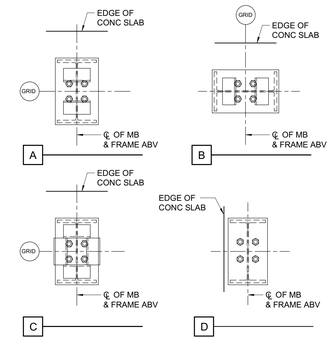
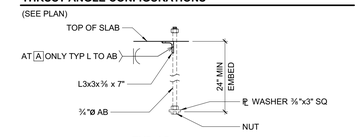


3 TYPICAL PERIMETER FOOTING
3/4" = 1'-0"



THRUST ANGLE CONFIGURATIONS



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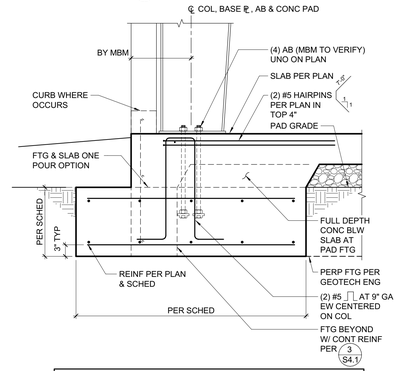
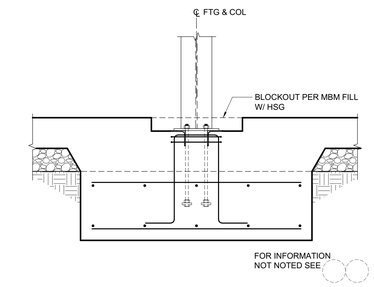
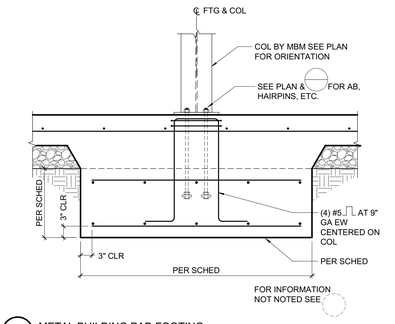


PAD FOOTING SCHEDULE			
MARK	FTG SIZE	REINFORCING	FOOTING DEPTH
A	5'-0" SQ	(5) #5 @ 16"oc EW T&B	18"
B	6'-0" SQ	(5) #5 @ 12"oc EW T&B	18"

1 METAL BUILDING PAD FOOTING
3/4" = 1'-0"



A OPTIONAL INTERIOR PAD FOOTING W/ BLOCKOUT



2 METAL BUILDING PAD FOOTING
3/4" = 1'-0"

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SHEET TITLE

FOUNDATION DETAILS

SHEET NUMBER

S4.1

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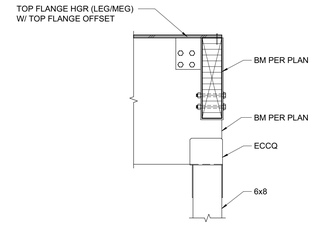

1 BEAM TO BEAM CONNECTION
3/4" = 1'-0"

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zfa job no. 17761
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LIBERTY HIGH SCHOOL

NEW MAINTENANCE OPERATIONS & TRANSPORTATION FACILITIES

850 2ND STREET
BRENTWOOD, CA
94513
LIBERTY UNION
HIGH SCHOOL
DISTRICT

-	-	-

ARCH PROJECT NO: 1707.00
ENGINEER: KPB
PROJECT MANAGER: AIZ
PTN:
100% DD
MAY 11, 2018

SHEET TITLE

WOOD DETAILS

SHEET NUMBER

S6.1

5/11/2018 3:59:00 PM \\zfa.com\SR\Projects\2017\17761 Liberty High School MO and Transportation\Drawings\17761_LIBERTY_M&O TRANS - BUS SHOP_S17.rvt

EQUIPMENT ANCHORAGE NOTES

MEP COMPONENT ANCHORAGE NOTE
ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS, WHERE NO DETAIL IS INDICATED, THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2016 CBC, SECTIONS 1616A.1.18 THROUGH 1616A.1.26 AND ASCE 7-10 CHAPTER 13, 26 AND 30.

1. ALL PERMANENT EQUIPMENT AND COMPONENTS.
2. TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS OR WATER.
3. MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS OR HAS A CENTER OF MASS LOCATED 4 FEET OR MORE ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT ARE REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.

THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT THE ATTACHMENT NEED NOT BE DETAILED ON THE PLANS. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING, AND CONDUIT.

A. COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVE A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.
B. COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS, LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.

FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE DESIGN PROFESSIONAL IN GENERAL RESPONSIBLE CHARGE OR STRUCTURAL ENGINEER DELEGATED RESPONSIBILITY AND THE DSA DISTRICT STRUCTURAL ENGINEER. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH ABOVE REQUIREMENTS.

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE
PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-10 SECTION 13.3 AS DEFINED IN ASCE 7-10 SECTION 13.6.5.6, 13.6.7, 13.6.8, AND 2016 CBC, SECTIONS 1616A.1.24, 1616A.1.25 AND 1616A.1.26.
THE METHOD OF SHOWING BRACING AND ATTACHMENTS TO THE STRUCTURE FOR THE IDENTIFIED DISTRIBUTION SYSTEM ARE AS NOTED BELOW. WHEN BRACING AND ATTACHMENTS ARE BASED ON A PREAPPROVED INSTALLATION GUIDE (E.G., SMACNA OR OSHPD OPM), COPIES OF THE BRACING SYSTEM INSTALLATION GUIDE OR MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF AND DURING THE HANGING AND BRACING OF THE DISTRIBUTION SYSTEMS. THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

MECHANICAL PIPING (MP), MECHANICAL DUCTS (MD), PLUMBING PIPING (PP), ELECTRICAL DISTRIBUTION SYSTEMS (E):

MP☒MD☒PP☐E☐ - OPTION 1: DETAILED ON THE APPROVED DRAWINGS WITH PROJECT SPECIFIC NOTES AND DETAILS.

MP☒MD☒PP☐E☐ - OPTION 2: SHALL COMPLY WITH THE APPLICABLE OSHPD PRE-APPROVAL (OPM #)

MP☒MD☒PP☐E☐ - OPTION 3: SHALL COMPLY WITH THE SMACNA SEISMIC RESTRAINT MANUAL, OSHPD EDITION (2009), INCLUDING ANY ADDENDA. FASTENERS AND OTHER ATTACHMENTS NOT SPECIFICALLY IDENTIFIED IN THE SMACNA SEISMIC RESTRAINT MANUAL, OSHPD EDITION, ARE DETAILED ON THE APPROVED DRAWINGS WITH PROJECT SPECIFIC NOTES AND DETAILS. THE DETAILS SHALL ACCOUNT FOR THE APPLICABLE SEISMIC HAZARD LEVEL AND CONNECTION LEVEL FOR THE PROJECT AND CONDITIONS.

VRF SPLIT SYSTEM SCHEDULE - M & O BLDG. AND BUS SHOP

MANUFACTURER: MITSUBISHI

INDOOR UNIT											OUTDOOR UNIT											
MARK	MODEL	AIR FLOW (CFM)	COOLING/ HEATING NOM.(MBH)	ELECTRICAL V-PH-HZ	MCA	MOCP	FLA	FILTERS NO.	L	W	OPERATING WEIGHT (LBS)	MARK	MODEL	NOMINAL COOLING CAP (MBH)	NOMINAL HEATING CAP (MBH)	ELECTRICAL V-PH-HZ	MCA	MOCP	-	OPERATING WEIGHT (LBS)	EER	HSPF	REMARKS
FC 1	PEFY-P24NMHU	880	24.0 / 27.0	208/1Ø/60	2.73	15.0	-	CLEANABLE/ INTEGRAL			80	HP 1	PURY-P192TSKMU	192.0	215.0	208-3Ø	33.0/33.0	50.0/50.0	-	703	12.1	3.59	1 - 6
FC 2	PEFY-P48NMHU	1160	48.0 / 54.0	208/1Ø/60	3.50	15.0	-	CLEANABLE/ INTEGRAL			80												
FC 3	PEFY-P48NMHU	1160	48.0 / 54.0	208/1Ø/60	3.50	15.0	-	CLEANABLE/ INTEGRAL			80												
FC 4	PEFY-P12NMAU	370	12.0 / 13.5	208/1Ø/60	1.20	15.0	-	CLEANABLE/ INTEGRAL			50												
FC 5	PLFY-P08NCMU	280	8.0 / 9.0	208/1Ø/60	0.35	15.0	-	CLEANABLE/ INTEGRAL			50												
FC 6	PLFY-P08NCMU	280	8.0 / 9.0	208/1Ø/60	0.35	15.0	-	CLEANABLE/ INTEGRAL			50												
FC 7	PLFY-P08NCMU	280	8.0 / 9.0	208/1Ø/60	0.35	15.0	-	CLEANABLE/ INTEGRAL			50												
FC 8	PLFY-P08NCMU	280	8.0 / 9.0	208/1Ø/60	0.35	15.0	-	CLEANABLE/ INTEGRAL			50												
FC 9	PLFY-P08NCMU	280	8.0 / 9.0	208/1Ø/60	0.35	15.0	-	CLEANABLE/ INTEGRAL			50												
FC 10	PEFY-AF1200 CFMR	1200	112.0 / 61.4	208/1Ø/60	-	15.0	-	CLEANABLE/ INTEGRAL			80												
FC 11	PKFY-P08NMHU	320	8.0 / 9.0	208/1Ø/60	0.30	15.0	-	CLEANABLE/ INTEGRAL			50												

HP-1 SERVES AS OUTDOOR UNIT FOR FC-1 TO FC-12

REMARKS:
1. PROVIDE WITH ALL NECESSARY REFRIGERATION PIPING & APPURTENANCES; R410A REFRIGERANT
2. PROVIDE WITH AUXILIARY CONDENSATE PUMP AS REQUIRED.
3. PROVIDE WITH NAVIGATIONS REMOTE CONTROLLER WITH BACNET INTERFACE AND INTELLIGENT TOUCH MANAGER
4. PROVIDE WITH MERV 13 FILTERS IN FILTER BOX FBM2-3 AND FBM2-4 FOR FC-1, FC-2, FC-3, FC-4.
5. SINGLE BC BRANCH CONTROLLER CMB-P1013NU-G FOR FC-1 THRU FC-11 PIPING REQUIRED FOR HP-1.
6. PROVIDE WITH FACTORY PELICAN WIRELESS THERMOSTAT TERMINAL BLOCK, WIRE PER MANUFACTURER'S INSTALLATION INSTRUCTIONS. CONTACT LOCAL REP FOR INFORMATION. FIELD MOUNTED THERMOSTAT ADAPTOR CARDS NOT ALLOWED.

SPLIT SYSTEM SCHEDULE HEAT PUMP

MANUFACTURER: MITSUBISHI

INDOOR UNIT												OUTDOOR UNIT											
MARK	MODEL	AIR FLOW (CFM)	COOLING/ HEATING CAP (MBH)	ELECTRICAL V-PH-HZ	MCA	MOCP	FLA	FILTERS NO.	L	W	OPERATING WEIGHT (LBS)	MARK	MODEL	NOMINAL COOLING CAP (MBH)	NOMINAL HEATING CAP (MBH)	ELECTRICAL V-PH-HZ	MCA	MOCP	-	OPERATING WEIGHT (LBS)	SEER	COP	REMARKS
FC 12	PEFY-P36NMAU	1160	36.0 / 40.0	208/1Ø/60	3.5	15.0	-	CLEANABLE/ INTEGRAL			80	HP 2	PUMY-P36NMHU	36.0	40.0	208-1Ø	26.0	30.0	-	320	14.3	3.56	1 - 5

REMARKS:
1. PROVIDE WITH ALL NECESSARY REFRIGERATION PIPING & APPURTENANCES; R410A REFRIGERANT
2. PROVIDE WITH AUXILIARY CONDENSATE PUMP AS REQUIRED.
3. PROVIDE WITH NAVIGATIONS REMOTE CONTROLLER WITH BACNET INTERFACE AND INTELLIGENT TOUCH MANAGER
4. PROVIDE WITH MERV 13 FILTERS IN FILTER BOX FBM2-4 FOR FC-12.
5. PROVIDE WITH FACTORY PELICAN WIRELESS THERMOSTAT TERMINAL BLOCK, WIRE PER MANUFACTURER'S INSTALLATION INSTRUCTIONS. CONTACT LOCAL REP FOR INFORMATION. FIELD MOUNTED THERMOSTAT ADAPTOR CARDS NOT ALLOWED.

GAS UNIT HEATER SCHEDULE

MANUFACTURER: REZNOR

MARK	MODEL	INTAKE AIR CONN.	EXHAUST FLUE CONN.	HP RPM	HEATING (MBH) INPUT	HEATING (MBH) OUTPUT	TEMP RISE (°F)	AIRFLOW CFM (FPM)	ELECTRICAL Volts	Ø	FLA	MOCP	24V	WT (LBS)	REMARKS
UH 1	UDAS-75	4"Ø	4"Ø	0.06 / 1550	75.0	62.25	60°F	960 (770)	208	1	3.3	15	1.0A	100	1
UH 2	UDAS-75	4"Ø	4"Ø	0.06 / 1550	75.0	62.25	60°F	960 (770)	208	1	3.3	15	1.0A	100	1
UH 3	UDAS-75	4"Ø	4"Ø	0.06 / 1550	75.0	62.25	60°F	960 (770)	208	1	3.3	15	1.0A	100	1
UH 4	UDAS-75	4"Ø	4"Ø	0.06 / 1550	75.0	62.25	60°F	960 (770)	208	1	3.3	15	1.0A	100	1

REMARKS: 1. PROVIDE WITH OPTION CC6 COMBINED HORIZONTAL CONCENTRIC ADAPTOR FOR SEPARATED COMBUSTION WITH WALL VENT TERMINAL.

EXHAUST FAN SCHEDULE

MANUFACTURER: GREENHECK

LOCATION	MARK	MODEL	AIR FLOW (CFM)	SP (" WC)	BHP (WATTS)	RPM	ELECTRICAL Volts	Ø	Amps	SERVICE	LOCATION	SONES	WT (LBS)	REMARKS	DETAIL
M&O BLDG.	EF 1	CSP-A510	460	0.25	(218)	1070	120	1	3.11	MENS / WOMENS TOILETS	INLINE (ABV, CLG.)	2.0	45	1, 2, 3	X M-3.1
M&O BLDG.	EF 2	CSP-A125	110	0.25	(23)	1100	120	1	0.63	BREAK ROOM	INLINE (ABV, CLG.)	1.0	25	1, 2, 3	X M-3.1
M&O BLDG.	EF 3	CSP-A290	260	0.25	(102)	1050	120	1	0.71	CUST. + STORAGE	INLINE (ABV, CLG.)	2.0	35	1, 2, 3	X M-3.1
M&O BLDG.	EF 4	CSP-A410	350	0.25	(132)	1000	120	1	1.87	PLAN ROOM	INLINE (ABV, CLG.)	2.0	45	1, 2, 3	X M-3.1
BUS SHOP	EF 5	CSP-A125	115	0.25	(23)	1100	120	1	0.63	UNISEX TOILET	INLINE (ABV, CLG.)	1.0	25	1, 2, 3	X M-3.1
BUS SHOP	EF 6	CSP-A200	200	0.25	(58)	900	120	1	0.43	TOILET + CUST.	INLINE (ABV, CLG.)	0.9	35	1, 2, 3	X M-3.1
M&O BLDG.	EF 9	BSQ 240	6000	0.25	0.85	684	120	1	-	GENERAL CO EXHAUST	INLINE EXPOSED	14.9	425	4	X M-3.1
BUS SHOP	EF 10	BSQ 240	6000	0.25	0.85	684	120	1	-	GENERAL CO EXHAUST	INLINE EXPOSED	14.9	425	4	X M-3.1

REMARKS:
1. PROVIDE CONTROL INTERFACE TO EMS SYSTEM.
2. INTERLOCK WITH LIGHT SWITCH (BY ELEC.)
3. PROVIDE WITH VARI-GREEN MOTORS ON ALL APPLICABLE MODELS.

MECHANICAL LEGEND

SYMBOL	ABBREVIATION	DESCRIPTION
1 / P-1		DRAWING NUMBER
A / P-1		DETAIL NUMBER / DRAWING NUMBER
WH 1		EQUIPMENT IDENTIFICATION
	SA OR OA	SECTION THRU SUPPLY AIR OR OUTSIDE AIR DUCT
	RA OR EA	SECTION THRU RETURN AIR OR EXHAUST AIR DUCT
		ROUND DUCT DOWN
DN	DN OR UP	SLOPE DUCT DOWN OR UP IN DIRECTION OF FLOW
	L	ACOUSTICAL LINING
	FC	FLEXIBLE DUCT CONNECTION
	VD	VOLUME DAMPER
	TV	TURNING VANES
		FLEXIBLE DUCT
		45° ROUND DUCT TAKE-OFF
		45° RECTANGULAR DUCT TAKE-OFF
		90° RADIUS TURN - ROUND OR RECTANGULAR DUCT
		SQUARE TO ROUND DUCT TRANSITION
		DUCT TRANSITION
		RECTANGULAR DUCT 90° SPLIT
T		THERMOSTAT
	AP	ACCESS PANEL
	POC	POINT OF CONNECTION
	POD	POINT OF DISCONNECT

TERMINAL SCHEDULE

MANUFACTURER: TITUS

CD		CEILING SUPPLY DIFFUSER	MODEL TDCA. COMPLETE WITH EQUALIZING GRID, ADJUSTABLE VANES, STEEL CONSTRUCTION
CR		CEILING RETURN GRILLE	MODEL 50F. 1/2" x 1/2" x 1/2" ALUMINUM CORE WITH ALUMINUM BORDER
EG		CEILING EXHAUST GRILLE	MODEL 50F. 1/2" x 1/2" x 1/2" ALUMINUM CORE WITH ALUMINUM BORDER
DSD		DUCT SUPPLY DIFFUSER	S300FS. DIRECT SPIRAL DUCT-MOUNTED, LOUVERS ON 3/4" CENTERS, DOUBLE DEFLECTION, ALUMINUM CONSTRUCTION, LOUVERS PARALLEL WITH SHORT DIMENSION, AIR SCOOP EXTRACTOR
WSD		SUPPLY WALL GRILLE	MODEL 300FS. LOUVERS ON 3/4" CENTERS, DOUBLE DEFLECTION, STEEL CONSTRUCTION, LOUVERS PARALLEL W/ SHORT DIMENSION, WITH AIR SCOOP EXTRACTOR
WRG		WALL RETURN GRILLE	MODEL 350ZRL-HD. LOUVERS ON 3/4" CENTERS, 0° DEGREES DEFLECTION, HEAVY DUTY CONSTRUCTION, LOUVERS LOUVERS PARALLEL WITH LONG DIMENSION
DL		DOOR LOUVER	MODEL T-700. STEEL CONSTRUCTION WITH FLANGED AND AUXILIARY FRAME

NOTES:
1. ADAPTER NEEDED FOR TRANSITION FROM SQUARE NECK TO ROUND DUCT.
2. SIZE (NECK/FACE) TYPE / CFM (NO. OF THROW) FACE SIZE FOR T-BAR CEILING ONLY

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KEYPLAN

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LIBERTY HIGH SCHOOL

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BRENTWOOD, CA
94513

LIBERTY UNION HIGH SCHOOL DISTRICT

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FILE NO: XX-XX
APPL NO: 0X-XXXXXX
AC_____ FLS_____ SS_____
DATE_____

REVISIONS

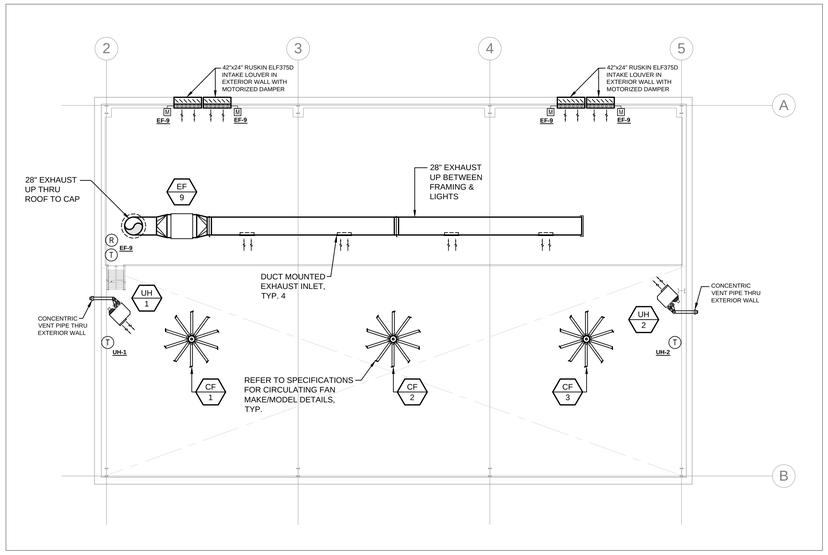
ARCH PROJECT NO: 1707.00
DRAWN BY: MEC
DRAWING SCALE: AS SHOWN

50% DD
APRIL 13, 2018

SHEET TITLE
MECHANICAL SCHEDULES & LEGENDS

SHEET NUMBER
M-1.1

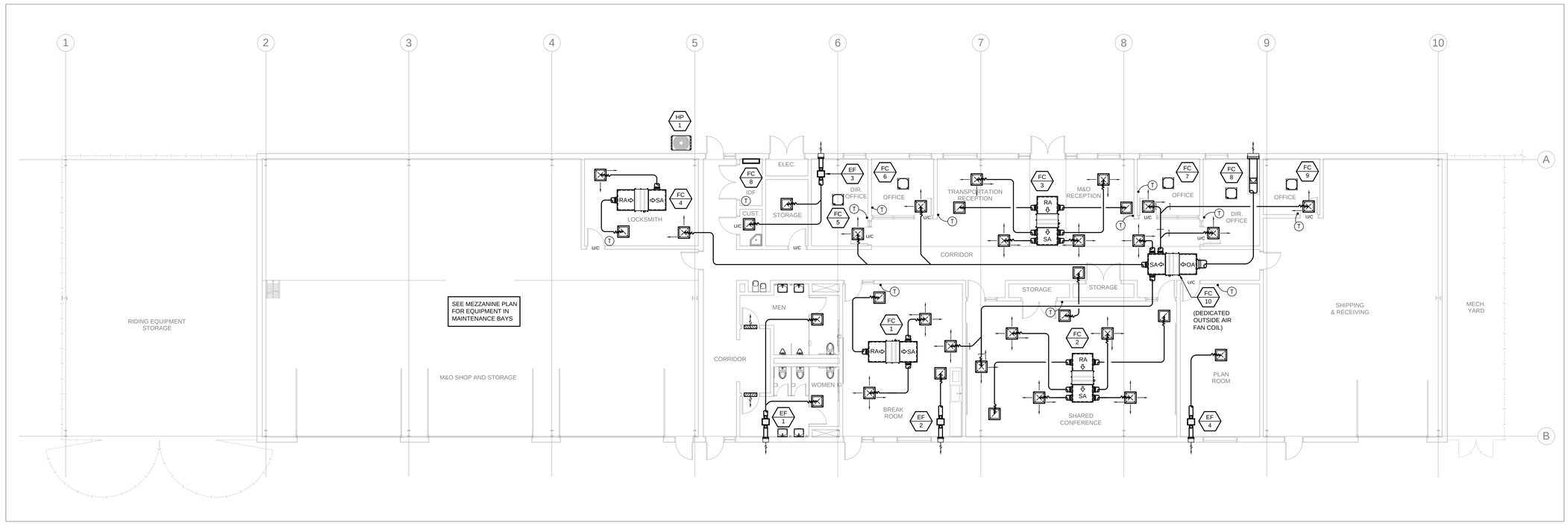
/Volumes/Projects/17007 QKA - Liberty High School M&O Bldgs.



2 M & O BLDG. MECHANICAL MEZZANINE PLAN

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

MECHANICAL SHEET NOTES



1 M & O BLDG. MECHANICAL FLOOR PLAN

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

KEYPLAN

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ARCH PROJECT NO:	1707.00
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50% DD

APRIL 13, 2018

SHEET TITLE

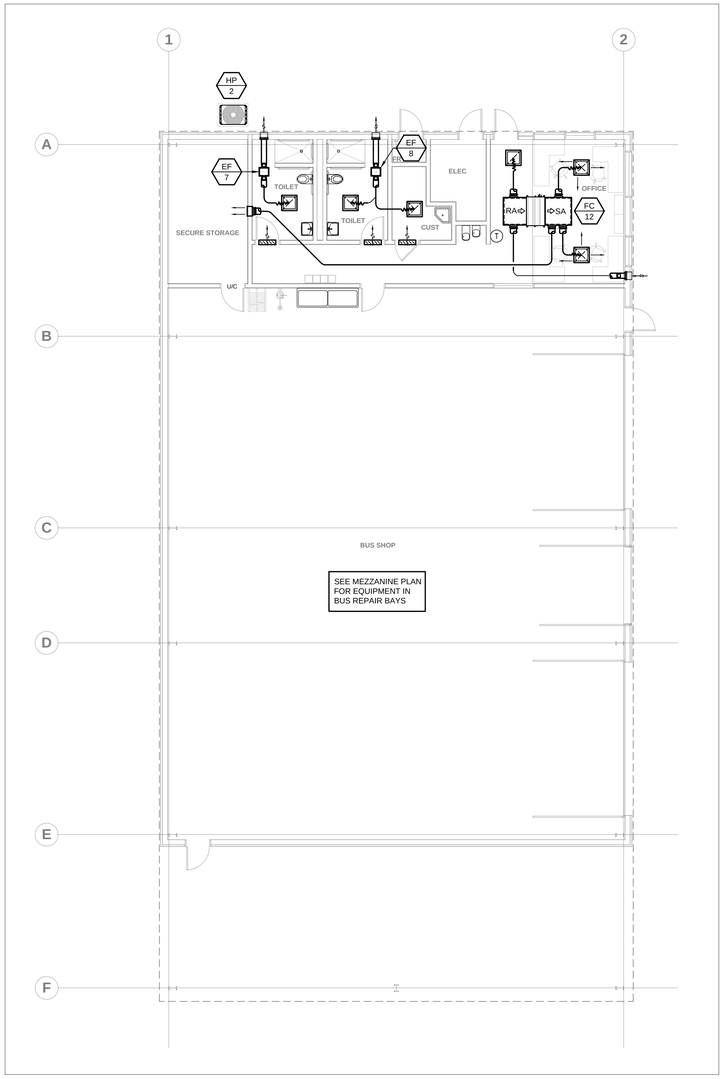
M & O BLDG. MECHANICAL FLOOR + MEZZ. PLAN

SHEET NUMBER

M-2.1

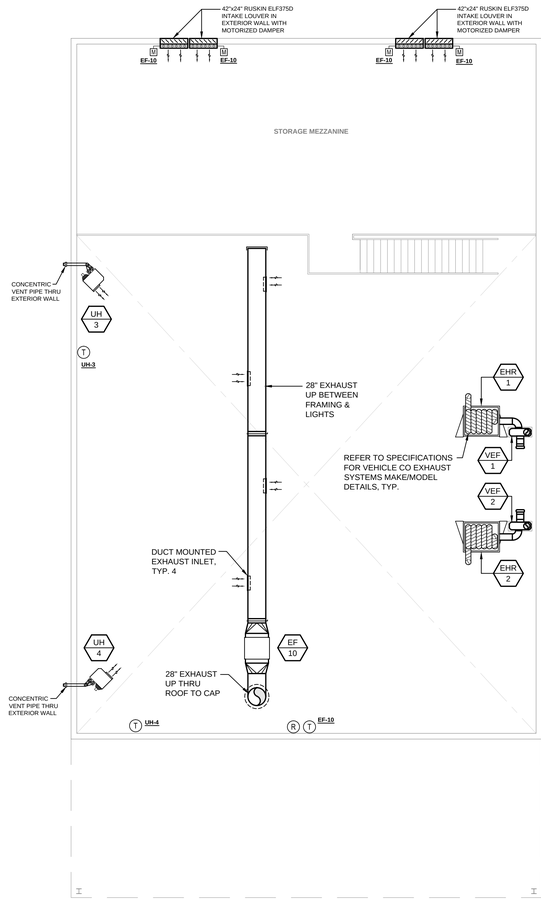
/Volumes/Projects/17007 QKA - Liberty High School M&O Bldgs.

MECHANICAL SHEET NOTES



1 BUS SHOP MECHANICAL FLOOR PLAN

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



1 BUS SHOP MECHANICAL MEZZANINE PLAN

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

KEYPLAN

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ARCH PROJECT NO: 1707.00

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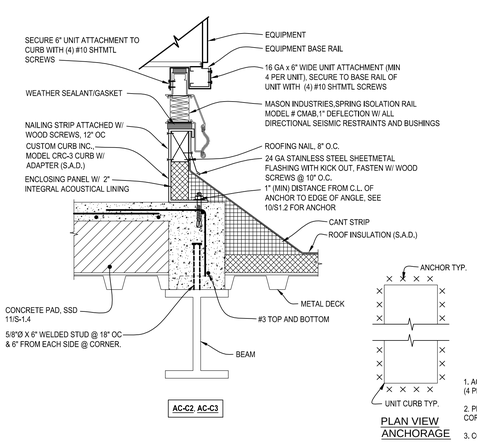
SHEET TITLE

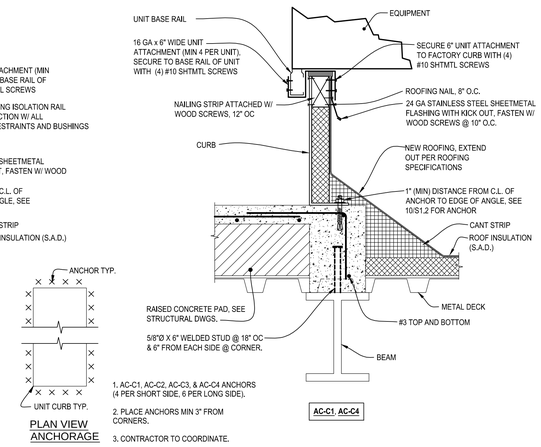
BUS SHOP MECHANICAL FLOOR + MEZZ. PLAN

SHEET NUMBER

M-2.2

/Volumes/Projects/17007 QKA - Liberty High School M&O Bldgs.

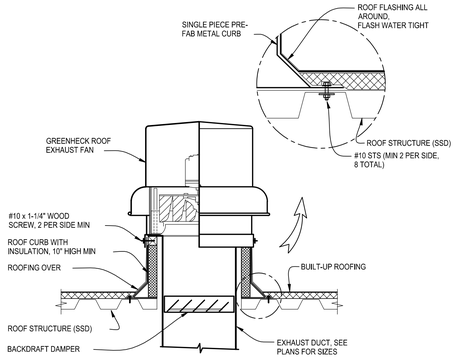




1. AC-C1, AC-C2, AC-C3, & AC-C4 ANCHORS (4 PER SHORT SIDE, 6 PER LONG SIDE).
2. PLACE ANCHORS MIN 3" FROM CORNERS.
3. CONTRACTOR TO COORDINATE.

A AC MOUNTING DETAIL - TYP. FOR UNITS AC-C1, AC-C2, AC-C3, AC-C4

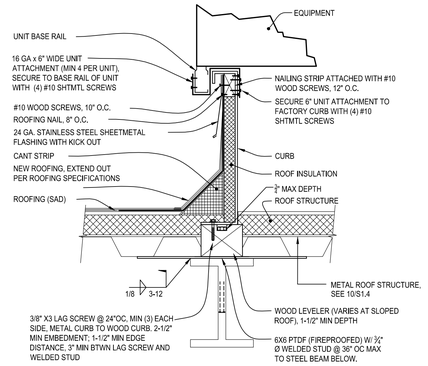
SCALE: NONE



NOTE:
1. ALL FASTENERS EXPOSED TO WEATHER SHALL BE SEALED WITH A SINGLE COMPONENT, POLYURETHANE SEALANT.
2. GREASE FAN, SIMILAR, W/O BACKDRAFT DAMPER, VENTED CURB, UPBLAST W/ GREASE COLLECTION CUP.

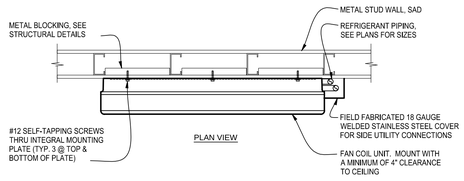
B SUPPLY/ EXHAUST FAN MOUNTING DETAILS

SCALE: NONE



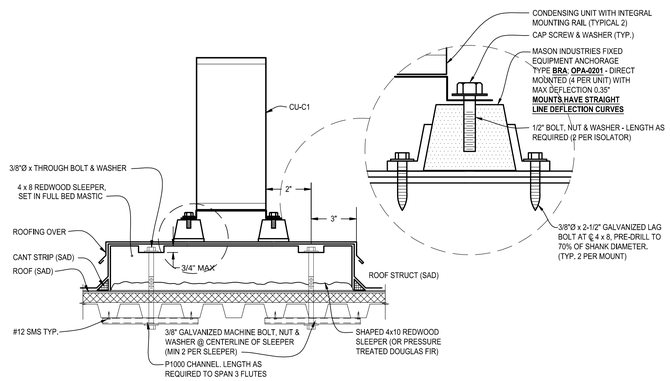
C ROOF EQUIPMENT MOUNTING DETAIL

SCALE:NONE



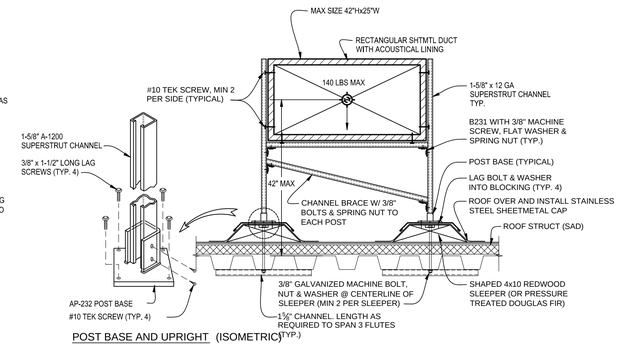
D WALL MOUNTED FAN COIL ON METAL STUD

SCALE: NONE



E CONDENSING UNIT MOUNTING DETAIL

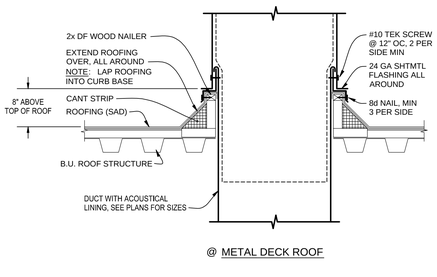
SCALE: NONE



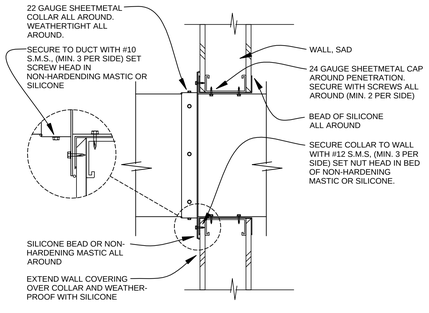
POST BASE AND UPRIGHT (ISOMETRIC)

F DUCT ON ROOF MOUNTING DETAIL

SCALE: NONE



@ METAL DECK ROOF



@ WALL

G DUCT PENETRATION DETAILS

SCALE: NONE

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LIBERTY HIGH SCHOOL

NEW MAINTENANCE, OPERATIONS & TRANSPORTATION FACILITIES

850 2ND STREET
BRENTWOOD, CA
94513

LIBERTY UNION HIGH SCHOOL DISTRICT

IDENTIFICATION STAMP
DIVISION OF THE STATE ARCHITECT
FILE NO: XX-XX
APPL NO: 0X-XXXXXX
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DATE_____

REVISIONS

ARCH PROJECT NO: 1707.00
DRAWN BY: MEC
DRAWING SCALE: AS SHOWN

50% DD
APRIL 13, 2018
SHEET TITLE

MECHANICAL DETAILS

SHEET NUMBER

M-4.1

KEYPLAN

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/Volumes/Projects/17007 QKA - Liberty High School M&O Bldgs.

NOTES:

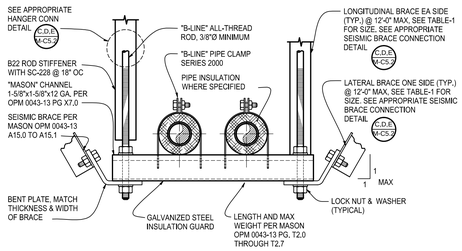
1. RUN PIPING TRAPEZE AS CLOSE AS POSSIBLE TO STRUCTURE.
2. SUPPORT PIPING AT A MAXIMUM OF 8'-0" INTERVALS.
3. SEE PLANS FOR PIPE SIZES.
4. CHANNEL DEFLECTION SHALL NOT EXCEED 1/360 OF THE SPAN BETWEEN RODS. DOUBLE-UP CHANNELS AS REQUIRED PER OPM 0043-13 PG. T2.0 -T2.7.
5. PROVIDE "B-LINE" CHANNEL ROD STIFFENER @ ALL-THREAD WHERE DIAGONAL BRACE OCCURS. INCLUDE SC228 ASSEMBLY AS RECOMMENDED BY MANUFACTURER.
6. NO BRACING IS REQUIRED ON FUEL PIPES WITH LESS THAN 1" I.D, AND ALL OTHER PIPES LESS THAN 2-1/2"

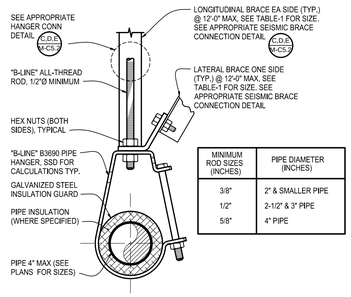
TRAPEZE LOAD & SUPPORT CONDITIONS:

HEAVY: 645 LBS PER TRAPEZE, OR MORE: 1/2"Ø ALL-THREAD TO STEEL

NOT HEAVY: LESS THAN 645 LBS PER TRAPEZE: 3/8"Ø ALL-THREAD TO CONC DECK

TABLE-1	
ANGLE (INCHES)	MAX LENGTH (INCHES)
1-1/2 x 1-1/2 x 1/8	3'-0"
2 x 2 x 3/16	6'-0"
3 x 3 x 1/4	8'-0"

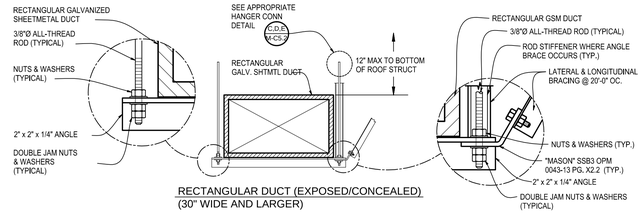




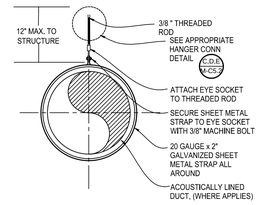
MINIMUM ROD SIZES (INCHES)	PIPE DIAMETER (INCHES)
3/8"	2" & SMALLER PIPE
1/2"	2-1/2" & 3" PIPE
5/8"	4" PIPE

A TYPICAL PIPE HANGER DETAILS

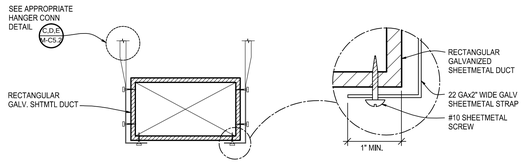
SCALE: NONE



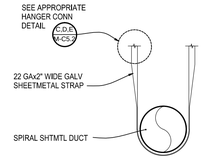
RECTANGULAR DUCT (EXPOSED/CONCEALED)
(30" WIDE AND LARGER)



ROUND DUCT (EXPOSED/CONCEALED)
(18"Ø AND LARGER)



RECTANGULAR DUCT (EXPOSED/CONCEALED)
(29" WIDE AND SMALLER)



ROUND DUCT (CONCEALED)
(16"Ø AND SMALLER)

DUCT SUPPORT NOTES:

A. ALL STRAPS, RODS, TRAPEZE ANGLES AND TRAPEZE CHANNELS SHALL BE SIZED AND INSTALLED IN ACCORDANCE WITH THE LATEST SMACNA REQUIREMENTS.

B. ALL BOLTS, NUTS, SCREWS AND OTHER FASTENING DEVICES SHALL BE LOAD-RATED AND SHALL MEET ALL CODE REQUIREMENTS AND SAFETY FACTORS WHICH APPLY.

C. WIRE, USED IN LIEU OF STRAPS AND RODS, IS NOT ALLOWED.

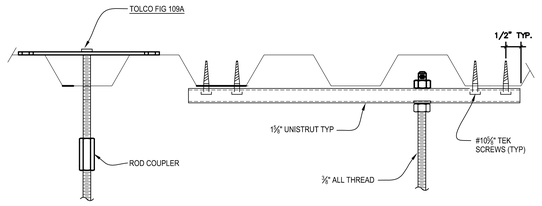
D. WHERE APPLICABLE, INSTALL INSULATION AFTER INSTALLING DUCT HANGERS.

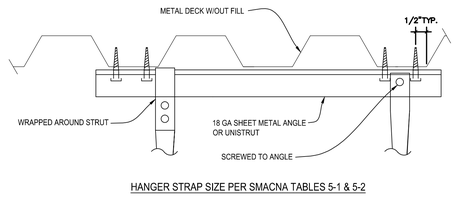
E. LATERAL BRACING REQUIRED ON 32" WIDE AND LARGER RECTANGULAR DUCTS, AND ON 18" DIAMETER AND LARGER ROUND DUCTS.

F. SUPPORTS SHALL BE PLACED AT 8'-0" ON CENTER (MAX) AND AT ALL CHANGES IN DIRECTION.

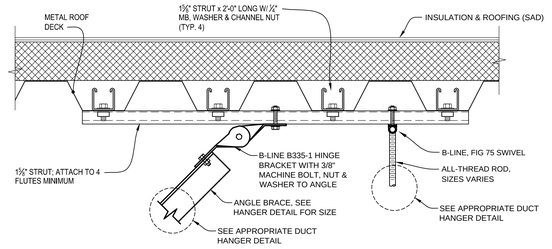
B TYPICAL DUCT HANGER DETAILS

SCALE: NONE



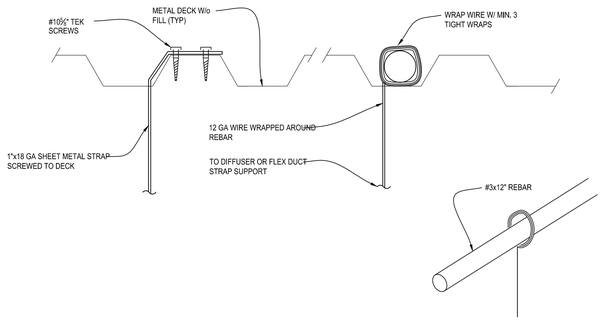


HANGER STRAP SIZE PER SMACNA TABLES 5-1 & 5-2



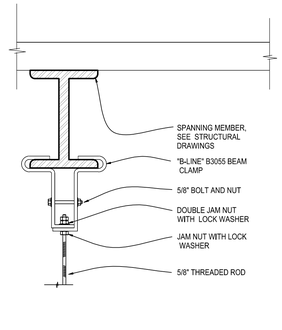
C SEISMIC BRACE & HANGER CONNECTION TO DECK W/O FILL

SCALE: NONE

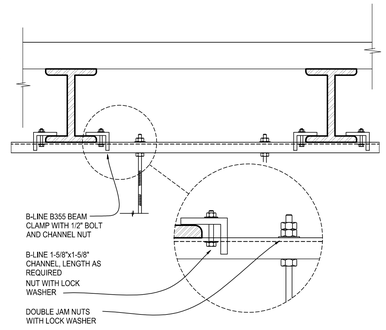


D TYP. HANGER CONNECTION @ METAL DECK W/O FILL

SCALE: NONE



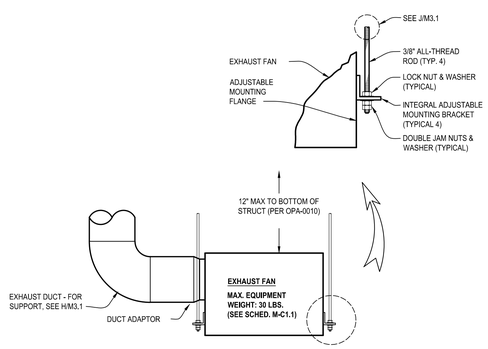
SUPPORT @ BEAM (PARELLEL)



SUPPORT @ BEAM (PERPENDICULAR)

E TYPICAL HANGER CONNECTION DETAILS TO STRUCTURE

SCALE: NONE



F CEILING EXHAUST FAN MOUNTING DETAIL

SCALE: NONE

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DRAWN BY: MEC
DRAWING SCALE: AS SHOWN

50% DD
APRIL 13, 2018
SHEET TITLE

MECHANICAL DETAILS

SHEET NUMBER

M-4.2

KEYPLAN

/Volumes/Projects/17007 QKA - Liberty High School M&O Bldgs.

PLUMBING GENERAL NOTES

A. ALL CONNECTIONS FROM NEW FIXTURES TO EXISTING DOMESTIC WATER SHALL BE PROVIDED WITH NEW RED BRASS NIPPLES.

B. PROVIDE ACCESS PANELS FOR ALL WATER HAMMER ARRESTORS LOCATED IN NON-ACCESSIBLE AREAS (WALLS, CEILINGS, AND SUB-FLOORING), SEE SPECIFICATIONS FOR ACCESS DOOR MODEL NUMBERS.

C. LOCATION OF EXISTING SANITARY SEWER, VENT PIPING, DOMESTIC WATER, ETC. HAS BEEN BASED ON THE BEST AVAILABLE INFORMATION OBTAINABLE AT THE SITE AND THROUGH RECORD DRAWINGS. VERIFY EXACT LOCATIONS, SIZES, AND EXTENT OF OF EXISTING SYSTEMS PRIOR TO START OF WORK.

D. MAKE ALL NECESSARY UTILITY OFFSETS AS REQUIRED TO CONNECT TO EXISTING SANITARY SEWER, VENT AND DOMESTIC WATER PIPING.

E. ALL UNUSED PIPING ABOVE GRADE SHALL BE REMOVED. ALL UNUSED PIPING BELOW GRADE SHALL BE CAPPED AND ABANDONED. CAP DEAD BRANCHES AS CLOSE AS POSSIBLE TO LIVE MAINS.

F. SEE FIXTURE CONNECTION SCHEDULE FOR FIXTURE BRANCH LINE SIZES.

G. SEE DRAIN, WASTE, AND VENT PLAN FOR FIXTURE IDENTIFICATION.

APPLICABLE GOVERNING CODES:

2016 CALIFORNIA BUILDING CODE
2016 CALIFORNIA ELECTRICAL CODE
2016 CALIFORNIA MECHANICAL CODE
2016 CALIFORNIA PLUMBING CODE

EQUIPMENT ANCHORAGE NOTES

MEP COMPONENT ANCHORAGE NOTE
ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS. WHERE NO DETAIL IS INDICATED, THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2016 CBC, SECTIONS 1616A.1.18 THROUGH 1616A.1.26 AND ASCE 7-10 CHAPTER 13, 26 AND 30.

1. ALL PERMANENT EQUIPMENT AND COMPONENTS.
2. TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS OR WATER.
3. MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS OR HAS A CENTER OF MASS LOCATED 4 FEET OR MORE ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT ARE REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.

THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT THE ATTACHMENT NEED NOT BE DETAILED ON THE PLANS. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING, AND CONDUIT.

A. COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVE A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.

B. COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS, LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.

FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE DESIGN PROFESSIONAL IN GENERAL RESPONSIBLE CHARGE OR STRUCTURAL ENGINEER DELEGATED RESPONSIBILITY AND THE DSA DISTRICT STRUCTURAL ENGINEER. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH ABOVE REQUIREMENTS.

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE
PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-10 SECTION 13.3 AS DEFINED IN ASCE 7-10 SECTION 13.6.5.6, 13.6.7, 13.6.8, AND 2016 CBC, SECTIONS 1616A.1.24, 1616A.1.25 AND 1616A.1.26.
THE METHOD OF SHOWING BRACING AND ATTACHMENTS TO THE STRUCTURE FOR THE IDENTIFIED DISTRIBUTION SYSTEM ARE AS NOTED BELOW. WHEN BRACING AND ATTACHMENTS ARE BASED ON A PREAPPROVED INSTALLATION GUIDE (E.G., SMACNA OR OSHPD OPM), COPIES OF THE BRACING SYSTEM INSTALLATION GUIDE OR MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF AND DURING THE HANGING AND BRACING OF THE DISTRIBUTION SYSTEMS. THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

MECHANICAL PIPING (MP), MECHANICAL DUCTS (MD), PLUMBING PIPING (PP), ELECTRICAL SYSTEMS (E):
MP@MD@PP□E□ - OPTION 1: DETAILED ON THE APPROVED DRAWINGS WITH PROJECT SPECIFIC NOTES AND DETAILS.

MP□MD□PP□E□ - OPTION 2: SHALL COMPLY WITH THE APPLICABLE OSHPD PRE-APPROVAL (OPM #)

MP□MD□PP□E□ - OPTION 3: SHALL COMPLY WITH THE SMACNA SEISMIC RESTRAINT MANUAL, OSHPD EDITION (2009), INCLUDING ANY ADDENDA. FASTENERS AND OTHER ATTACHMENTS NOT SPECIFICALLY IDENTIFIED IN THE SMACNA SEISMIC RESTRAINT MANUAL, OSHPD EDITION, ARE DETAILED ON THE APPROVED DRAWINGS WITH PROJECT SPECIFIC NOTES AND DETAILS. THE DETAILS SHALL ACCOUNT FOR THE APPLICABLE SEISMIC HAZARD LEVEL AND CONNECTION LEVEL FOR THE PROJECT AND CONDITIONS.

PLUMBING MATERIALS

A. INSIDE, BELOW & ABOVE THE BUILDING SLAB AND ENDING 5'-0" OUTSIDE THE EXTERIOR BUILDING WALLS:

1. DOMESTIC WATER DISTRIBUTION PIPING BELOW GROUND: ALL INTERIOR DOMESTIC WATER PIPING SHALL BE "K" HARD DRAWN COPPER TUBING (SIL-FOS 2, FOS-DLO 7 OR OTHER SILVER BRAZING MATERIAL). THIS IS REQUIRED FOR WATER SERVICE LINE FROM THE SHUT-OFF VALVE IN THE BUILDING TO A POINT 5 FEET OUTSIDE THE BUILDING.

2. DOMESTIC WATER DISTRIBUTION PIPING ABOVE GROUND: HARD COPPER TUBEM TYPE L.

3.SOIL, WASTE, AND VENT PIPING BELOW GROUND: SCHEDULE 40 POLY VINYL CHLORIDE (PVC) PLASTIC DWV PIPE.

4. WASTE & VENT ABOVE GROUND: HUBLESS CAST-IRON SOIL PIPE OR POLY VINYL CHLORIDE (PVC) PLASTIC DWV.

B. CW APPLICATIONS FROM 5'-0" OUTSIDE THE BUILDING TO THE UTILITY POINT OF CONNECTION (POC):

1. 3/4"-1 1/4" SCHEDULE 40 PVC PIPE WITH SOLVENT-WELDED JOINTS.

2. 1 1/2"-3", SDR-21, PVC PIPE (ASIM D2241) CLASS 200, BELL AND SPIGOT WITH RUBBER GASKETED JOINTS.

3. 3/4"-3", TYPE "K" HARD DRAWN COPPER TUBBING (SIL-FOS 2, FOS-FLO 7 OR OTHER SILVER BRAZINGMATERIAL)

4. 4" AND LARGER, SDR-18 PVC PIPE (AWWA C-900) CLASS 150 BELL AND SPIGOT WITH RUBBERGASKETED JOINTS.

C. UNDERGROUND SANITARY SEWER PIPING FROM A POINT 5 FEET OUTSIDE THE BUILDING TO THE POC:

1. POLYVINYL CHLORIDE (PVC) SEWER PIPE SHALL CONFORM TO ASTM D3034 (SDR-35)

2.CAST IRON OR DUCTILE IRON PIPE SHALL CONFORM TO USASI #A-21 CLASS 50.

LOCAL CONNECTION SCHEDULE

MARK	FIXTURE	S	IW	V	CW	HW	GAS	REMARKS
P-1	WATER CLOSET	4"	-	2"	1-1/2"	"	-	WALL MOUNTED FLUSH VALVE; VITREOUS CHINA; MANUAL LEVER HANDLE
P-1A	WATER CLOSET	4"	-	2"	1-1/2"	"	-	WALL MOUNTED FLUSH VALVE; VITREOUS CHINA; MANUAL LEVER HANDLE, ADA COMPLIANT
P-2A	LAVATORY	2"	-	1-1/2"	1/2"	1/2"	-	WALL MOUNTED; VITREOUS CHINA; METERING HANDLE, 105°F MAX. TEMP., ADA COMPLIANT
P-3	URINAL	2"	-	1-1/2"	1"	"	-	WALL MOUNTED FLUSH VALVE; VITREOUS CHINA; MANUAL LEVER HANDLE
P-3A	URINAL	2"	-	1-1/2"	1"	"	"	WALL MOUNTED FLUSH VALVE; VITREOUS CHINA; MANUAL LEVER HANDLE, ADA COMPLIANT
P-4	MOP SINK, SQUARE	3"	-	2"	3/4"	3/4"	-	FLOOR MOUNTED, ONE PIECE MOLDED
P-5	STAFF DOUBLE SINK	2"	-	1-1/2"	3/4"	3/4"	-	COUNTER MOUNTED; STAINLESS STEEL; WRIST BLADE HANDLES, BUBBLER, ADA COMPLIANT.
P-6	DRINKING FOUNTAIN	2"	-	2"	3/4"	"	-	HIGH/LOW ADA COMPLIANT WITH BOTTLE FILLER
P-7A	SHOWER, TILED (ADA)	2"	-	1-1/2"	3/4"	"	3/4"	TILED ENCLOSURE W/ METERING TEMPERED HANDLE, 105°F MAX., ADA COMPLIANT (SLIDE BAR)
FD	FLOOR DRAIN	3"	-	1-1/2"	-	-	-	PROVIDE WITH TRAP PRIMER & ACCESS PANEL
FS	FLOOR SINK	3"	-	1-1/2"	-	-	-	PROVIDE WITH TRAP PRIMER & ACCESS PANEL
HB-1	HOSE BIBB (INTERIOR)	-	-	-	3/4"	-	-	~~PROVIDE LOOSE KEY VALVE IN VACUUM BREAKER~~
HB-2	HOSE BIBB (EXTERIOR)	-	-	-	3/4"	-	-	
MV	MIXING VALVE	-	-	-	3/4"	3/4"	-	0.5 GPM - 20 GPM RATED, 140°F EWT/105°F LWT

GREEN STANDARDS FIXTURE SCHEDULE

FIXTURE (TAG)	MAX. FLOW TBL. 5.303.2	SPECIFIED FLOW RATES	REMARKS
WATER CLOSET (P-1, P1-A)	1.28 GPF	1.28 GPF	REFER TO SPECIFICATION SECTION 22 0000 2.17G FOR FIXTURE BOWL AND FLUSHOMETER MODELS
LAVATORY (P-2, P2-A)	0.5 GPM	0.5 GPM	REFER TO SPECIFICATION SECTION 22 0000 2.17G FOR FIXTURE BOWL AND FAUCET MODELS
URINAL (P-3, P3-A)	0.125 GPF	0.125 GPF	REFER TO SPECIFICATION SECTION 22 0000 2.17G FOR FIXTURE CARTRIDGE AND COUPLER MODELS
MOP SINK (P-4)	1.8 GPM	1.5 GPM	REFER TO SPECIFICATION SECTION 22 0000 2.17G FOR FIXTURE BOWL AND FAUCET MODELS
DOUBLE SINK (P-5)	1.8 GPM	1.5 GPM	REFER TO SPECIFICATION SECTION 22 0000 2.17G FOR FIXTURE BOWL AND FAUCET MODELS

GAS WATER HEATER SCHEDULE

MANUFACTURER: A.O. SMITH

MARK	MODEL #	STORAGE CAPACITY	GAS TYPE	INPUT (BTU/HR)	GPH RECOVERY @ 100° RISE	FLUE SIZE	THERMAL EFFICIENCY	WEIGHT	REMARKS
WH 1	BTH-120	60 gal.	NATURAL	120,000	138	3"	98%	1000 lbs.	1, 2, 3, 4, 5
WH 2	BTH-120	60 gal.	NATURAL	120,000	138	3"	98%	1000 lbs.	1, 3, 4, 5

REMARKS:
1. SUPPLIED WITH CONCENTRIC CPVC VENT PIPE, ELBOWS AND TERMINATION CAP.
2. COMPLETE WITH HOT WATER RECIRC. PUMP CP-1 W/ AQUASTAT. REFER TO PUMP SCHEDULE.
3. **PROVIDE WITH EXPANSION TANK, AMTROL MODEL "THERM-X-TROL" ST-8**
4. PROVIDE WITH MIXING VALVE MV-1; WATTS SERIES LFMMV - US. REFER TO FIXTURE SCHEDULE.
5. ADJUST DOMESTIC WATER OUTPUT AT 105°F MAXIMUM TO HAND SINK.

CIRCULATOR PUMP SCHEDULE

MANUFACTURER: GRUNDFOS

MARK	MODEL	TYPE	MOTOR				PERFORMANCE		REMARKS
			HP	VOLT/PH	AMPS	WATTS	GPM	HEAD	
CP 1	UPS 26-99FC	CIRCULATING PUMP	1/6	115/1Ø	1.3	150	2.2	6 FT	1, 2, 3

REMARKS:
1. ALL BRONZE CONSTRUCTION; PROVIDE WITH AQUASTAT
2. FOR DOMESTIC HOT WATER RECIRCULATION
3. PROVIDE WITH PIGTAIL CONNECTION

PLUMBING LEGEND

SYMBOL	ABBREVIATION	DESCRIPTION
1 / P-1		DRAWING NUMBER
A / P-1		DETAIL NUMBER / DRAWING NUMBER
WH 1		EQUIPMENT IDENTIFICATION
		PIPE UP
		PIPE DOWN
	CW	COLD WATER LINE
	HW	HOT WATER LINE
	HWR	HOT WATER RETURN LINE
FCW	FCW	FILTERED COLD WATER LINE
G	G	GAS LINE
	S OR W	SANITARY SEWER OR WASTE LINE
S(G)	S(G)	SANITARY SEWER LINE (GREASE)
	V	VENT LINE
	BG	PIPE BELOW GRADE
		DIRECTION OF FLOW
F	F	FIRE PROTECTION WATER SUPPLY
CD	CD	CONDENSATE DRAIN
	FCO	FLOOR CLEANOUT
	WCO	WALL CLEANOUT
	GCO	GRADE CLEANOUT
GM	GM	GAS METER
	SA	SHOCK ABSORBER
	CV	CHECK VALVE
	GC	GAS COCK
	STR	STRAINER
		UNION
	POC	POINT OF CONNECTION
	AP	ACCESS PANEL
	BF	BELOW FLOOR
	CFH	CUBIC FEET PER HOUR
	CR	CONDENSATE RECEIVER
	DIW	DOWN IN WALL
	DN	DOWN
	DTBG	DOWN TO BELOW GRADE
	DTR	DOWN THROUGH ROOF
	GA	GAUGE
	HB	HOSE BIBB
	IFC	IN FURRED CEILING
	ITS	IN TRUSS SPACE
	IW	IN WALL
	NIPS	NOT IN PLUMBING SECTION
	SHTMTL	SHEET METAL
	SMD	SEE MECHANICAL DRAWINGS
	TP	TRAP PRIMER
	UIW	UP IN WALL
	UTR	UP THROUGH ROOF
	VTR	VENT THROUGH ROOF

NOT FOR CONSTRUCTION

KEYPLAN

FOR REFERENCE ONLY

QUATTROCCHI KWOK ARCHITECTS
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LIBERTY HIGH SCHOOL

NEW MAINTENANCE, OPERATIONS & TRANSPORTATION FACILITIES

850 2ND STREET
BRENTWOOD, CA
94513

LIBERTY UNION HIGH SCHOOL DISTRICT

IDENTIFICATION STAMP
DIVISION OF THE STATE ARCHITECT
FILE NO: XX-XX
APPL NO: 0X-XXXXXX
AC_____ FLS_____ SS_____
DATE_____

REVISIONS

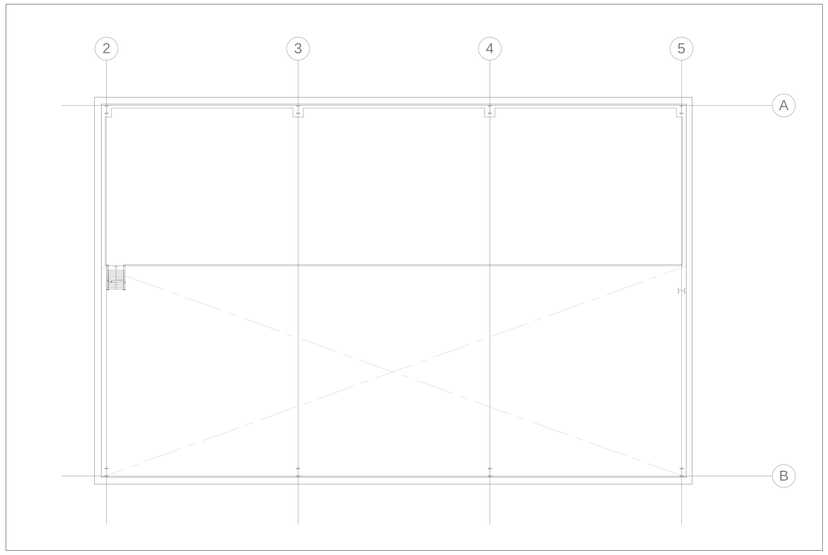
ARCH PROJECT NO: 1707.00
DRAWN BY: MEC
DRAWING SCALE: AS SHOWN

50% DD
APRIL 13, 2018

SHEET TITLE
PLUMBING SCHEDULES & LEGENDS

SHEET NUMBER
P-1.1

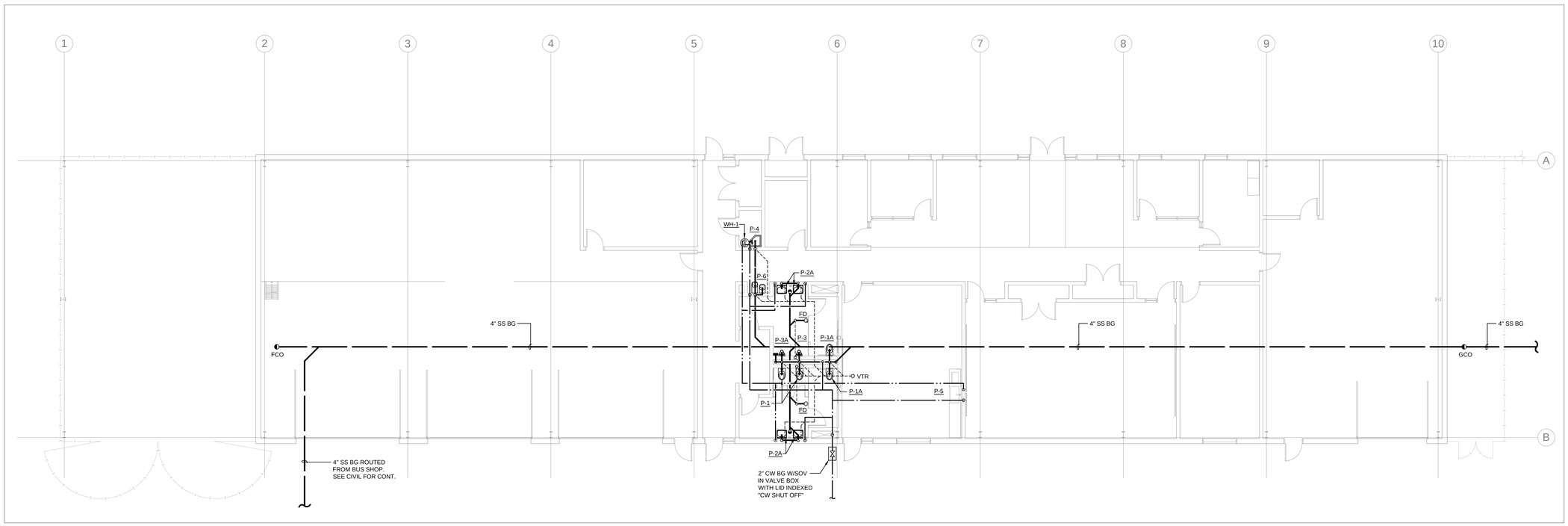
/Volumes/Projects/17007 QKA - Liberty High School M&O Bldgs.



2 M & O BLDG. PLUMBING MEZZANINE PLAN

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

PLUMBING SHEET NOTES



1 M & O BLDG. PLUMBING FLOOR PLAN

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

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KEYPLAN

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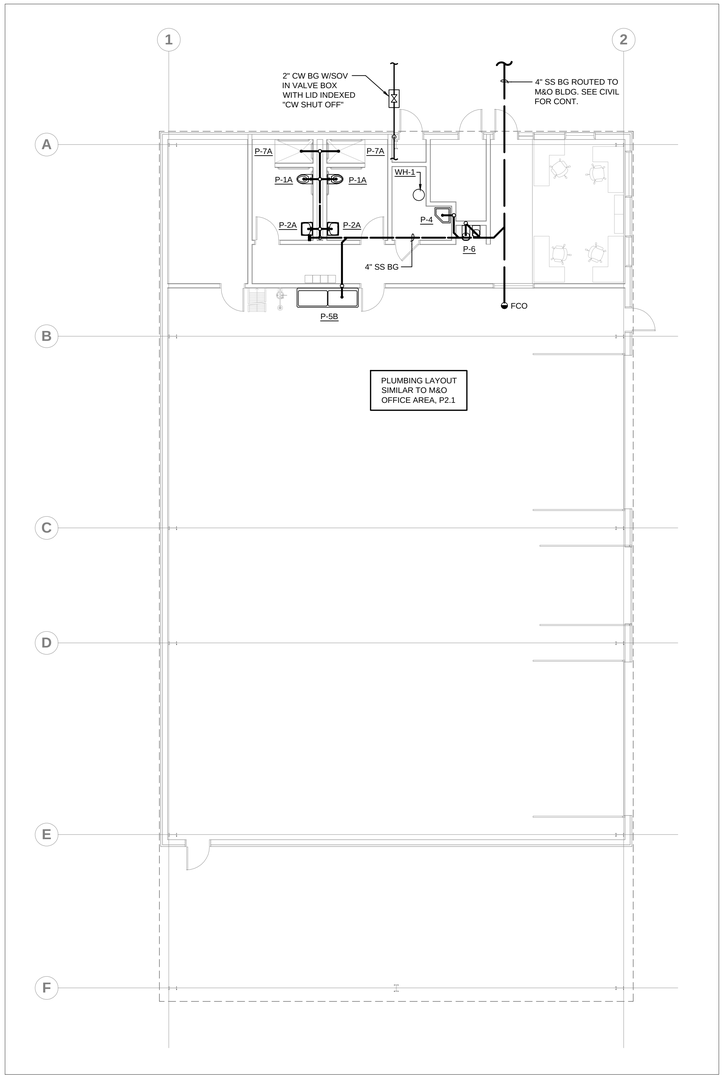
SHEET TITLE

M & O BLDG. PLUMBING FLOOR + MEZZ. PLAN

SHEET NUMBER

P-2.1

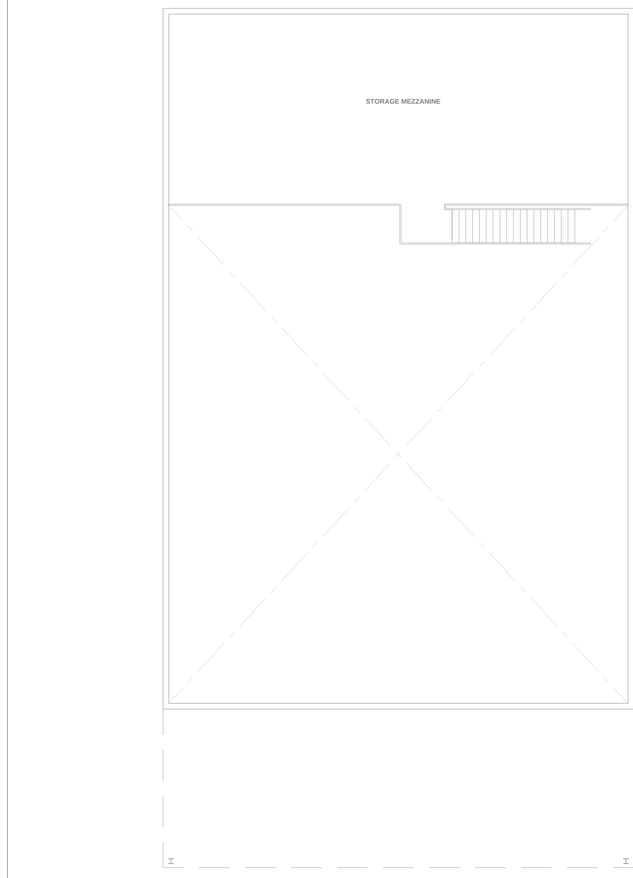
/Volumes/Projects/17007 QKA - Liberty High School M&O Bldgs.



1 BUS SHOP PLUMBING FLOOR PLAN

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

PLUMBING SHEET NOTES



1 BUS SHOP PLUMBING MEZZANINE PLAN

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

FOR REFERENCE ONLY

KEYPLAN

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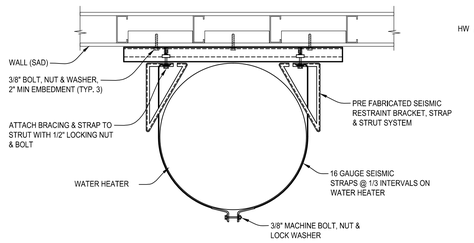
SHEET TITLE

BUS SHOP PLUMBING FLOOR + MEZZ. PLAN

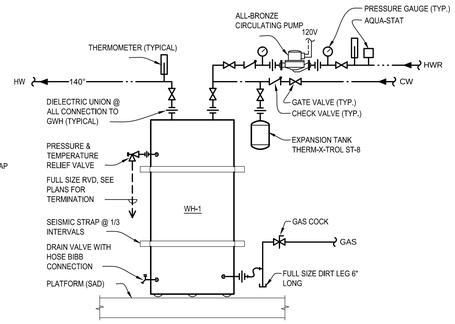
SHEET NUMBER

P-2.2

J:\Volumes\Projects\17007 QKA - Liberty High School M&O Bldgs.



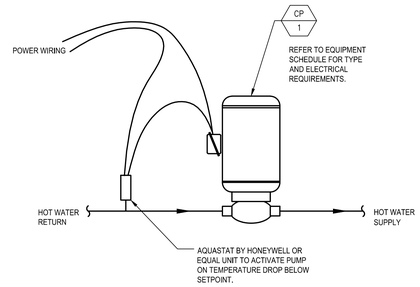
PLAN VIEW



PIPING DIAGRAM

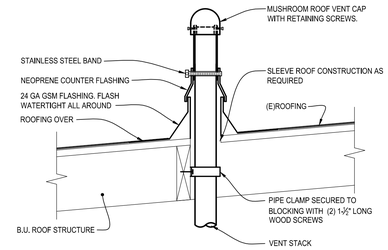
A WATER HEATER MOUNTING DETAIL & PIPING DIAGRAM

SCALE: NONE



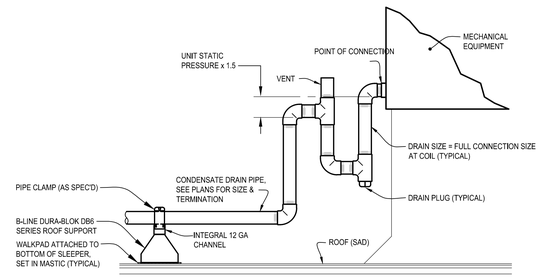
B HW CIRCULATING PUMP DETAIL

NOT TO SCALE



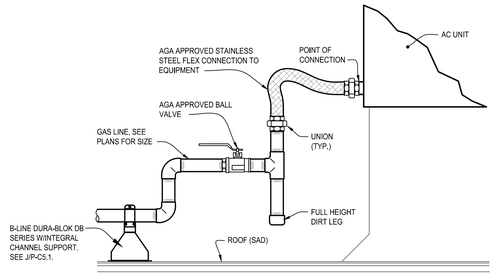
C VENT THROUGH ROOF DETAIL

SCALE: NONE



D CONDENSATE ON ROOF DRAIN DETAIL

SCALE: NONE



E GAS CONNECTION DETAIL

SCALE: NONE

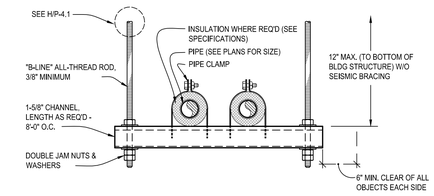
NOTES:

1. RUN PIPING TRAPEZE AS CLOSE AS POSSIBLE TO STRUCTURE.
2. SUPPORT PIPING AT A MAXIMUM OF 8'-0" INTERVALS.
3. SEE PLANS FOR PIPE SIZES.
4. CHANNEL DEFLECTION SHALL NOT EXCEED 1/360 OF THE SPAN BETWEEN RODS. DOUBLE-UP CHANNELS AS REQUIRED.
5. NO BRACING IS REQUIRED ON PIPES LESS THAN 2-1/2" IN DIAMETER, AND WHEN SUPPORTED LESS THAN 12" FROM BOTTOM OF BLDG STRUCTURE.

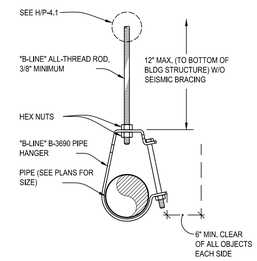
TRAPEZE LOAD & SUPPORT CONDITIONS:

HEAVY: 645 LBS PER TRAPEZE, OR MORE: 1/2"Ø ALL-THREAD TO WOOD BLOCKING.

NOT HEAVY: LESS THAN 645 LBS PER TRAPEZE: 3/8"Ø ALL-THREAD TO WOOD BLOCKING.

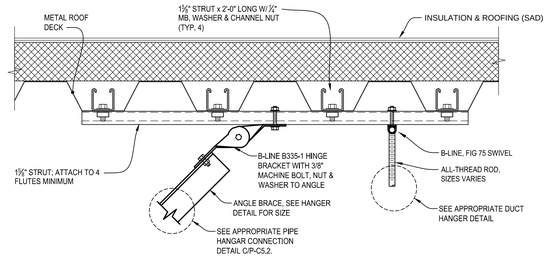


MINIMUM ROD SIZES (INCHES)	PIPE DIAMETER (INCHES)
3/8"	2" & SMALLER PIPE
1/2"	2-1/2" & LARGER PIPE



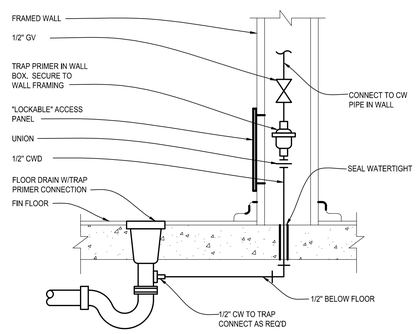
F TYPICAL PIPE HANGER DETAILS

SCALE: NONE



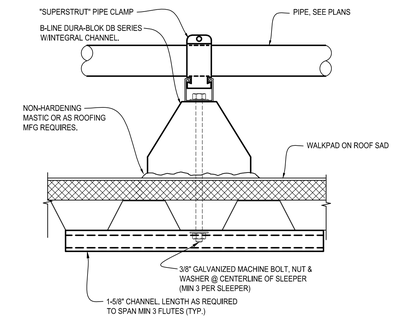
G SEISMIC BRACE & HANGER CONNECTION TO DECK W/O FILL

SCALE: NONE



H TRAP PRIMER TO FLOOR DRAIN

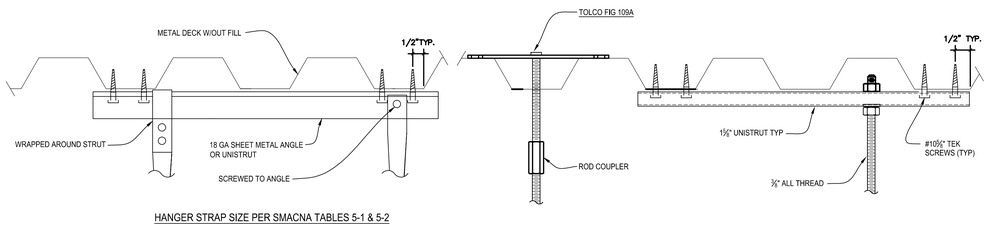
SCALE: NONE



NOTE: SUPPORTS SHALL BE AT 8'-0" ON CENTER & AT ALL CHANGE OF DIRECTION

J PIPE SUPPORT DETAIL - FUEL PIPING

SCALE: NONE



HANGER STRAP SIZE PER SMACNA TABLES 5-1 & 5-2

K TYP. HANGER CONNECTION @ METAL DECK WITHOUT FILL

SCALE: NONE

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APRIL 13, 2018

SHEET TITLE

PLUMBING DETAILS

SHEET NUMBER

P-4.1

FOR REFERENCE ONLY

/Volumes/Projects/17007 QKA - Liberty High School M&O Bldgs.

SYMBOLS LIST

	FIRE ALARM SYSTEM END-OF-LINE RESISTOR
FSD	FIRE SMOKE DAMPER BY MECHANICAL. COORDINATE WITH MECHANICAL FOR MONITORING TO FIRE ALARM SYSTEM (INCLUDING SMOKE DETECTOR PROVISIONS). CONTROL OF DAMPER TO BE BY MECHANICAL, U.O.N. PROVIDE TOGGLE TYPE DISCONNECT SWITCH
FACP	FIRE ALARM CONTROL PANEL
FAAP	FIRE ALARM ANNUNCIATOR PANEL
	WEATHERPROOF ENCLOSURE
	CONDUIT AND WIRE CONCEALED IN CEILING OR WALL
	CONDUIT AND WIRE CONCEALED IN OR UNDER SLAB OR UNDERGROUND
	CONDUIT AND WIRE RUN EXPOSED
	CROSSMARKS INDICATE QUANTITY OF #12 CONDUCTORS PLUS PARITY SIZED GROUND CONDUCTOR (INCLUDED BUT NOT INDICATED), NO HASHMARKS INDICATES (2) #12 CONDUCTORS PLUS PARITY SIZED GROUND CONDUCTOR, U.O.N.
	GROUND WIRE
(#10)	WIRE SIZE 10 AWG FOR ALL CONDUCTORS, INCLUDING GROUND WIRE, THROUGHOUT THE COMPLETE CIRCUIT
	FLEXIBLE METALLIC CONDUIT
	HOMERUN TO PANELBOARD OR TERMINAL BOARD, AS NOTED ON PLANS
	COMPLETE CONNECTION OF EQUIPMENT
	CONDUIT STUBBED OUT, CAPPED AND MARKED
	CONDUIT TURNED UP
	CONDUIT TURNED DOWN
T	TELEPHONE SYSTEM CONDUIT AND PULLWIRE; 3/4" U.O.N.
C	COMPUTER/DATA SYSTEM CONDUIT AND PULLWIRE; 3/4" U.O.N.
D	TELEPHONE/DATA SYSTEM CONDUIT AND PULLWIRE; 3/4" U.O.N.
G	#4/0 COPPER GROUNDING ELECTRODE CONDUCTOR, U.O.N.
AC-1	MECHANICAL EQUIPMENT DESIGNATION - SEE MECHANICAL PLANS
3 / E-6	DETAIL DESIGNATION - SEE DETAIL 3, SHEET E-6
1	NUMBERED SHEET NOTE
M	UTILITY METER
CT'S	CURRENT TRANSFORMERS
30A 3P	CIRCUIT BREAKER. NUMBER INDICATES 30A 3-POLE
1504N	FEEDER SIZE - SEE POWER SINGLE LINE DIAGRAMS & FEEDER SCHEDULE

ABBREVIATIONS

A.F.F.	ABOVE FINISHED FLOOR
A.F.G.	ABOVE FINISHED GRADE
C	CONDUIT
CATV	CABLE TV
C.O.	CONDUIT ONLY
CU	COPPER
E.C.	ELECTRICAL CONTRACTOR
E	EMERGENCY LIGHT FIXTURE ON EMERGENCY GENERATOR OR INVERTER, SWITCHABLE, U.O.N.
EM	EMERGENCY LIGHT FIXTURE WITH BATTERY PACK, SWITCHABLE
EMS	ENERGY MANAGEMENT SYSTEM
(E)	EXISTING
EQPT	EQUIPMENT
(ER)	EXISTING EQUIPMENT TO BE RELOCATED
(EX)	EXISTING EQUIPMENT TO BE DISCONNECTED AND REMOVED
EXT	EXTERIOR
FMC	FLEXIBLE METALLIC CONDUIT
GFI	GROUND FAULT CIRCUIT INTERRUPTING TYPE RECEPTACLE
IDF	INTERMEDIATE DISTRIBUTION FRAME
L	LOCKABLE
LV	LOW VOLTAGE
MCB	MAIN CIRCUIT BREAKER
MDF	MAIN DISTRIBUTION FRAME
MFR	MANUFACTURER
MLO	MAIN LUGS ONLY
MTD	MOUNTED
(N)	NEW
N.E.C.	NATIONAL ELECTRICAL CODE
NEU	NEUTRAL
N.I.E.C.	NOT IN ELECTRICAL CONTRACT
O.A.H.	OVERALL HEIGHT
O.F.C.I.	OWNER FURNISHED, CONTRACTOR INSTALLED
P	INDICATES FIXTURES ON PHOTOCELL CONTROL
PA	PUBLIC ADDRESS
PNL	PANEL
S.A.D.	SEE ARCHITECTURAL DRAWINGS
STC	SIGNAL TERMINAL CABINET
TC	INDICATES FIXTURES ON TIMECLOCK CONTROL
TELE	TELEPHONE
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
U.O.N.	UNLESS OTHERWISE NOTED
VAV	VAV BOX, SEE MECHANICAL DIVISION DRAWINGS FOR LOCATIONS. PROVIDE TOGGLE TYPE DISCONNECT SWITCH
WP	WEATHER PROOF, NEMA 3R
WPIU	WEATHER PROOF WHILE IN USE

SYMBOLS LIST

	MAIN SWITCHBOARD, DISTRIBUTION PANEL OR MOTOR CONTROL CENTER
	FLUSH MOUNTED PANELBOARD, 6'-6" TO TOP
	SURFACE MOUNTED PANELBOARD, 6'-6" TO TOP
	FUSED EQUIPMENT DISCONNECT SWITCH WITH FUSE SIZE AS RECOMMENDED BY EQUIPMENT MANUFACTURER
	MOTOR DISCONNECT SWITCH; HORSEPOWER RATED, NON FUSE
	COMBINATION MOTOR STARTER & DISCONNECT
	MAGNETIC MOTOR STARTER
VFD	VARIABLE FREQUENCY DRIVE, FURNISHED BY MECHANICAL, INSTALLED & CONNECTED COMPLETE BY ELECTRICAL
	MANUAL MOTOR STARTER WITH OVERLOAD PROTECTION
	MOTOR WITH FLEXIBLE CONDUIT CONNECTION AND DISCONNECT
T	TRANSFORMER
	CONCRETE PULLBOX, SIZE AS REQUIRED OR SHOWN - CHRISTY OR EQUAL WITH LABELED LID PER USE
	COPPER GROUND ROD
J	FLUSH CEILING MOUNTED JUNCTION BOX, U.O.N.
J	FLUSH WALL MOUNTED JUNCTION BOX, UP 18" U.O.N.
J	JUNCTION BOX FLUSH FLOOR MOUNTED
	20A 3PG 125V DUPLEX RECEPTACLE, UP 18" U.O.N.
	20A 3PG 125V DUPLEX RECEPTACLE, WEATHERPROOF, UP 18" U.O.N.
GFI	20A 3PG 125V DUPLEX RECEPTACLE, GROUND FAULT CIRCUIT INTERRUPTER TYPE, UP 18" U.O.N.
IG	20A 3PG 125V DUPLEX RECEPTACLE, ISOLATED GROUND TYPE, UP 18" U.O.N.
T	20A 3PG 125V DUPLEX RECEPTACLE, TAMPER RESISTANT, UP 18" U.O.N.
	20A 3PG 125V DUPLEX RECEPTACLE, MOUNTED ABOVE COUNTER, U.O.N.
	20A 3PG 125V DOUBLE DUPLEX RECEPTACLE, UP 18" U.O.N.
	20A 3PG 125V DOUBLE DUPLEX RECEPTACLE, MOUNTED ABOVE COUNTER, U.O.N.
	20A 3PG 125V SINGLE RECEPTACLE, UP 18" U.O.N.
	20A 3PG 125V SINGLE TWISTLOCK RECEPTACLE, NEMA L5-20R, UP 18" U.O.N.
	SPECIAL RECEPTACLE AS INDICATED ON PLANS
	CONTROLLED AND IDENTIFIED (SPLIT-WIRED) DUPLEX RECEPTACLE, WITH ONE HALF OF RECEPTACLE WIRED THROUGH LOCAL PLUG-LOAD CONTROLLER, UP 18" U.O.N.
	FLUSH IN FLOOR OUTLET BOX WITH QUANTITY OF 20A 3PG 125V DUPLEX RECEPTACLES AS INDICATED ON PLANS
	FLUSH CEILING MTD. DUPLEX OUTLET, 20A 3PG
T	LINE VOLTAGE THERMOSTAT, PROVIDED & INSTALLED BY ELECTRICAL, CONNECTED COMPLETE BY MECHANICAL
	SURFACE MOUNTED WIREMOLD RACEWAY WITH RECEPTACLES AS INDICATED ON PLANS
	TERMINAL MOUNTING BACKBOARD, 3/4" PLYWOOD, DIMENSIONS AS NOTED ON PLANS, PAINT TO MATCH ADJACENT WALL SURFACE, MAINTAINING UL FIRE LABEL VISIBLE
	TELEPHONE OUTLET, UP 18" U.O.N.
w	TELEPHONE OUTLET, UP 48" U.O.N.
(2)	COMBINED TELEPHONE/DATA OUTLET, UP 18" U.O.N.
	NUMBER INDICATES QUANTITY OF DATA OUTLET JACKS
	COMBINED VOICE/DATA OUTLET, MOUNTED ABOVE COUNTER U.O.N.
	INTERCOM HANDSET, UP 48" U.O.N.
	WALL MOUNTED SIGNAL SYSTEM CLOCK, UP 96" U.O.N.
TV	WALL MOUNTED VIDEO OUTLET, UP 18" U.O.N.
	FLUSH WALL MOUNTED INDOOR PUBLIC ADDRESS SPEAKER, UP 96" U.O.N.
	FLUSH WALL MOUNTED OUTDOOR WEATHERPROOF PUBLIC ADDRESS SPEAKER
	FLUSH CEILING MOUNTED INDOOR PUBLIC ADDRESS SPEAKER
	FLUSH WALL MOUNTED INDOOR PUBLIC ADDRESS SPEAKER & SIGNAL SYSTEM CLOCK, UP 96" U.O.N.
F	FIRE ALARM SYSTEM MANUAL PULL STATION, UP 48" U.O.N.
F 110	FIRE ALARM SYSTEM HORN/STROBE, UP 80" U.O.N. NUMBER ADJACENT INDICATES CANDELA VALUE FOR STROBE
F 110	WEATHERPROOF FIRE ALARM SYSTEM HORN/STROBE, UP 80" U.O.N. NUMBER ADJACENT INDICATES CANDELA VALUE FOR STROBE
H 110	FIRE ALARM SYSTEM HORN/STROBE, CEILING MOUNTED. NUMBER ADJACENT INDICATES CANDELA VALUE FOR STROBE
S 110	FIRE ALARM SYSTEM STROBE, UP 80" U.O.N. NUMBER ADJACENT INDICATES CANDELA VALUE FOR STROBE
S 110	FIRE ALARM SYSTEM STROBE, CEILING MOUNTED. NUMBER ADJACENT INDICATES CANDELA VALUE FOR STROBE
H	WEATHERPROOF FIRE ALARM SYSTEM HORN, UP 90" U.O.N.
D 110	WALL MOUNTED ELECTROMAGNETIC DOOR HOLD-OPEN DEVICE, FURNISHED BY DIV. 8, INSTALLED & CONNECTED COMPLETE TO FIRE ALARM SYSTEM BY DIV. 28
FS	FIRE ALARM SYSTEM SPRINKLER FLOW SWITCH. PROVIDE MONITOR MODULE
TS	FIRE ALARM SYSTEM SPRINKLER VALVE SUPERVISORY SWITCH. PROVIDE MONITOR MODULE
PIV	POST INDICATING VALVE
B	SPRINKLER FLOW ALARM (PROVIDE BY SPRINKLER CONTRACTOR). CONNECT COMPLETE VIA WATER FLOW SWITCH AUX. CONTACTS
S	FIRE ALARM SYSTEM SMOKE DETECTOR
E S	FIRE ALARM SYSTEM CEILING MOUNTED SMOKE DETECTOR PROGRAMMED FOR AUTOMATIC RECALL OF ELEVATOR
H	FIRE ALARM SYSTEM HEAT DETECTOR
D	FIRE ALARM SYSTEM HVAC DUCT MOUNTED SMOKE DETECTOR. COORDINATE WITH MECHANICAL FOR SUPPLY, INSTALL AND COMPLETE CONNECTION (INCLUDING CONTROL OF HVAC EQUIPMENT) - SEE SPECIFICATIONS
M	FIRE ALARM SYSTEM MONITOR MODULE
C	FIRE ALARM SYSTEM CONTROL MODULE
R	FIRE ALARM SYSTEM RELAY MODULE
CO	FIRE ALARM SYSTEM CEILING MOUNTED CARBON MONOXIDE DETECTOR WITH SOUNDER BASE
H	FIRE ALARM SYSTEM MAGNETIC DOOR HOLD-OPEN

SYMBOLS LIST

ALL SWITCH AND CONTROL MOUNTING HEIGHTS OF 48" SHALL BE TO TOP OF THE DEVICE BOX. ALL RECEPTACLES WITH MOUNTING HEIGHT OF UP TO 18" SHALL BE NO LOWER THAN 15" TO BOTTOM OF THE DEVICE BOX, TYPICAL, U.O.N.

AA1	INDICATES LUMINAIRE TYPE, SEE LUMINAIRE SCHEDULE
	RECESSED 2'x2', 2'x4' OR 1'x4' LUMINAIRE, FULLY LENSED
EM OR E	INDICATES EMERGENCY LUMINAIRE. SEE ABBREVIATIONS FOR TYPE OF EMERGENCY SOURCE
EM OR E	SUSPENDED LINEAR LUMINAIRE
	INDICATES AIRCRAFT CABLE SUPPORT POINT (VERIFY WITH MANUFACTURER)
	INDICATES COMBINATION AIRCRAFT CABLE/ELECTRICAL FEED POINT (VERIFY WITH MANUFACTURER)
	SURFACE CEILING OR WALL MOUNTED LUMINAIRE
	UNDER CABINET LUMINAIRE
	SURFACE CEILING MOUNTED LUMINAIRE
	WALL MOUNTED LUMINAIRE
	POLE ARM-MOUNTED AREA LUMINAIRE; ARROW INDICATES DIRECTION OF LIGHT DISTRIBUTION WHEN NOT PARALLEL TO ARM ORIENTATION
	POST-TOP PEDESTRIAN-SCALE AREA LUMINAIRE; ARROW INDICATES DIRECTION OF LIGHT DISTRIBUTION
	WALL MOUNTED EXIT SIGN, ARROWS AS NOTED ON PLANS. SHADED AREA INDICATES NUMBER OF FACES
	CEILING MOUNTED EXIT SIGN, ARROWS AS NOTED ON PLANS. SHADED AREA INDICATES NUMBER OF FACES
$a	LINE VOLTAGE SINGLE POLE TOGGLE SWITCH, LETTER ADJACENT INDICATES RESPECTIVE ZONE CONTROLLED, UP 48" U.O.N.
$2	LINE VOLTAGE TWO POLE TOGGLE SWITCH, UP 48" U.O.N.
$3	LINE VOLTAGE THREE-WAY TOGGLE SWITCH, UP 48" U.O.N.
$k	LINE VOLTAGE KEY OPERATED TOGGLE SWITCH
$m	LINE VOLTAGE MOTOR RATED TOGGLE SWITCH INSTALLED AT EQPT SHOWN
$p	LINE VOLTAGE TOGGLE SWITCH WITH PILOT LIGHT, LIGHT IS ON WHEN CIRCUIT IS CLOSED, UP 48" U.O.N.
$ab	LOW VOLTAGE MOMENTARY CONTACT SWITCH - SEE LOW VOLTAGE RELAY SCHEDULE, LOWER CASE LETTER ADJACENT INDICATES RESPECTIVE ZONE CONTROLLED, UP 48" U.O.N. SEE SPECS FOR TYPE OF SWITCH
k$ab	LOW VOLTAGE KEYED MOMENTARY CONTACT SWITCH - SEE LOW VOLTAGE RELAY SCHEDULE, LOWER CASE LETTER ADJACENT INDICATES RESPECTIVE ZONE CONTROLLED, UP 48" U.O.N. SEE SPECS FOR TYPE OF SWITCH
aOSb	WALL MOUNTED SWITCH TYPE INFRARED OCCUPANCY SENSOR; UP 48" U.O.N.; SINGLE OR DUAL AS NOTED BY LETTERS ADJACENT. SET TO FIXED 20 MINUTE TIME DELAY AND MAX SENSITIVITY
aDSb	WALL MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR; UP 48" U.O.N.; SINGLE OR DUAL AS NOTED BY LETTERS ADJACENT. SET TO FIXED 20 MINUTE TIME DELAY AND MAX SENSITIVITY
OST	WALL MOUNTED DIGITAL DUAL TECHNOLOGY DIMMING OCCUPANCY SENSOR SWITCH; UP 48" U.O.N.
Sa	WALL MOUNTED DIGITAL SWITCH, UP 48" U.O.N.; LOWER CASE LETTER ADJACENT INDICATES RESPECTIVE ZONE CONTROLLED; SEE DETAILS FOR TYPE
aDa,b	WALL MOUNTED SINGLE OR MULTI-ZONE DIGITAL DIMMER SWITCH, UP 48" U.O.N.; LOWER CASE LETTERS ADJACENT INDICATE RESPECTIVE ZONES TO BE SIMULTANEOUSLY MANUALLY CONTROLLED; NUMERAL DESIGNATES NUMBER OF ZONES ASSIGNED TO THE DEVICE; SEE DETAILS FOR TYPE.
	CEILING MOUNTED DUAL TECHNOLOGY DIGITAL OCCUPANCY SENSOR; SEE DETAILS FOR TYPE
	WALL MOUNTED DUAL TECHNOLOGY DIGITAL OCCUPANCY SENSOR; SEE DETAILS FOR TYPE
	CEILING MOUNTED LINE VOLTAGE DUAL TECHNOLOGY OCCUPANCY SENSOR
Z3,Z4 P	SINGLE OR MULTI-ZONE SWITCHING OR DIMMING OPEN LOOP DIGITAL DAYLIGHTING SENSOR; NOTATIONS ADJACENT IDENTIFY DAYLIGHT ZONES ASSIGNED TO THE DEVICE; SEE DETAILS FOR TYPE. VERIFY EXACT LOCATION PRIOR TO ROUGH-IN
Z1 P	SINGLE ZONE SWITCHING OR DIMMING CLOSED LOOP DIGITAL DAYLIGHTING SENSOR; NOTATIONS ADJACENT IDENTIFY DAYLIGHT ZONES ASSIGNED TO THE DEVICE; SEE DETAILS FOR TYPE. VERIFY EXACT LOCATION PRIOR TO ROUGH-IN
Z1 P	DAYLIGHT CONTROL PHOTOCELL - BRACKET MOUNTED; NOTATIONS ADJACENT IDENTIFY DAYLIGHT ZONES ASSIGNED TO THE DEVICE; SEE DETAILS FOR TYPE. VERIFY EXACT LOCATION PRIOR TO ROUGH-IN
Z2	INDICATES DAYLIGHT ZONE CONTROLLED VIA PHOTOCELL
RC 2	ROOM CONTROLLER; SEE DETAILS FOR TYPE ADJACENT NUMERAL REFERS TO THE NUMBER OF ZONES TO BE CONTROLLED. VENDOR OR CONTRACTOR TO PROVIDE QUANTITY OF ROOM CONTROLLERS REQUIRED FOR THE NUMBER OF CONTROLLED ZONES.
PC	PLUG LOAD ROOM CONTROLLER; SEE DETAILS FOR TYPE
NB	NETWORK BRIDGE; SEE DETAILS FOR TYPE AND CABLING
IR	ISOLATED RELAY INTERFACE; SEE DETAILS FOR TYPE
EC	EMERGENCY LIGHTING CONTROL MODULE
P	OCCUPANCY SENSOR POWER PACK MOUNTED IN CONCEALED ACCESSIBLE LOCATION
R	REMOTE LIGHTING SCENE CONTROL STATION
	INFRARED PARTITION SENSOR - TRANSMITTER AND RECEIVER

CALIFORNIA GREEN BUILDING STANDARDS COMPLIANCE

ALL EXTERIOR LUMINAIRES SPECIFIED IN THESE CONTRACT DOCUMENTS COMPLY WITH THE REQUIREMENTS OF THE CALIFORNIA ENERGY CODE AND THE CALIFORNIA GREEN BUILDING STANDARDS CODE, SECTION A5.106.8 LIGHT POLLUTION REDUCTION. EXTERIOR LUMINAIRES COMPLY WITH BACKLIGHT, UPLIGHT, AND GLARE (BUG) RATINGS AS DEFINED IN IESNA TM-15-11 AND BUG RATINGS DO NOT EXCEED THE MAXIMUM ALLOWABLE RATINGS FOR THIS PROJECT.

GENERAL NOTES

1. PRIOR TO BID THE CONTRACTOR SHALL VISIT THE SITE TO ADEQUATELY DETERMINE ALL PRE-EXISTING CONDITIONS. BY THE ACT OF SUBMITTING A BID, THE CONTRACTOR WILL BE DEEMED TO HAVE COMPLIED WITH THE FOREGOING, TO HAVE ACCEPTED SUCH CONDITIONS, AND TO HAVE MADE ALLOWANCES THEREFORE IN PREPARING THE BID.
2. PROVIDE PARITY SIZED GREEN GROUND WIRE IN ALL POWER CONDUITS, BRANCH CIRCUITS (LIGHTING & POWER) AND HOMERUNS. PROVIDE ADDITIONAL ISOLATED GROUND, GREEN WITH YELLOW STRIPE, TO ALL ISOLATED GROUND RECEPTACLES.
3. PROVIDE PULLROPE IN ALL EMPTY CONDUITS THROUGHOUT THE PROJECT.
4. REFER TO ARCHITECTURAL PLANS AND ELEVATIONS FOR EXACT LOCATION & CONNECTION REQUIREMENTS OF ALL LUMINAIRE(S) AND ALL OUTLET, SWITCH, AND ELECTRICAL RELATED DEVICE MOUNTING HEIGHTS AND LOCATIONS. COORDINATE LOCATIONS OF ALL LUMINAIRE(S) AND JUNCTION BOXES WITH MECHANICAL DIVISION PRIOR TO ROUGH-IN. COORDINATE LOCATIONS OF ELECTRICAL DEVICES WITH FURNITURE PLANS PRIOR TO ROUGH-IN.
5. REFER TO MECHANICAL PLANS FOR EXACT LOCATION(S) OF ALL MECHANICAL EQUIPMENT, AND CONFIRM EXACT CONNECTION REQUIREMENTS OF ALL MECHANICAL EQUIPMENT WITH MECHANICAL DIVISION, PRIOR TO ROUGH-IN. VERIFY EXACT REQUIREMENTS FOR VOLTAGE, PHASE, HORSE-POWER, OR KVA RATINGS, OF ALL MECHANICAL DIVISION EQUIPMENT REQUIRING ELECTRICAL CONNECTION.
6. VERIFY EXACT CONNECTION REQUIREMENTS, OUTLET TYPE(S), MOUNTING HEIGHT(S) AND LOCATION(S) OF ALL OWNER-SUPPLIED EQUIPMENT, AND ALL EQUIPMENT PROVIDED UNDER OTHER SECTIONS OF THE SPECIFICATIONS, PRIOR TO ROUGH-IN. REFER TO ARCHITECTURAL DRAWINGS FOR EQUIPMENT LOCATIONS.
7. COORDINATE TRENCHING WITH OWNER AND OTHER TRADES BEFORE BEGINNING WORK.
8. ALL CONDUIT PENETRATIONS THROUGH FIRE-RATED WALLS AND FLOORS SHALL BE SEALED AND EQUIPPED WITH U.L. LISTED FIRE PENETRATION ASSEMBLIES TO MAINTAIN FIRE SEPARATION RATING.
9. DO NOT INSTALL ANY OUTLETS BACK TO BACK IN STUD WALLS OR DE-MOUNTABLE PARTITIONS.
10. THE CONTRACTOR SHALL VERIFY ALL CEILING TYPES BEFORE ORDERING OF LUMINAIRE(S). ALSO VERIFY THAT ALL FEATURES CALLED FOR IN LUMINAIRE DESCRIPTIONS ON THE LUMINAIRE SCHEDULE ARE INCLUDED WITH CATALOG NUMBERS LISTED ON THE LUMINAIRE SCHEDULE WHEN LUMINAIRE ORDERS ARE PLACED, AND ARE INCLUDED AS PART OF THE LIGHTING SUBMITTALS FOR THIS PROJECT. IF A DISCREPANCY EXISTS, CONTACT THE ARCHITECT AND ELECTRICAL ENGINEER FOR CLARIFICATION PRIOR TO BID.
11. CIRCUITRY AND CONDUIT ROUTING SHOWN ON THE PLANS IS DIAGRAMMATIC ONLY. THIS CONTRACTOR IS RESPONSIBLE FOR BECOMING COMPLETELY FAMILIAR WITH THE ARCHITECTURAL AND STRUCTURAL CONDITIONS AND LIMITATIONS IN THE BUILDING AND TO PROVIDE ALL LABOR, TOOLS AND MATERIALS REQUIRED TO PRODUCE A COMPLETELY CONCEALED INSTALLATION WHEREVER INDICATED ON THE PLANS.
12. MAINTAIN "AS-BUILT" RECORDS AT ALL TIMES, SHOWING EXACT LOCATION OF ALL UNDERGROUND AND/OR CONCEALED CONDUITS AND SERVICES INSTALLED UNDER THIS CONTRACT, INCLUDING CIRCUIT IDENTIFICATION WHERE APPLICABLE. PROVIDE OWNER WITH "AS-BUILT" DOCUMENTS AS INDICATED IN THE SPECIFICATIONS, AND/OR CALLED FOR IN THE SPECIFICATIONS.
13. DRAWINGS INDICATE THE LOCATION(S) OF DEVICES, LUMINAIRE(S) AND EQUIPMENT, AND THE CIRCUIT NUMBER AND PANEL DESIGNATED TO SUPPLY THEM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETELY CONNECTING ALL ELECTRICAL DEVICES TO CIRCUITS INDICATED ON THE DRAWINGS.
14. UNLESS OTHERWISE NOTED, ALL WORK SHOWN ON DRAWINGS IS NEW AND TO BE PROVIDED AND INSTALLED COMPLETE UNDER THIS CONTRACT.
15. ALL EQUIPMENT GROUNDING SHALL CONFORM TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE, LATEST EDITION.
16. ALL EXTERIOR CONDUIT ABOVE GRADE, INCLUDING ALL ROOF MOUNTED CONDUIT, SHALL BE GALVANIZED RIGID STEEL. COAT ALL EXPOSED THREADS WITH GALVANIZING PAINT. PAINT ALL SURFACE MOUNTED RACEWAYS AND PULLBOXES TO MATCH SURROUNDING CONDITIONS, AS DIRECTED BY THE ARCHITECT.
17. ALL ELECTRICAL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE LATEST EDITION OF THE N.E.C., AS WELL AS STATE, AND LOCAL CODES AND REQUIREMENTS.
18. ALL CONDUIT SHALL BE CONCEALED, UNLESS OTHERWISE NOTED.
19. THE CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY THE AVAILABLE SHORT CIRCUIT CURRENT AT THE MAIN SWITCHBOARD INCOMING TERMINALS WITH THE UTILITY COMPANY, AND TO VERIFY THAT ALL POWER AND SIGNAL SERVICE PROVISIONS, INCLUDING CONCRETE EQUIPMENT PADS, CONDUITS, PULLBOXES AND CLEARANCES, MEET THE UTILITY COMPANY'S REQUIREMENTS, PRIOR TO INSTALLATION.
20. EQUIPMENT OVERLOADS AND FUSES SHALL BE PROVIDED AND INSTALLED AS PER NAME PLATE ON THE EQUIPMENT ACTUALLY PROVIDED.
21. THE CONTRACTOR SHALL PAY FOR ALL REQUIRED PERMITS AND INSPECTION FEES.
22. THE CONTRACTOR SHALL VERIFY ALL CRITICAL DIMENSIONS WITH THE ARCHITECTURAL DRAWINGS PRIOR TO ROUGH-IN.
23. ALL EXIT SIGNS SHALL COMPLY WITH THE RELEVANT PORTIONS OF SECTIONS 1008 AND 1013 OF THE CBC.
24. ALL MECHANICAL DIVISION EQUIPMENT LOW VOLTAGE CONTROL WIRING AND RACEWAY SHALL BE PROVIDED AND INSTALLED AS SPECIFIED IN MECHANICAL DIVISION U.O.N.
25. COORDINATE INSTALLATION OF ALL RECESSED LUMINAIRE(S) WITH MECHANICAL DIVISION PRIOR TO INSTALLATION OF HVAC DUCTS AND SPRINKLER HEADS. ENSURE AFTER INSTALLATION OF LUMINAIRE(S) THAT THERE IS NO CONTACT BETWEEN DUCTS AND LUMINAIRE(S) TO AVOID VIBRATION IN LUMINAIRE(S).
26. USE FLEXIBLE CONDUIT FOR ALL MOTOR, TRANSFORMER, RECESSED LUMINAIRE CONNECTIONS, AND CONNECTIONS BETWEEN TWO SEPARATE STRUCTURES AND FOR ALL FINAL CONNECTIONS TO "CRITICAL EQUIPMENT" AS DEFINED IN SPECIFICATIONS. MINIMUM 1/2" DIAMETER, LIQUID TIGHT TYPE USED OUTDOORS AND IN ALL WET LOCATIONS; PROVIDE WITH CODE-SIZE (MINIMUM #12) BARE GROUND WIRE IN ALL FLEXIBLE CONDUIT.
27. PROVIDE A DEDICATED NEUTRAL CONDUCTOR FOR ALL BRANCH CIRCUITS FEEDING OUTLETS AS NOTED ON THE DRAWINGS.
28. ALL CONDUIT CONNECTORS TO OUTLET OR JUNCTION BOXES SHALL HAVE INSULATED THROATS (MANUFACTURED AS AN INTEGRAL PART OF THE CONNECTOR). AFTER-MARKET INSERTABLE THROATS ARE NOT ACCEPTABLE.
29. ALL CIRCUITS IN ALL JUNCTION BOXES AND DEVICES SHALL BE CLEARLY IDENTIFIED BY MEANS OF "EZ" NUMBERING TAGS OR EQUIVALENT, TO IDENTIFY THE CIRCUIT NUMBER OR RELAY SUPPLYING THE CONDUCTOR. ALL JUNCTION BOXES SHALL BE LABELED PER SPECIFICATIONS.
30. ALL SURFACE MOUNTED POWER AND SIGNAL BOXES IN FINISHED AREAS SHALL BE "WIREMOLD" TYPE, WITH MATCHING RACEWAYS. SURFACE MOUNTED STEEL JUNCTION BOXES AND/OR EMT ARE NOT ACCEPTABLE.
31. ALL LOCATIONS OF BARE METAL SURFACE MOUNTED CONDUIT, BOXES, PANEL COVERS, AND RELATED FITTINGS OR ACCESSORIES INSTALLED IN FINISHED AREAS (BOTH INTERIOR AND EXTERIOR) SHALL BE FINISH PAINTED TO MATCH THE SURFACE TO WHICH THEY ARE MOUNTED TO (AFTER INSTALLATION). PAINTING SHALL INCLUDE DIFFERENT COLORS AS REQUIRED TO MATCH EXISTING STRIPING OR OTHER BUILDING FEATURES TO WHICH THE EQUIPMENT IS ATTACHED AND VISIBLE. VERIFY EXACT JUNCTION BOX LOCATION(S) AND ROUTING OF EXPOSED RACEWAYS WITH THE ARCHITECT PRIOR TO ROUGH-IN.
32. PROVIDE A BLANK COVER PLATE (COLOR TO MATCH ADJACENT DEVICES OR AS SPECIFICALLY CALLED FOR IN SPECIFICATIONS) FOR ALL JUNCTION BOXES (NEW AND EXISTING) ON THE PROJECT WHEN NO DEVICE IS INSTALLED.
33. FOR OUTDOOR 15 AND 20-AMPERE, 125 AND 250-VOLT RECEPTACLES: RECEPTACLES LOCATED IN "WET" LOCATIONS SHALL HAVE "IN-USE" TYPE WEATHERPROOF COVER PLATES PROVIDED AND INSTALLED; RECEPTACLES LOCATED IN "DAMP" LOCATIONS SHALL HAVE "IN-USE" TYPE WEATHERPROOF COVER PLATES IN LOCATIONS DEEMED TO BE "IN-USE" WITH CORD AND PLUG ATTACHED.
34. TWO OR THREE DIFFERENT PHASES SUPPLIED BY A 3-PHASE PANEL MAY SHARE A SINGLE NEUTRAL ONLY IF CIRCUIT POSITIONS ARE ADJACENT IN THE PANEL. PROVIDE COMMON HANDLE-TIE ON BREAKERS FOR MULTI-WIRE BRANCH CIRCUITS, WITH COMMON NEUTRAL, PER NEC REQUIREMENTS.

LIST OF DRAWINGS

E-0.1	SYMBOLS LIST, GENERAL NOTES & LIST OF DRAWINGS
E-1.1	SITE PLAN - ELECTRICAL
E-B2.1	BUS SHOP FLOOR PLAN - LIGHTING
E-B3.1	BUS SHOP FLOOR PLAN - POWER & SIGNAL
E-B2.1	M & O FLOOR PLANS - LIGHTING
E-M3.1	M & O FLOOR PLANS - POWER & SIGNAL
E-4.1	PARTIAL PLAN
E-5.1	SINGLE LINE DIAGRAM
E-6.1	SCHEDULES
E7.1	DETAILS
E8.1	T24 DOCUMENTATION
FE-0.1	FIRE ALARM EQUIPMENT LIST & NOTES
FE-1.1	SITE PLAN - FIRE ALARM
FE-B3.1	BUS SHOP FLOOR PLAN - FIRE ALARM
FE-M3.1	M & O FLOOR PLANS - FIRE ALARM
FE-5.1	DIAGRAMS

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REVISIONS

ARCH PROJECT NO: 1707.00
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DRAWING SCALE: AS NOTED
PTN: XXXXX-XX
100% DD
MAY 10, 2018
SHEET TITLE

SYMBOLS LIST, GENERAL NOTES & LIST OF DRAWINGS

SHEET NUMBER

E-0.1

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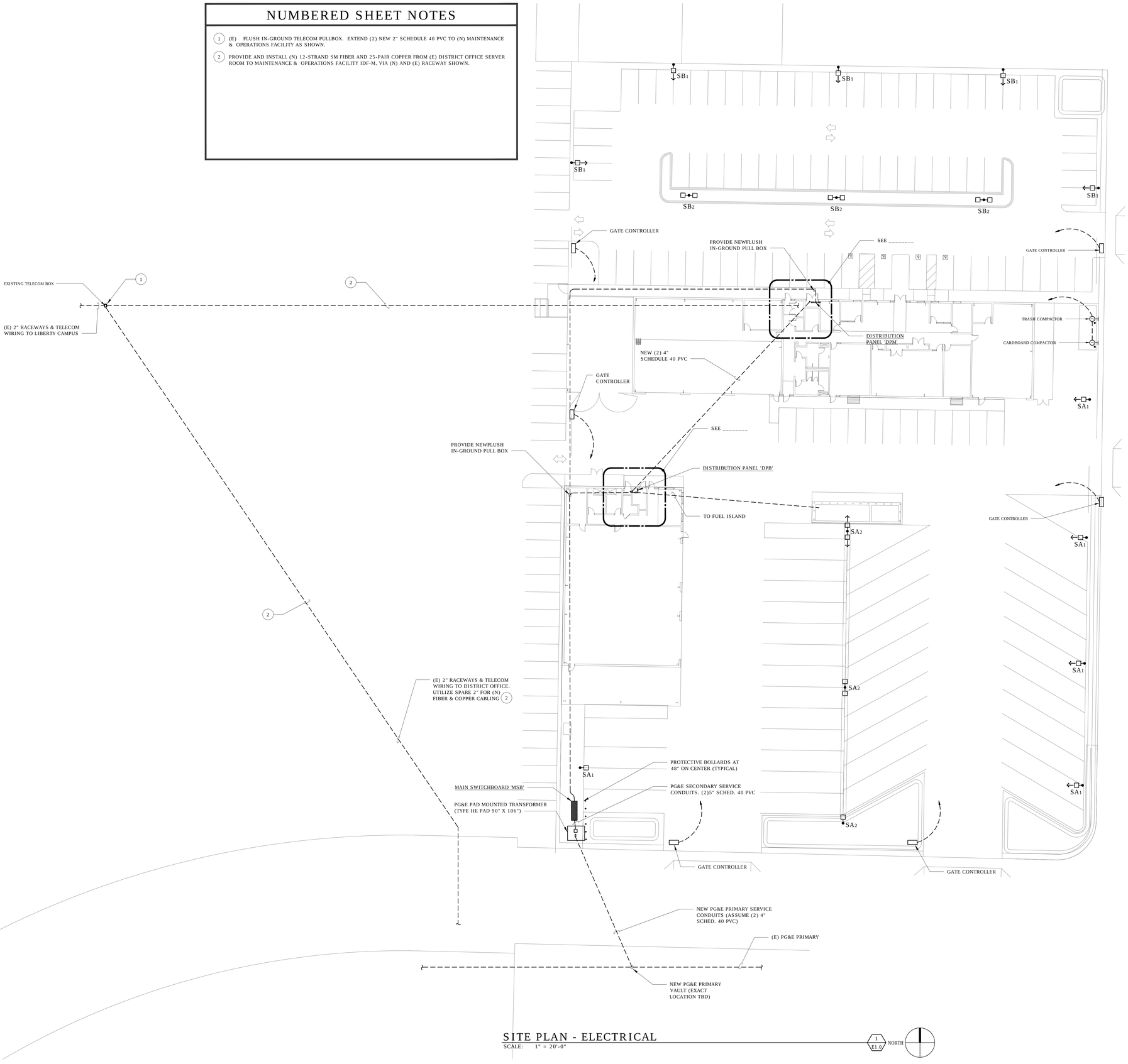
NUMBERED SHEET NOTES

1. (E) FLUSH IN-GROUND TELECOM PULLBOX. EXTEND (2) NEW 2" SCHEDULE 40 PVC TO (N) MAINTENANCE & OPERATIONS FACILITY AS SHOWN.
2. PROVIDE AND INSTALL (N) 12-STRAND SM FIBER AND 25-PAIR COPPER FROM (E) DISTRICT OFFICE SERVER ROOM TO MAINTENANCE & OPERATIONS FACILITY IDF-M, VIA (N) AND (E) RACEWAY SHOWN.



SITE PLAN - ELECTRICAL
SCALE: 1" = 20'-0"

1 / E1.0 NORTH

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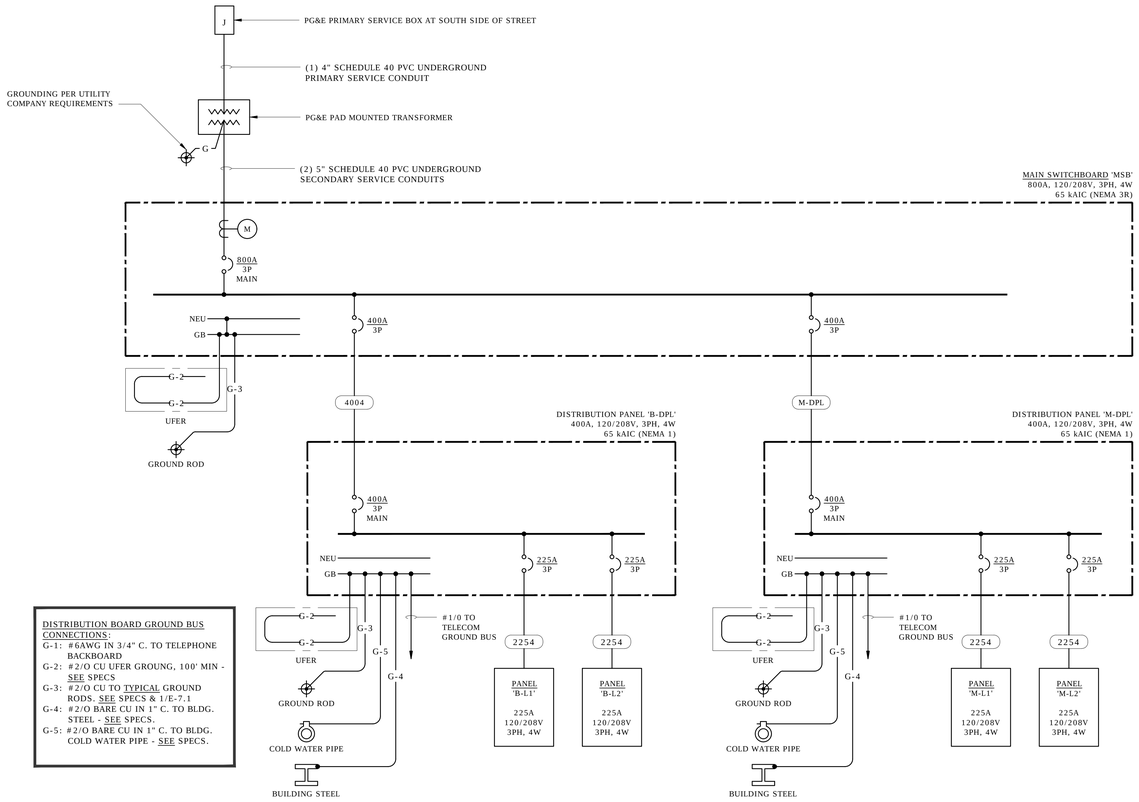
SHEET TITLE

SITE PLAN - ELECTRICAL

SHEET NUMBER

E-1.1



DISTRIBUTION BOARD GROUND BUS CONNECTIONS:

- G-1: #6AWG IN 3/4" C. TO TELEPHONE BACKBOARD
- G-2: #2/O CU UFER GROUNG, 100' MIN - SEE SPECS
- G-3: #2/O CU TO TYPICAL GROUND RODS. SEE SPECS & 1/E-7.1
- G-4: #2/O BARE CU IN 1" C. TO BLDG. STEEL - SEE SPECS.
- G-5: #2/O BARE CU IN 1" C. TO BLDG. COLD WATER PIPE - SEE SPECS.

NOTE:
PROVIDE ENGRAVED PHENOLIC NAMEPLATES ON EACH POWER PANEL TO INDICATE PANEL NAME, FEEDER AMPERAGE, VOLTAGE, PHASE, AND "FED FROM" SOURCE PANEL NAME.

COPPER FEEDER SCHEDULE

FEEDER	CONDUIT	CONDUCTORS
10004	(3) 3"	3 SETS: (4)400 MCM & (1)#2/0 G.
4004	(1) 4"	(4)500 MCM & (1)#1/0 G.
3004	(1) 3.5"	(4)350 MCM & (1)#2 G.
2254V	(1) 3.5"	(4)#250 & (1)#2 G.
2254	(1) 3"	(4)#4/0 & (1)#4 G.
2003	(E) 2". SEE E-100	(4)#3/0 & (1)#4 G.
1503	(1) 2"	(3)#1/0 & (1)#6 G.
1004	(1) 2"	(4)#2 & (1)#6 G.
1003	(1) 2"	(3)#2 & (1)#6 G.
903	(1) 1.25"	(3)#3 & (1)#8 G
M-DPL	(2) 4"	(4)#300 & (1)#2 G

FEEDER TAG KEY

400 4 N

- N INDICATES DBL NEUTRAL / V INDICATES UPSIZED FOR VOLTAGE DROP
- WIRE QUANTITY
- FEEDER AMPACITY

NOTE: NOT ALL FEEDERS ON THIS SCHEDULE ARE NECESSARILY USED ON THIS PROJECT.

GENERAL NOTES

A. PER CEC 110.06 PROVIDE AND INSTALL ELECTRIC ARC FLASH WARNING SIGNS ON SWITCHBOARD, PANELBOARDS, CONTROL PANELS, METER SOCKET ENCLOSURES, AND MOTOR CONTROLS.

B. VERIFY AVAILABLE FAULT DUTY AT NEW MAIN SWITCHBOARD TERMINALS WITH PG&E. SUBMIT MAIN SWITCHBOARD SHOP DRAWINGS TO PG&E FOR APPROVAL, PRIOR TO RELEASE. COORDINATE WITH PG&E FOR ALL UTILITY SYSTEM INFRASTRUCTURE REQUIREMENTS AND SCHEDULING FOR NEW SERVICE INSTALLATION.

C. PROVIDE ARC FLASH AND SHORT CIRCUIT COORDINATION STUDY BASED ON ACTUAL EQUIPMENT TO BE INSTALLED, PER SECTION 26 24 00 - 2.3 AND 2.4.

SINGLE LINE DIAGRAM - ELECTRICAL
SCALE: NO SCALE

1 / E-5.1

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SHEET TITLE

SINGLE LINE DIAGRAM - POWER

SHEET NUMBER

E-5.1

FOR REFERENCE ONLY

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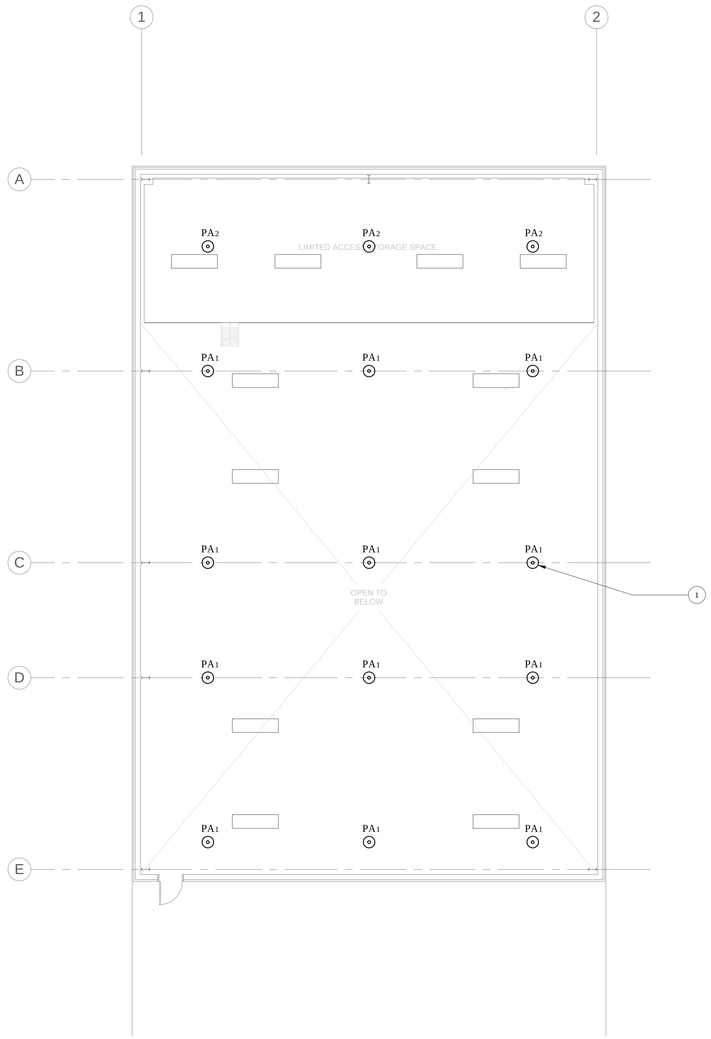
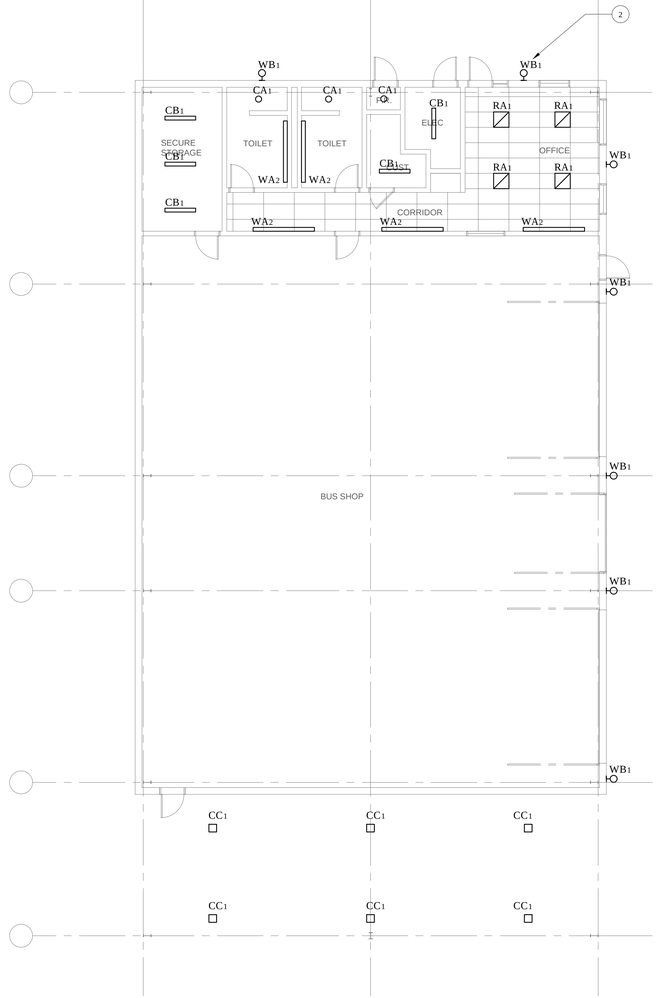


BUS SHOP MEZZANINE LEVEL PLAN - LIGHTING

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

2 / E-B2.1



BUS SHOP GROUND FLOOR PLAN - LIGHTING

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

1 / E-B2.1

REF. NORTH

NUMBERED SHEET NOTES

1. MOUNT AT 20'-0" AFF TO BOTTOM OF LUMINAIRE.
2. MOUNT AT 8'-6" AFG TO BOTTOM OF LUMINAIRE.

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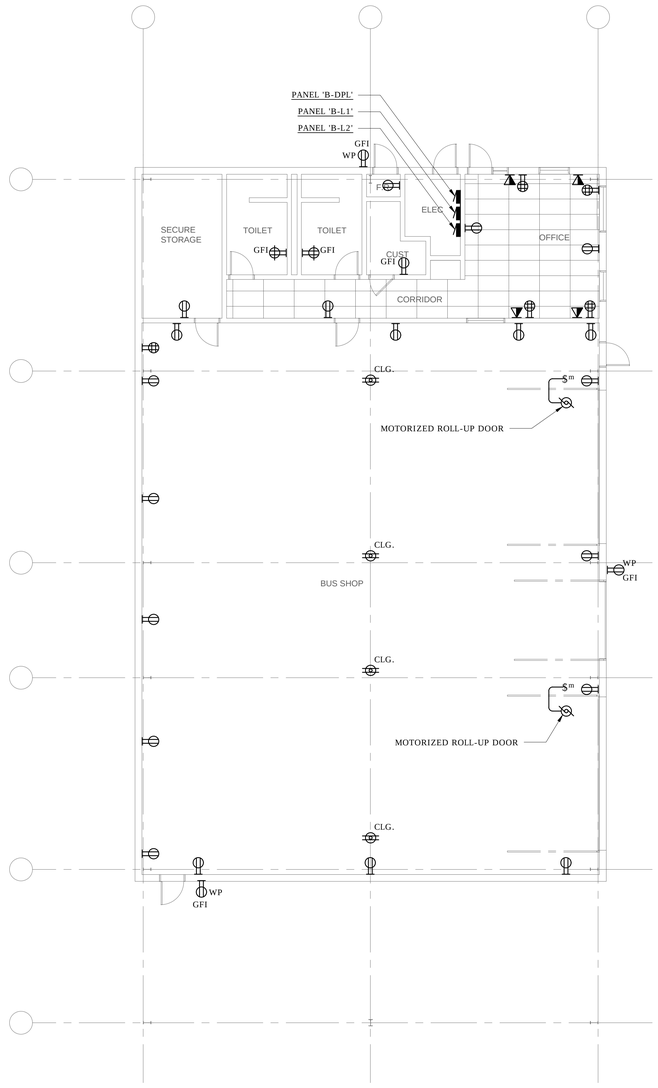
SHEET TITLE

BUS SHOP FLOOR PLAN - LIGHTING

SHEET NUMBER

E-B2.1



BUS SHOP FLOOR PLAN - POWER & SIGNAL

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

1 / E-B3.1

REF. NORTH

NUMBERED SHEET NOTES

1 xxxxxxx

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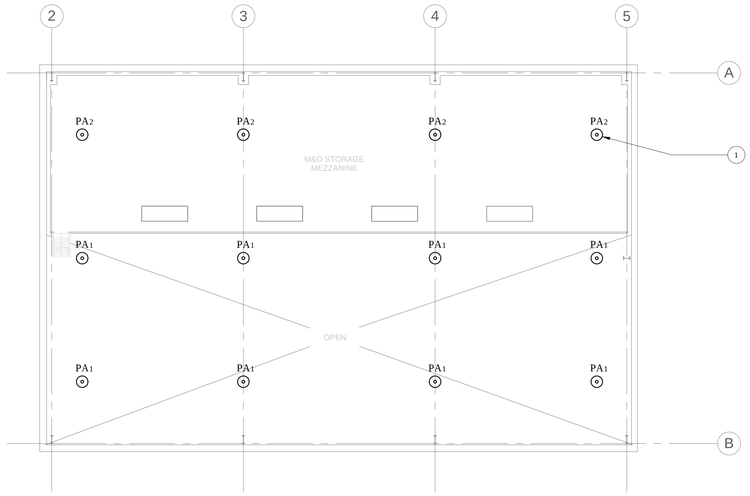
MAY 10, 2018

SHEET TITLE

BUS SHOP FLOOR PLAN - POWER & SIGNAL

SHEET NUMBER

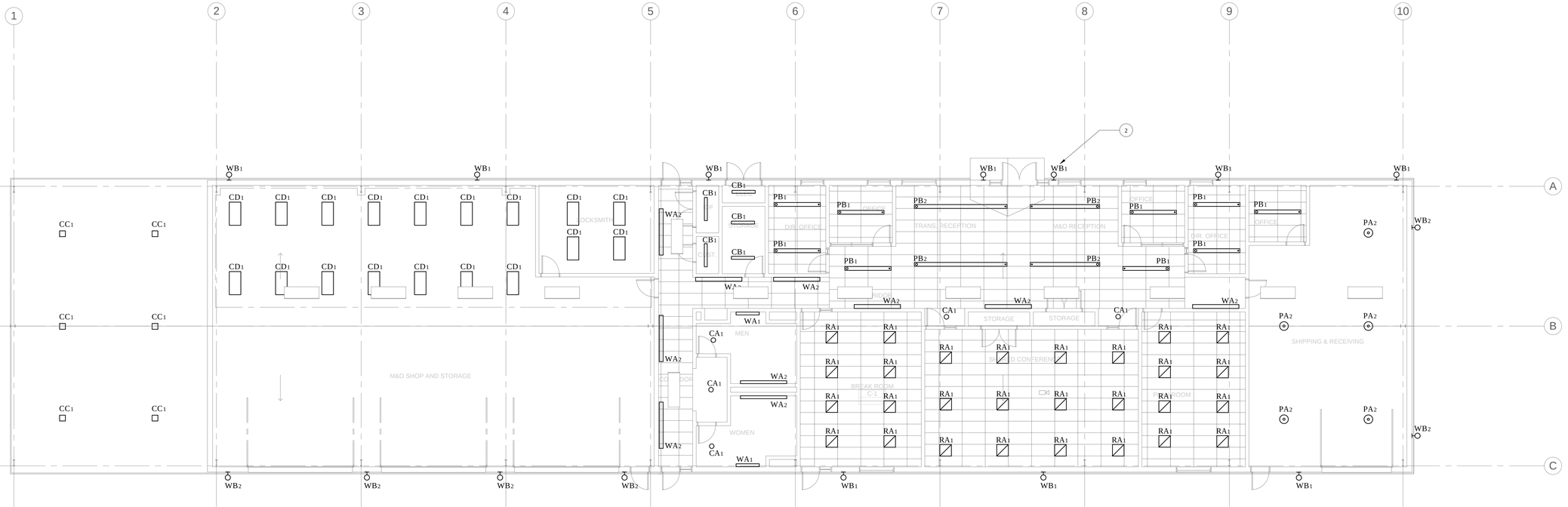
E-B3.1



M & O MEZZANINE FLOOR PLAN - LIGHTING

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

2 E-M2.1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A
B
C
WB1
WB2
CC1
CD1
CB1
PB1
PB2
WA1
WA2
CA1
RA1
PA2
M&O SHOP AND STORAGE
LOCKSMITH
DIR.OFFICE
TRANS. RECEPTION
M&O RECEPTION
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WOMEN
BREAK ROOM
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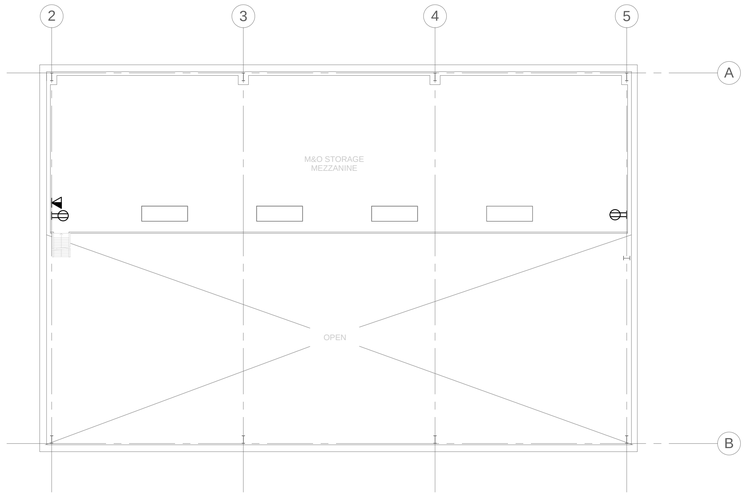
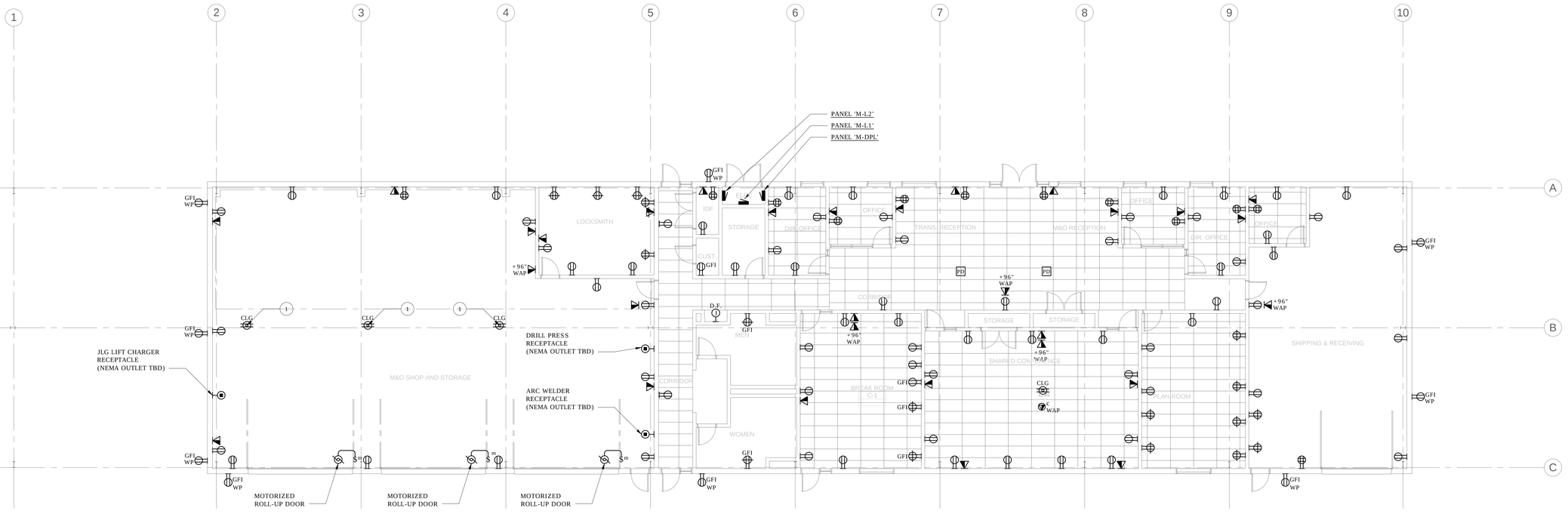


M & O MEZZANINE FLOOR PLAN - POWER & SIGNAL

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

2 E-M3.1



M & O GROUND FLOOR PLAN - POWER & SIGNAL

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

1 E-M3.1

REF. NORTH

NUMBERED SHEET NOTES

1 CEILING MOUNTED RECEPTACLES FOR NEW DROP DOWN CORD REELS

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SHEET NUMBER

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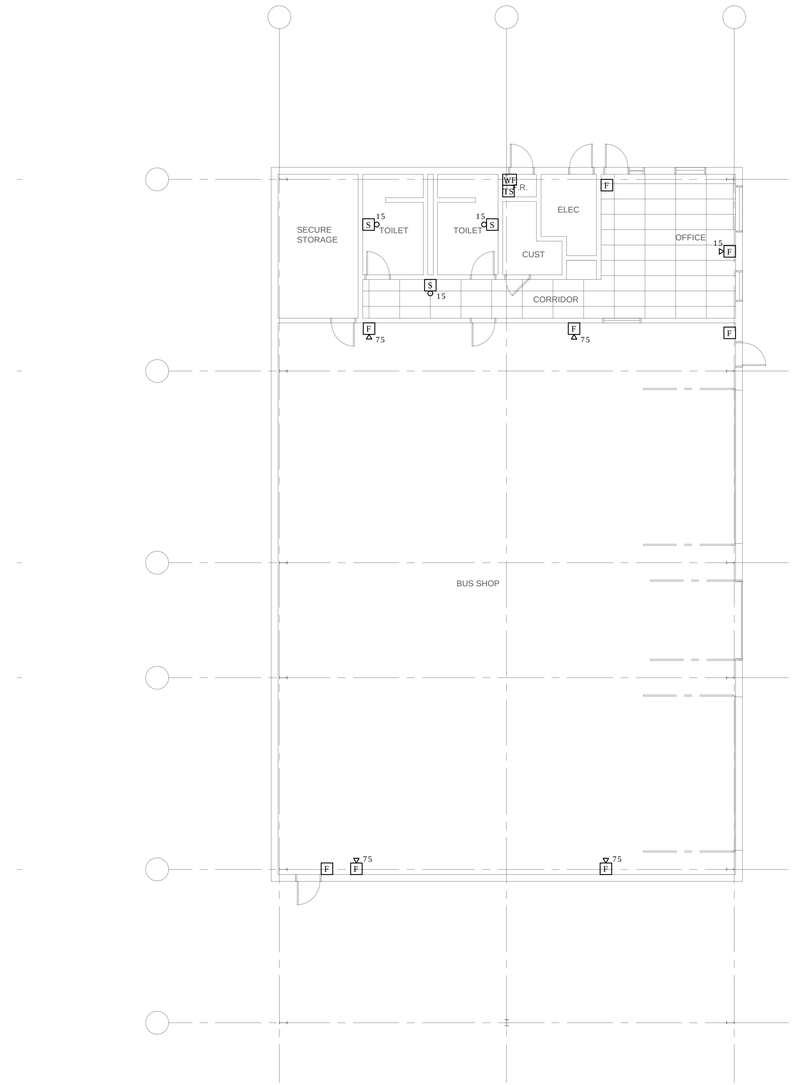

BUS SHOP FLOOR PLAN - FIRE ALARM

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

1 / E-B3.1

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MAY 10, 2018

SHEET TITLE

BUS SHOP FLOOR PLAN - FIRE ALARM

SHEET NUMBER

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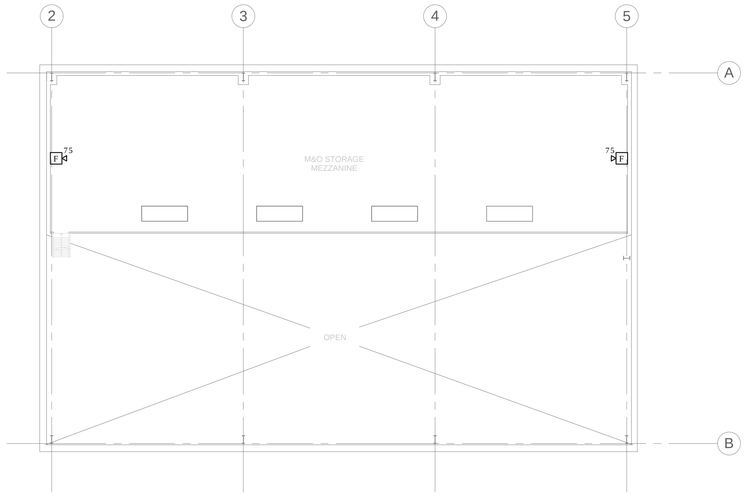
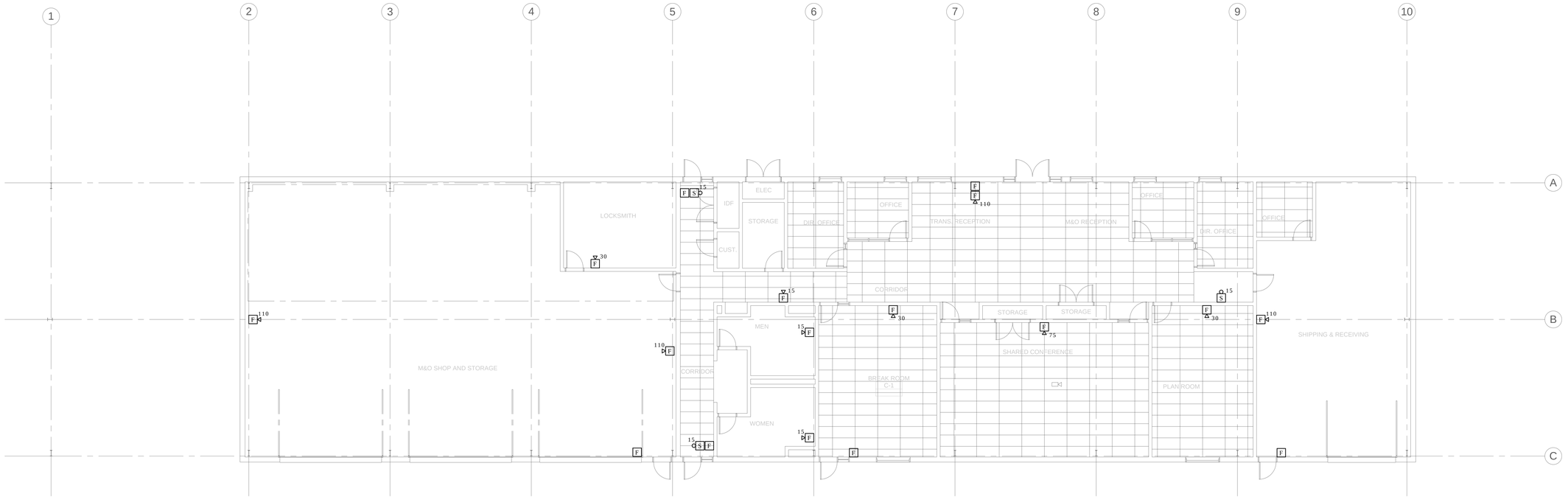


M & O MEZZANINE FLOOR PLAN - FIRE ALARM

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

2 FE-M3.1



M & O GROUND FLOOR PLAN - FIRE ALARM

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

1 FE-M3.1

REF. NORTH

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1. CEILING MOUNTED RECEPTACLES FOR NEW DROP DOWN CORD REELS

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M & O FLOOR PLANS FIRE ALARM

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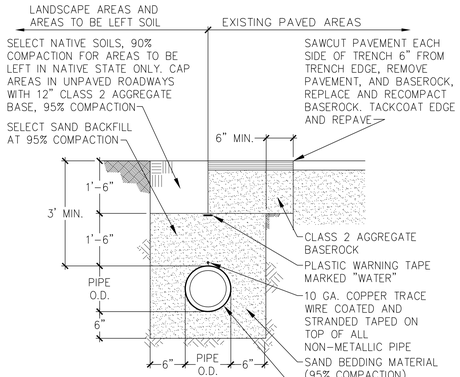
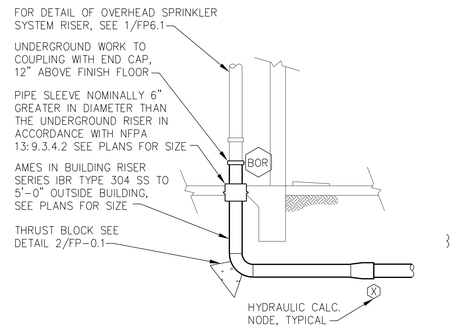


3 FP-0.1 **UTILITY TRENCH**
NO SCALE



1 FP-0.1 **IN BUILDING RISER**
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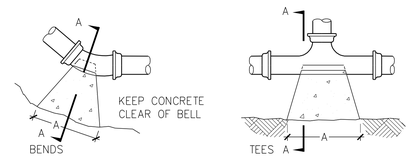

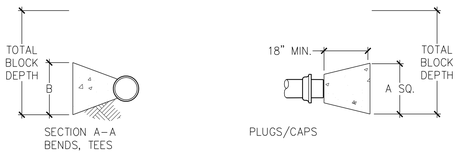

SOIL BEARING CAPACITY 3000 PSF. SEE PAGE 6 OF PROJECT GEOTECH REPORT.

THRUST BLOCK CALCULATIONS PER NFPA 13: TABLE A.10.8.2(b)

6" – 90 BEND AREA = (7.9 S.F.)(225 PSI/100 PSI)(1000 PSF/2000 PSF) = 8.9 S.F.
6" – 45 BEND AREA = 8.9 S.F. x 0.414 = 3.7 S.F.
6" – 22.5 BEND AREA = 8.9 S.F. x 0.199 = 1.8 S.F.
6" – DEAD END AREA = (5.6 S.F.)(225 PSI/100 PSI)(1000 PSF/2000 PSF) = 6.3 S.F.

PIPE SIZE	90° BENDS			45° BENDS			22.5° BENDS			TEES and PLUGS		
	SIZE SQ. FT.	"A"	"B"	SIZE SQ. FT.	"A"	"B"	SIZE SQ. FT.	"A"	"B"	SIZE SQ. FT.	"A"	"B"
6"	8.9	54"	24"	3.7	30"	18"	2	24"	12"	6.3	36"	24"

BASED ON A WATER PRESSURE OF 225 POUNDS PER SQUARE INCH AND A SOIL RESISTANCE OF 2000 POUNDS PER SQUARE FOOT, PER NFPA TABLE A.10.8.2(b).

TOTAL BLOCK DEPTH SHALL BE AT LEAST TWICE THE BLOCK DEPTH "B" IN ACCORDANCE WITH NFPA 24.

JOINT RESTRAINT SHALL UTILIZE BOTH THRUST BLOCKS AND MEGALUG JOINT RESTRAINT FITTINGS

2 FP-0.1 **THRUST BLOCKS**
NO SCALE

LIST OF GOVERNING CODES:

2016 BUILDING STANDARDS ADMINISTRATIVE CODE, PART 1, TITLE 24, C.C.R.
2016 CALIFORNIA BUILDING CODE (CBC), PART 2, TITLE 24, C.C.R.
2016 CALIFORNIA ELECTRICAL CODE, PART 3, TITLE 24, C.C.R.
2016 CALIFORNIA MECHANICAL CODE (CMC), PART 4, TITLE 24, C.C.R.
2016 CALIFORNIA PLUMBING CODE (CPC), PART 5, TITLE 24, C.C.R.
2016 CALIFORNIA ENERGY CODE (CEC), PART 6, TITLE 24, C.C.R.
2016 CALIFORNIA FIRE CODE (CFC), PART 9, TITLE 24, C.C.R.
2016 CALIFORNIA REFERENCED STANDARDS CODE, PART 12, TITLE 24, C.C.R. TITLE 19, C.C.R., PUBLIC SAFETY, STATE FIRE MARSHAL REGULATIONS.
2016 NFPA 13 AS AMENDED
2016 NFPA 24 AS AMENDED

ALL SECTION NUMBERS BELOW REFER TO GROUP 1, CHAPTER 4, PART 1, TITLE 24, C.C.R.

1. ADDENDA, CHANGE ORDERS PER SECTION 4-338.
2. INSPECTOR APPROVED BY DSA. INSPECTOR AND CONTINUOUS INSPECTION OF WORK PER SECTION 4-333(b) AND 4-342.
3. TESTS AND TESTING LABORATORY PER SECT. 4-335.
4. SPECIAL INSPECTION PER SECT. 4-333(c).
5. CONTRACTOR SHALL SUBMIT VERIFIED REPORTS PER SECT. 4-336 AND 4-343(c).
6. ADMINISTRATION OF CONSTRUCTION PER PART 1, TITLE 24, C.C.R. – DUTIES OF ARCHITECT, STRUCTURAL ENGINEER OR PROFESSIONAL ENGINEER PER SECT. 4-333(a) AND 4-341.
7. GOVERNING CODES: TITLE 24.
8. A COPY OF PARTS 1, 2, 3, 4, AND 5 OF TITLE 24 SHALL BE KEPT AVAILABLE IN THE FIELD DURING CONSTRUCTION.
9. DSA SHALL BE NOTIFIED OF START OF CONSTRUCTION PER SECT. 4-331.
10. SUPERVISION BY THE OFFICE OF REGULATION SERVICE PER SECT. 4-334.

DSA GENERAL NOTES

1. THE INTENT OF THE CONTRACT DOCUMENTS IS TO ADD 2 NEW STORAGE BUILDINGS ON THE SCHOOL'S CAMPUS. SHOULD ANY CONDITIONS DEVELOP NOT COVERED BY THE CONTRACT DOCUMENTS, A CONSTRUCTION CHANGE DOCUMENT DETAILING AND SPECIFYING THE REQUIRED WORK SHALL BE SUBMITTED TO AND APPROVED BY DSA BEFORE PROCEEDING WITH THE WORK.
2. ALL HANGERS AND SEISMIC SWAY BRACING SHALL BE DESIGNED AND INSTALLED PER NFPA 13 AND CHAPTER 16A CALIFORNIA BUILDING CODE.
3. WHERE ANCHORAGE DETAILS ARE NOT SHOWN ON THE DRAWINGS, THE FIELD INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE STRUCTURAL ENGINEER AND THE FIELD REPRESENTATIVE OF THE DIVISION OF THE STATE ARCHITECT.

FIRE DEPARTMENT CONNECTIONS:

NFPA 13 (2016) SEC. 8.17.2.5.1 CHECK-VALVE SHALL BE PROVIDED AT FIRE DEPARTMENT CONNECTION ASSEMBLY (FDC) TO PREVENT WATER (PRESSURE) AT INLET OF FDC VALVE.

TITLE 19 ARTICLE 906 (A) A LABEL OF THE SELF-ADHESIVE TYPE SHALL BE PLACED ON THE FIRE DEPARTMENT CONNECTION OR ON THE RISER FOR FIRE SPRINKLER SYSTEMS WITH THE DATE OF SERVICE AND/OR DATE INSTALLATION WAS PERFORMED AND LICENSE NUMBER OF PERSON PERFORMING SERVICE WORK.

FIRE DEPARTMENT SIGNAGE:

CONTRACTOR SHALL PROVIDE SIGNS AT FIRE DEPARTMENT CONNECTIONS SERVING THIS SYSTEM. SIGNS SHALL INDICATE BUILDINGS SERVED BY FIRE DEPARTMENT CONNECTIONS.

CONTRACTOR SHALL PROVIDE SIGNS AT EXISTING BACKFLOW PREVENTER. SIGNS SHALL INDICATE BUILDINGS AND HYDRANTS SERVED BY BACKFLOW PREVENTER.

SEE SITE PLAN FOR BUILDING AND HYDRANT MARKS/IDENTIFICATIONS.

OVERHEAD FIRE SPRINKLER SYSTEM GENERAL NOTES:

NFPA 13 (2016) SEC. 9.2.1.3.3.4 WHERE FLEXIBLE SPRINKLER HOSE FITTINGS ARE USED TO CONNECT SPRINKLERS TO BRANCH LINES IN SUSPENDED CEILINGS, A LABEL LIMITING RELOCATION OF THE SPRINKLER SHALL BE PROVIDED ON THE ANCHORING COMPONENT.

NFPA 13 (2016) SEC. 10.10.2.1 UNDERGROUND MAINS AND LEAD-IN CONNECTION MADE TO OVERHEAD SPRINKLER PIPING SYSTEMS SHALL BE COMPLETELY FLUSHED.

NFPA 13 (2016) SEC. 10.10.2.2 ALL INTERIOR PIPING AND APPURTENANCES SUBJECTED TO SYSTEM WORKING PRESSURE SHALL BE HYDROSTATIC ALLY TESTED AT 200 PSI AND SHALL MAINTAIN THAT PRESSURE WITHOUT LOSS FOR 2 HOURS. LOCAL FIRE DEPARTMENT SHOULD BE NOTIFIED OF DATE AND TESTING SO THEY MAY OBSERVE TESTING.

NFPA 13 (2016) SEC. 6.2.9 PROVIDE SPARE SPRINKLER HEAD CABINET, SPRINKLER WRENCH, AND NO FEWER THAT A TOTAL OF 6 SPARE HEADS MATCHING THE TYPES AND TEMPERATURE RATINGS IN EACH PROTECTED BUILDING FOR SYSTEMS LESS THAN 300 SPRINKLERS AND FEWER THAN 12 FOR SYSTEMS HAVING 300 TO 1000 SPRINKLERS.

NFPA 13 (2016) SEC. 9.3.6.1 PROVIDE RESTRAINT OF BRANCH LINES BY USING ONE OF THE FOLLOWING:
(1) LISTED SWAY BRACE ASSEMBLY
(2) WRAPAROUND U-HOOK SATISFYING THE REQUIREMENTS OF 9.3.5.5.11
(3) NO. 12, 440LB (200KG) WIRE INSTALLED AT LEAST 45 DEGREES FROM THE VERTICAL PLANE AND ANCHORED ON BOTH SIDES OF THE PIPE.
(4) CPVC HANGERS LISTED TO PROVIDE RESTRAINT
(5) HANGER NOT LESS THAN 45 DEGREES FROM VERTICAL INSTALLED WITHIN 6IN. OF THE VERTICAL HANGER ARRANGED FOR RESTRAINT AGAINST UPWARD MOVEMENT, PROVIDED IT IS UTILIZED SUCH THAT L/R DOES NOT EXCEED 400, WHERE THE ROD EXTENDS TO THE PIPE OR A SURGE CLIP HAS BEEN INSTALLED.

NFPA 72 (2016) SEC. 17.12.2 SPRINKLER FLOW SWITCH SHALL BE TESTED BY IOR TO CONFIRM THAT WHEN THE INSPECTOR'S TEST VALVE IS ACTIVATED AN ALARM WILL SOUND IN NOT MORE THAN 90 SECONDS.

NFPA 13 (2016) SEC. 6.9.3 FLOW SWITCH SHALL BE CONNECTED TO AN OUTSIDE ALARM BELL FOR EACH RISER. APPROVED IDENTIFICATION SIGN SHALL BE PROVIDED FOR OUTSIDE ALARM BELL "SPRINKLER FIRE ALARM – WHEN BELL RINGS CALL 911/FIRE DEPARTMENT".

NFPA 13 (2016) SEC. 25.5 FIGURE A25.5 HYDRAULIC CALCULATIONS DESIGN DATA PLACARD SHALL BE ATTACHED TO RISER. SHALL INCLUDE: 1) LOCATION OF DESIGN AREA(S). 2) DISCHARGE DENSITIES. 3) REQUIRED FLOW AND RESIDUAL PRESSURE DEMAND AT BASE OF RISER. 4) OCCUPANCY CLASSIFICATION. 5) HOSE STREAM DEMAND INCLUDED IN ADDITION TO SPRINKLER DEMAND. 6) THE NAME OF THE INSTALLING CONTRACTOR.

NFPA 13 (2016) SEC. 25.1 (3) SPRINKLER CONTRACTOR (C16) SHALL COMPLETE AND SIGN CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR THE OVERHEAD SPRINKLER SYSTEM USING FORM IN FIGURE 25.1. THIS COMPLETED FORM SHALL BE GIVEN TO THE APPROVING AUTHORITY, OWNER, AND CONTRACTOR.

NFPA 13 (2016) SEC. 25.2.3.4.1 THE MAIN DRAIN VALVE SHALL BE OPENED AND REMAIN OPENED UNTIL THE SYSTEM PRESSURE STABILIZES. THE STATIC AND RESIDUAL PRESSURES SHALL BE RECORDED ON THE CONTRACTOR'S TEST CERTIFICATE.

TITLE 19 ARTICLE (A) A LABEL OF SELF-ADHESIVE TYPE SHALL BE PLACED ON THE FIRE DEPARTMENT CONNECTION OR ON THE RISER FOR THE FIRE SPRINKLER SYSTEM WITH THE DATE OF SERVICE AND/OR DATE OF INSTALLATION WAS PREFORMED AND LICENSE NUMBER OF PERSON PERFORMING SERVICE WORK.

THE SPRINKLER CONTRACTOR SHALL HAVE A REPRESENTATIVE PRESENT AT THE ROUGH-IN/HYDRO INSPECTION.

NFPA 13 (2016) SEC. 9.3.4.2 WHERE PIPE PASSES THROUGH HOLES IN PLATFORMS, FOUNDATIONS, WALLS, OR FLOORS, THE HOLES SHALL BE SIZED SUCH THAT THE DIAMETER OF THE HOLE IS NOMINALLY 2" LARGER THAN THE PIPE FOR PIPE 1" NOMINAL TO 3 1/2" NOMINAL AND 4" LARGER THAN PIPE FOR PIPE 4" NOMINAL AND LARGER.

FIRE PROTECTION LEGEND

SYMBOL	ABBRV.	IDENTIFICATION	ABBRV.	IDENTIFICATION
	F	FIRE WATER	(E)	EXISTING
SPKR	SPKR	SPRINKLER	ELEC	ELECTRICAL
		PENDENT ON 401 EXTENSION	ELEV	ELEVATION
		RECESSED PENDENT	EQUIP	EQUIPMENT
		UPRIGHT W/ 1" OUTLET BELOW	FFE	FINISHED FLOOR ELEVATION
		UPRIGHT ON 1" SPRIG UP	FLA	FULL LOAD AMPS
		UPRIGHT ON BRANCH LINE	FLEX	FLEXIBLE
		UPRIGHT OVER PENDENT	FLR	FLOOR
		SIDEWALL	FS	FLOOR SINK
		GROOVED COUPLING	FPM	FEET PER MINUTE
		EQ BRACE LOCATION	FT	FEET
		4WAY EQ BRACE LOCATION	FT HD	FEET HEAD
		HANGER LOCATION	GPM	GALLONS PER MINUTE
		BRANCH LINE RESTRAINT	HP	HORSEPOWER
		HYDRAULIC CALCULATION NODE	HZ	HERTZ
	CHVA	CHECK VALVE	IE	INVERT ELEVATION
		GATE VALVE	IN	INCH
	T&PRV	TEMP & PRESS RELIEF VALVE	INV	INVERT
	DCDA	DOUBLE CHECK DETECTOR ASSEMBLY	KW	KILOWATTS
		UNION	LBS	POUNDS
P		PRESSURE GAUGE	MAX	MAXIMUM
	FC	FLEXIBLE CONNECTION	MBH	1000 BTU PER HOUR
	RPBP	REDUCE PRESS BACKFLOW PREVENTER	MFR	MANUFACTURER
			MIN	MINIMUM
	FH	FIRE HYDRANT	(N)	NEW
	PIV	POST INDICATING VALVE	NC	NORMALLY CLOSED
AD	AD	ACCESS DOOR	NIC	NOT IN CONTRACT
		BACK OF ELBOW	NO	NORMALLY OPEN
ø	DIA	DIAMETER	OC	ON CENTER
	P.O.C.	POINT OF CONNECTION	PH	PHASE
℄		CENTERLINE	PRV	PRESSURE REDUCING VALVE
	&	AND	PSI	POUNDS PER SQUARE INCH
	@	AT	P/T	PRESSURE/TEMPERATURE
	°F	DEGREES FAHRENHEIT	QTY	QUANTITY
	AFF	ABOVE FINISH FLOOR	REQD	REQUIRED
	AMP	AMPERE	RLA	RATED/RUNNING LOAD AMPS
	APPROX	APPROXIMATE	RPM	REVOLUTIONS PER MINUTE
	BHP	BRAKE HORSEPOWER	SOV	SHUT-OFF VALVE
	BLDG	BUILDING	STD	STANDARD
	CFH	CUBIC FEET PER HOUR	STRUCT	STRUCTURAL
	CI	CAST IRON	TEMP	TEMPERATURE
	CIRC	CIRCULATING	TYP	TYPICAL
	CLG	CEILING	UL	UNDERWRITER'S LABORATORIES
	CONC	CONCRETE	UON	UNLESS OTHERWISE NOTED
	CONN	CONNECTION	V	VOLT
	CONT	CONTINUED	VTR	VENT THROUGH ROOF
	COORD	COORDINATE	W/	WITH
	CONST	CONSTRUCTION	WC	WATER COLUMN
	DN	DOWN	WT	WEIGHT
	DWGS	DRAWINGS		

PRELIMINARY SPRINKLER DEMAND ESTIMATE:

HAZARD CLASS: ORDINARY HAZARD GROUP 1
REQUIRED DENSITY: 0.15 GPM/SQ. FT
DESIGN AREA: 1500 SQ. FT
OVERAGE FACTOR: 1.2
SPRINKLER DEMAND: 0.20 x 486 x 1.2 = 360 GPM
TOTAL COMBINED HOSE FLOW: 250 GPM

FIRE FLOW CALCULATIONS:

CODE REQUIRED SITE FLOW:

CONSTRUCTION TYPE: X-X (WITH AUTOMATIC SPRINKLER SYSTEM)
FIRE FLOW CALCULATION AREA: XXXX SF
2016 CFC FIRE FLOW(TABLE B105.1): XXXX GPM
2016 CFC MINIMUM FIRE FLOW: 1500 GPM

AVAILABLE WATER SUPPLY:

XX FIRE PROTECTION FLOW TEST XXXX X, 2018
STATIC PRESSURE: XX PSI X HYDRANT SEE FP1.1 FOR LOCATION
RESIDUAL PRESSURE: XX PSI
OBSERVED FLOW: XXX GPM (XX PSI PITOT ON 2 1/2" OUTLET)
AVAILABLE FLOW: XXX GPM AT 20 PSI RESIDUAL

DESIGN SITE FLOW:

MINIMUM HYDRANT DESIGN FLOW: 1000 GPM
NUMBER OF HYDRANTS FLOWING: X
DESIGN SITE FLOW:
FLOW AT EXISTING ON SITE HYDRANT X 1000 GPM
FLOW AT EXISTING ON SITE HYDRANT X 1000 GPM
TOTAL DESIGN SITE FLOW: 2000 GPM
PERCENT REDUCTION = (XXXX – XXXX)/XXXX x 100% = 0%

SEISMIC BRACING:

SPECTRAL RESPONSE:
LATITUDE: XX.XX
LONGITUDE: XXX.XX
S_s = X.X (2010 ASCE 7 STANDARD)
SEE DESIGN CRITERIA ON STRUCTURAL DRAWING SX.X.

SEISMIC COEFFICIENT:
C_p = X.XX (2016 NFPA 13-TABLE 9.3.5.9.3)

USE C_p =X.X

SEE DRAWING FPX.X FOR SPECIFIC SEISMIC BRACING DEATILS AND THIS SHEET FOR CALCULATIONS.

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850 2ND STREET
BRENTWOOD, CA
94513

LIBERTY UNION HIGH SCHOOL DISTRICT

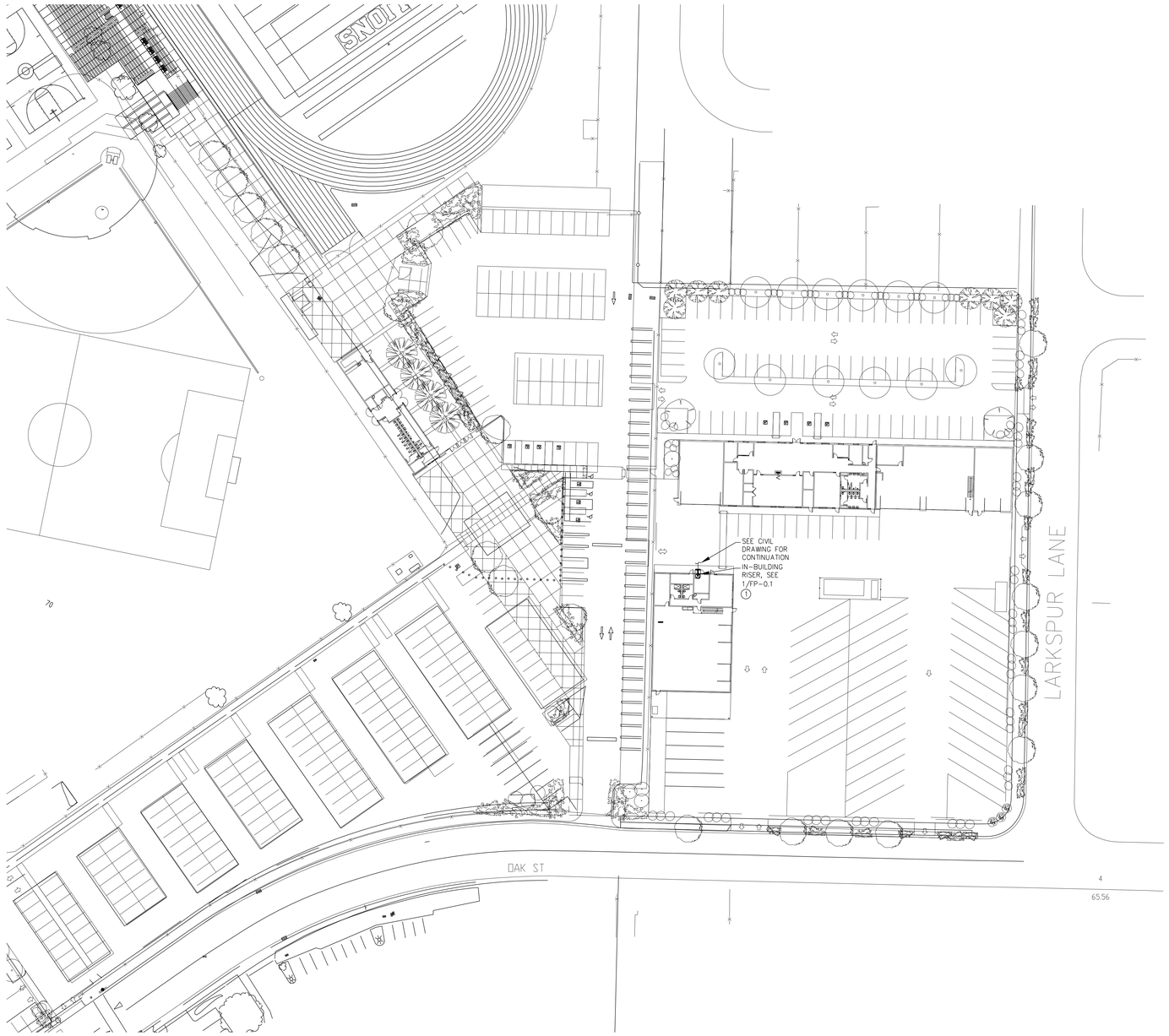
REVISIONS

ARCH PROJECT NO: 1707.00
DRAWN BY: DRAFTSPERSON
DRAWING SCALE: NONE

50% DD
APRIL, 13 2018

SHEET TITLE
LEGEND, NOTES, AND DETAILS - FIRE PROTECTION

SHEET NUMBER
FP-0.1



SITE PLAN - FIRE PROTECTION

SCALE: 1" = 40'-0"

NOTES

1. FIRE SERVICE PIPING IS SHOWN ON DRAWING FP1.1 TO SHOW NODE LOCATIONS REQUIRED FOR OVERHEAD FIRE SPRINKLER HYDRAULIC CALCULATIONS. DESIGN AND SPECIFICATION NEW UNDERGROUND FIRE SERWICE PIPING IS BY THE PROJECT CIVIL ENGINEER, SEE CIVIL DRAWINGS AND SPECIFICATIONS.

KEY NOTES

(1) FIRE RISER WITH CONTROL VALVE AND FLOW SWITCH THAT REQUIRES MONITORING BY THE FIRE ALARM SYSTEM

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AE Project # 20189131

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50% DD
APRIL, 13 2018

SHEET TITLE

SITE PLAN - FIRE PROTECTION

SHEET NUMBER

FP-1.1

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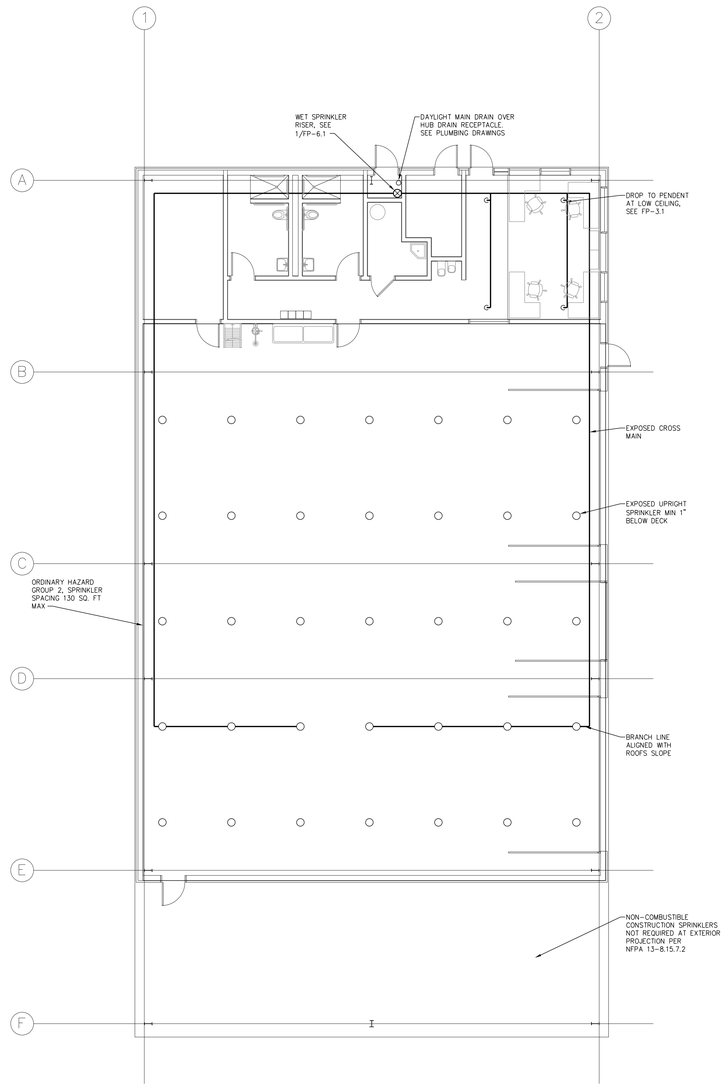

BUS SHOP PIPING PLAN - FIRE PROTECTION

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

SPRINKLERS

SYMBOL	DESCRIPTION	MANF.	MODEL	SIN	TYPE	K FACTOR	TEMP. RATING	QTY	REMARKS
●	PENDENT ON 401 EXTENSION	TYCO	TY-FRB	32.31	SSP	5.6	155° F	0	(1) (2)
◉	RECESSED PENDENT	TYCO	TY-FRB	32.31	SSP	5.6	155° F	0	(1)
✖	DRY PENDENT	TYCO	DS-1	39.35	SSP	5.6	200° F	0	(1) (3)
○	UPRIGHT IN CONCEALED SPACE	TYCO	TY-FRB	31.31	SSU	5.6	200° F	0	
△	SIDEWALL	TYCO	TY-FRB	33.31	SSS	5.6	155° F	0	(1)
◎	UPRIGHT ON SPRIG UP	TYCO	TY-FRB	31.31	SSU	5.6	200° F	0	
✲	FLAT SPRAY UPRIGHT	TYCO	CC2	31.89	FSU	5.6	175° F	0	
○	UPRIGHT ON BRANCH LINE	TYCO	TY-FRB	31.31	SSU	5.6	155° F	0	
TOTAL SPRINKLERS (THIS SHEET)								0	
TOTAL SPRINKLERS (JOB)								0	

(1) FINISH TO MATCH ADJACENT MATERIAL VERIFY WITH ARCHITECT

(2) PENDENT ON 401 EXTENSION

(3) PROVIDE PLUGGED TEE IN DROP IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTION

(4) PROVIDE STYLE 10 RECESSED ESCUTCHEON. FINISH TO MATCH ADJACENT MATERIAL VERIFY WITH ARCHITECT

(5) FOR LAY IN PANEL SUSPENDED CEILINGS PROVIDE 1" ANNULAR CLEARANCE AROUND RECESSED ESCUTCHEON. CONCEAL OVERSIZE HOLE WITH VIKING 12620 EXPANSION PLATE. FINISH TO MATCH ADJACENT MATERIAL VERIFY WITH ARCHITECT

NOTES:

1. ALL DIMENSIONS ARE CENTERLINE TO CENTERLINE UNLESS OTHERWISE NOTED.
2. ALL PIPE 1-1/2" AND SMALLER SHALL BE SCHEDULE 40 BLACK STEEL WITH CAST IRON THREADED FITTINGS IN ACCORDANCE WITH ANSI B16.4.
3. ALL PIPE 2" AND GREATER SHALL BE SCHEDULE 10 BLACK WITH GROOVED COUPLINGS AND WELDED OUTLETS.
4. ALL PIPE 1-1/2" AND SMALLER SHALL HAVE SUPPORT SPACING LESS THAN 12 FEET.
5. ALL PIPE 2" AND GREATER SHALL HAVE SUPPORT SPACING LESS THAN 15 FEET.
6. BRANCH LINES SHALL BE RESTRAINED WITH NO. 12 440 LB WIRE AT THE END OF BRANCH LINE, AND AT INTERVALS NOT EXCEEDING 30 FT.
7. PROVIDE 1" ANNULAR CLEARANCE AT ALL SPRINKLER PENETRATIONS OF LAY IN PANEL SUSPENDED CEILINGS.

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LIBERTY UNION HIGH SCHOOL DISTRICT

REVISIONS

ARCH PROJECT NO:	1707.00
DRAWN BY:	DRAFTSPERSON
DRAWING SCALE:	NONE

50% DD
APRIL, 13 2018

SHEET TITLE

BUS SHOP PIPING PLAN - FIRE PROTECTION

SHEET NUMBER

FP-2.1

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Layout: FP-2.1 Plotted: Apr 13, 2018 - 8:45:50AM

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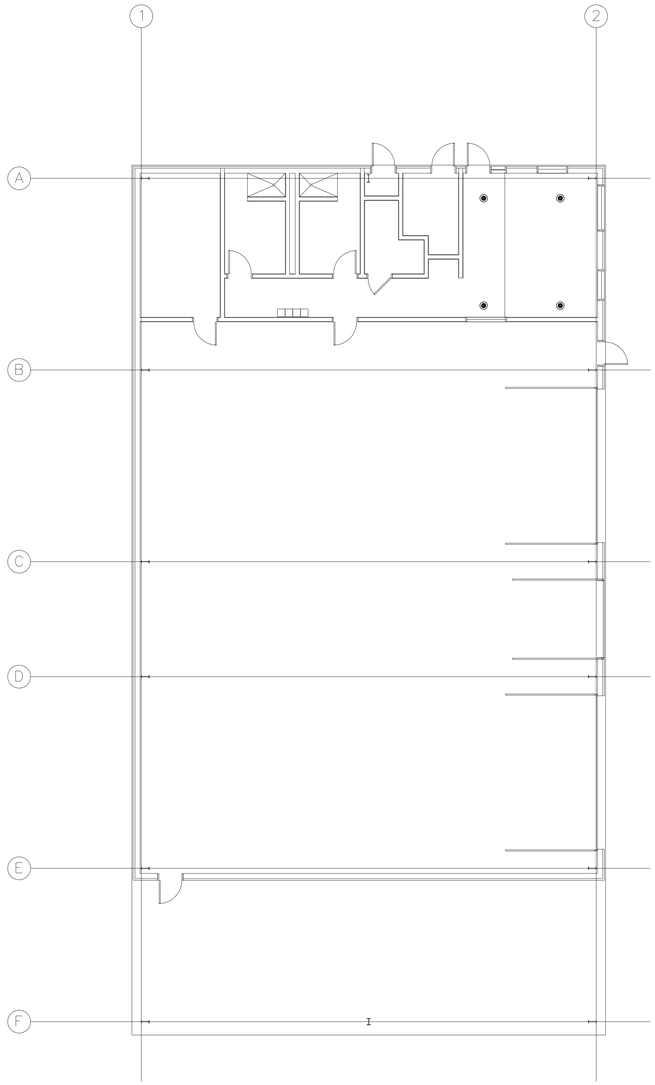

BUS SHOP CEILING PLAN - FIRE PROTECTION
SCALE: 1/8" = 1'-0"

SPRINKLERS

SYMBOL	DESCRIPTION	MANF.	MODEL	SIN	TYPE	K FACTOR	TEMP. RATING	QTY	REMARKS
●	PENDENT ON 401 EXTENSION	TYCO	TY-FRB	3231	SSP	5.6	155° F	0	(1) (2)
◉	RECESSED PENDENT	TYCO	TY-FRB	3231	SSP	5.6	155° F	0	(1)
✖	DRY PENDENT	TYCO	DS-1	3935	SSP	5.6	200° F	0	(1) (3)
○	UPRIGHT IN CONCEALED SPACE	TYCO	TY-FRB	3131	SSU	5.6	200° F	0	
△	SIDEWALL	TYCO	TY-FRB	3331	SSS	5.6	155° F	0	(1)
◎	UPRIGHT ON SPRIG UP	TYCO	TY-FRB	3131	SSU	5.6	200° F	0	
✲	FLAT SPRAY UPRIGHT	TYCO	CC2	3189	FSU	5.6	175° F	0	
○	UPRIGHT ON BRANCH LINE	TYCO	TY-FRB	3131	SSU	5.6	155° F	0	
TOTAL SPRINKLERS (THIS SHEET)								0	
TOTAL SPRINKLERS (JOB)								0	

(1) FINISH TO MATCH ADJACENT MATERIAL VERIFY WITH ARCHITECT
(2) PENDENT ON 401 EXTENSION
(3) PROVIDE PLUGGED TEE IN DROP IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTION
(4) PROVIDE STYLE 10 RECESSED ESCUTCHEON. FINISH TO MATCH ADJACENT MATERIAL VERIFY WITH ARCHITECT
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NOTES:

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LIBERTY UNION HIGH SCHOOL DISTRICT

REVISIONS

ARCH PROJECT NO: 1707.00
DRAWN BY: DRAFTSPERSON
DRAWING SCALE: NONE

50% DD
APRIL, 13 2018

SHEET TITLE
BUS SHOP CEILING PLAN- FIRE PROTECTION

SHEET NUMBER
FP-3.1

THE PLANS AND SPECIFICATIONS REMAIN WITH THE ENGINEER WITHOUT PREJUDICE. VISUAL CONTACT WITH THESE PLANS AND SPECIFICATIONS SHALL CONSTITUTE PRIMA FACIE EVIDENCE OF THE ACCEPTANCE OF THESE RESTRICTIONS. AXIOM ENGINEERS INC — LEE & ASSOCIATES CONSULTING ENGINEERS
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Layout: SD-MAIN.DWG 22-Dec-2018,08:45:59AM,PDT

1 / FP-4.1 **CROSS SECTION B**
SCALE: 1/8" = 1'-0"

1 / FP-4.1 **CROSS SECTION A**
SCALE: 1/8" = 1'-0"

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LIBERTY HIGH SCHOOL

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REVISIONS

ARCH PROJECT NO: 1707.00
DRAWN BY: DRAFTSPERSON
DRAWING SCALE: NONE

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SHEET TITLE
BUS SHOP SECTIONS- FIRE PROTECTION

SHEET NUMBER
FP-4.1

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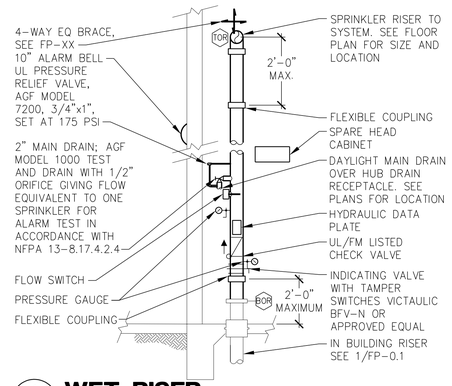

1 / FP-6.1 **WET RISER**

NO SCALE

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SHEET TITLE

DETAILS - FIRE PROTECTION

SHEET NUMBER

FP-6.1

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AE Project # 2018P131

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LIBERTY UNION HIGH
SCHOOL DISTRICT

REVISIONS

ARCH PROJECT NO: 1707.00
DRAWN BY: DRAFTSPERSON
DRAWING SCALE: NONE

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APRIL, 13 2018

SHEET TITLE

SEISMIC BRACING CALCULATIONS - FIRE PROTECTION

SHEET NUMBER

FP-6.2

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LUHSD Transportation, Maintenance & Operations Facility

Liberty Union High School District

Design Development Specifications
NOT FOR CONSTRUCTION
FOR REFERENCE ONLY

Date: May 17, 2018

Owner:
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20 Oak Street
Brentwood, CA 94513

Architect:
Quattrocchi Kwok Architects
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f.: 707.576.0295

Architect's Project No.: 1707.00

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DIVISION 0 – BID DOCUMENTS

AWAITING OWNER (LUHSD) TO PROVIDE DIVISION 00 SPECIFICATION SECTIONS.

DIVISION 1 - GENERAL REQUIREMENTS

AWAITING COORDINATION WITH OWNER (LUHSD) PROVIDED INFORMATION

SECTION 01 1100 – SUMMARY OF WORK

The project consists of constructing a Maintenance & Operations / Transportation Services building, a Bus Shop building, a facility yard with parking stalls for school buses, and a parking lot for staff and visitors.

The Maintenance & Operations / Transportation building is approximately 11,941 square feet (including mezzanine) and will be a pre-engineered metal building. The riding equipment storage and M&O shop will be a tall volume space that will accommodate a storage mezzanine in the shop area. The remaining portion of the building, which includes offices, reception, toilet rooms, conference room, break room, shipping and receiving will be a single-story high space. The building is construction Type 2-B and Occupancy Type B at the office/department areas and Occupancy Type F-1 at the M&O shop and riding equipment storage. Shipping and receiving area will be Occupancy Type S-1. The building will not be provided automatic fire sprinkler system.

The Bus Shop building is approximately 8,050 square feet (including mezzanine) and will be a pre-engineered metal building. The building will be a tall volume space to accommodate a Storage Mezzanine above the shop office area which includes toilet rooms, a secured storage room, custodial, mechanical and electrical rooms. The building is construction Type 2-B and Occupancy Type S-1. The building will be provided automatic fire sprinkler system.

General new site work will include a parking lot for staff and visitors, bio-swale planters, a maintenance and transportation facility yard with parking stalls for 40 full-size school buses. The facility yard will be secured with non-climbable chain link fencing and access gates at the perimeter.

SECTION 01 2100 –ALLOWANCES

Describes line item allowances to be included in the Bid Proposal.

SECTION 01 2200 –MEASUREMENT AND PAYMENT

Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.

SECTION 01 2300 –ALTERNATES

Describes additive and/or deductive alternates to the contract and procedures for preparing and submitting the bids for these alternates.

SECTION 01 2600 –MODIFICATION PROCEDURES

Describes administrative procedures for Requests for Information, Architect's Supplemental Instructions, Requests for Proposal for Owner-initiated changes, Change Order processing and approval.

SECTION 01 2900 –APPLICATIONS FOR PAYMENT

Describes administrative procedures for Application and Certificate for Payment, Schedule of Values, Unit pricing for predetermined quantities of work, administrative requirements for initial and final payments including Contractor's provision of insurance and notification of Surety on close-out.

SECTION 01 3200 –CONSTRUCTION SCHEDULE

Specifies requirements for submittal, distribution and review of Contractor's Construction Progress Schedule. Specifies responsibilities of the Contractor to complete the Work within the time allotted. Establishes limits of Architect's review and Contractor responsibility for compliance. Specifies delay contingency for expected weather during the project duration and procedures for requesting, verifying and authorizing project time extensions. A schedule of Project Milestones and their respective dates or elapsed durations may also be included.

SECTION 01 3300 –SUBMITTALS

Specifies procedural requirements for submittals of samples, product information and shop drawings for review by Architect. Establishes limits of Architect's review and Contractor responsibility for compliance.

SECTION 01 3546 – CONSTRUCTION INDOOR AIR QUALITY PLAN (CHPS) (CALGREEN)

Indoor Air Quality Plan: Within 14 days after receipt of Notice to Proceed and prior to any waste removal from the project, Contractor to develop and submit for review a healthy indoor air quality plan. The plan shall include:

List of IAQ protective measures to be instituted on the site.

Schedule for inspection and maintenance of IAQ measures.

SECTION 01 3900 –COORDINATION AND MEETINGS

Specifies requirements for periodic meetings and conferences during construction, including joint meetings of all parties, meetings for the Contractor’s use and pre-construction conferences.

Describes procedures and requirements for Contractor's coordination of the Work.

SECTION 01 4000 –QUALITY CONTROL

Specifies procedures, processes and requirements to insure quality of materials and workmanship.

SECTION 01 4200 –REFERENCE STANDARDS

Defines and specifies the standards and definitions to be followed during construction.

SECTION 01 4523 –TESTING AND INSPECTION SERVICES

Specifies procedures, processes and requirements for independent testing and inspection services provided by the Owner pursuant to Division of State Architect requirements.

SECTION 01 5000 –TEMPORARY FACILITIES

Specifies procedures, processes and requirements for temporary facilities including field offices storage sheds, temporary utilities such as water, sewer, sanitary, electric, telephone and fax lines, lighting and safety measures, cleaning, trash removal, protection of Work and property. Project requirements are coordinated with Section 00800 – Supplemental General Conditions.

SECTION 01 5600 –TEMPORARY CONTROLS

Specifies procedures, processes and requirements for control of noise, erosion, dewatering, site winterization, access, weeds and dust.

SECTION 01 5700- SITE WINTERIZATION

Verify extent of SWPPP required.

SECTION 01 5800 –PROJECT IDENTIFICATION AND SIGNS

Specifies project identification signage, installation, maintenance and removal. Coordinate with District and QKA Marketing.

SECTION 01 6000 –PRODUCT REQUIREMENTS

Establishes the range of product options available to the Contractor. Specifies procedures and time limits for the Contractor's proposal of substitutions of specified items and Architect's review of these proposals.

SECTION 01 6116 – VOLATILE ORGANIC COMPOUND (VOC) RESTRICTIONS

Single section outlining mandated VOC restrictions as defined by the CBC for all building materials.

SECTION 01 6116.16– VOLATILE ORGANIC COMPOUND (VOC) CERTIFICATION FORM

SECTION 01 7000 –CONTRACT CLOSEOUT

Specifies requirements for cleaning of the Work during the Contract Time and prior to acceptance by the Owner; requirements for Contractors maintenance of Record Documents and their submittal to the Owner prior to acceptance of the Work; administrative procedures for the close-out of the project.

SECTION 01 7419 – CONSTRUCTION WASTE MANAGEMENT

Describes Contractor's responsibilities to implement procedures to divert construction waste.

SECTION 01 7500 - STARTING OF SYSTEMS

Specifies administrative procedures for starting up mechanical, plumbing, electrical, and other special building systems. Attendance and scheduling of staff training sessions.

SECTION 01 7513 –EXECUTION REQUIREMENTS

Specifies general administrative procedures related to cutting and patching, general procedures and requirements for execution of work, installation of products, adjusting cleaning and protecting finished work.

SECTION 01 8113 – SUSTAINABLE DESIGN REQUIREMENTS

Section includes general requirements and procedures for compliance with California Code of Regulations, Title 24, Part 11 California Green Building Standards Code, "CAL-Green".

DIVISION 2 – EXISTING CONDITIONS

SECTION 02 5000 – SITE REMEDIATION

Hazardous Material Mitigation will be defined and coordinated through Owner (LUHSD) retained consultant.

All existing pipes slated for removal and disposal shall first be identified by the material and the methods available for removal and disposal.

Contractor shall comply with air quality, public health and safety, storm water pollution prevention plan, water quality, noise and hazardous material during the removal and disposal process. All hazardous materials encountered shall be handled per the current federal, State and Local Laws.

Where existing pipes are to be cut, the open ends of said pipes shall be securely closed by a tight fitting plug or wall of concrete not less than 2 feet think, or by a tight brick wall no less than 8 inches thick with cement mortar joints.

DIVISION 3 – CONCRETE

SECTION 03 1000 – CONCRETE FORMS AND ACCESSORIES

SEE APPENDIX A – ZFA STRUCTURAL SPECIFICATION

SECTION 03 2000 – CONCRETE REINFORCING

SEE APPENDIX A – ZFA STRUCTURAL SPECIFICATION

SECTION 03 3000 – CAST-IN-PLACE CONCRETE

SEE APPENDIX A – ZFA STRUCTURAL SPECIFICATION

SECTION 03 3511 - CONCRETE FLOOR FINISHES

Sealing of Concrete floor surfaces in locations indicated on floor plans.

MANUFACTURER

Curecrete Distribution Inc.; Ashford Formula: www.ashfordformula.comby

W.R. Meadows, Inc; Liqui-Hard: www.wrmeadows.com.

PRODUCT DATA

Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set. Colored sealants and finishing materials compatible with concrete color additives specified in Section 03 3519.

DIVISION 4 – MASONRY

None.

DIVISION 5 – METALS

SECTION 05 1100 – STRUCTURAL STEEL

See Section 13 3419 – Metal Building Systems

SECTION 05 5000 – METAL FABRICATIONS

All miscellaneous metal work not classified as structural steel. For Decorative Metal Railings see Section 05 7500.

Miscellaneous shapes, plates, angles, clip angles, supports, bolts, and specialty iron and steel items indicated and as necessary to complete the work, including, but not limited to, the following:

Metal handrails, railings, guardrails.

Pipe sleeves.

Miscellaneous sunshades, brackets, canopies.

Steel pipe rain water leaders and brackets.

Decorative grilles, trusses, and architectural features.

Pipe bollards.

Security enclosures.

PRODUCT DATA

Materials: Steel shapes, bars and plates ASTM A36; Steel pipe ASTM A53 Grade B Type 3. Hot-dipped galvanized steel at exterior exposure and at interior locations subject to high moisture.

Handrails and Pipe Railings: Steel pipe or tube handrails and railings: Fabricate to dimensions and details shown, with welded joints ground smooth and flush. Hot-dipped galvanized at exterior locations.

Steel Pipe Rain Water Leaders: Schedule 40 iron pipe with welded joints ground smooth and flush, hot-dipped galvanized.

Perforated sheet steel and plate. Perforations can be round or square, and can have a free area of 30% to 65% depending on the pattern. Exterior installations shall be paintable.

Shop drawings and certificates of welding inspection are required.

Ladders shall require calculations and details by a structural engineer licensed in California.

SECTION 05 5133 – ACCESS LADDERS

Fixed aluminum ladder for mezzanine access. Fixed aluminum ladders for roof access. For Roof Hatches see Section 07 723

MANUFACTURER

O'Keeffes, www.okeeffes.com

ALACO Ladder Co., www.alacoladder.com

PRODUCT DATA

1. Standard Duty Channel Rail Fixed Aluminum Ship Ladder. Basis of design: O'Keeffe Model 520 with 60-degree angle.

Ship ladder shall be attached to floor and wall with brackets per manufacturer's written instructions.

Treads shall be of extruded aluminum 6063-T5 alloy, 4"x 1-1/4". Tread shall be serrated so as to provide maximum grip and foot traction. Tread shall be capable of withstanding 1,500 lb. load. Handrails and posts shall be aluminum 1.666" diameter pipe (schedule 40).

2. Standard Duty Channel Rail Fixed Access Ladder.

Tubular Rail Low Parapet Access Ladder with Platform and Return and AB - Alternative Bottom support.

Extendible ladder safety post: Safety post shall be attached at the top of the access ladder to the roof per manufacturer's written instructions and shall extend 30" above the level of the roof.

Rungs shall be of extruded aluminum 6063-T5 alloy not less than 1-1/4" in section and 18 3/8"long. Rungs shall be serrated so as to provide maximum grip and foot traction. Heavy duty side rails shall be a channel or tubular section of extruded aluminum of 3" in width and a minimum extrusion thickness of 1/8".

SECTION 05 5213 – PIPE AND TUBE RAILINGS

Steel. Mechanically jointed, slip-on non-weld fittings. Mezzanine railings and guardrails.

MANUFACTURER

Forms + Surfaces; Product Silhouette Railing System. www.forms-surfaces.com

HDI Product Circum Guardrail with Stainless Steel top rail - Perforated Stainless steel infill panels www.handrail-design.com

PRODUCT DATA

Railings - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.

Shop drawings will be required.

DIVISION 6 – WOOD, PLASTIC AND COMPOSITES

SECTION 06 1000 – ROUGH CARPENTRY

SEE APPENDIX A – ZFA STRUCTURAL SPECIFICATION

SECTION 06 1733 – WOOD I-JOISTS

SEE APPENDIX A – ZFA STRUCTURAL SPECIFICATION

SECTION 06 1800 – GLUE LAMINATED CONSTRUCTION

SEE APPENDIX A – ZFA STRUCTURAL SPECIFICATION

SECTION 06 2000 – FINISH CARPENTRY

Finish carpentry items. Interior and exterior wood trim; Wood casings and moldings. Hardware and attachment accessories.

PRODUCT DATA

Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

Wood fabricated from old growth timber is not permitted.

Wood and Plywood: Selected for exposed surfaces to meet requirements for WI "Custom Grade" work, unless otherwise indicated.

Types:

Exterior wood: Dry; with moisture content up to 15 percent, unless otherwise indicated.

Interior wood: Dry; with moisture content between 6 and 12 percent, unless otherwise indicated. Finger joints not permitted. WI manual, Section 3 and Section 4; "Custom Grade"

Softwoods:

Opaque Finish: Clear; western softwood.

Hardwoods: Transparent finish, plain sawn White Maple.

SECTION 06 4100 – ARCHITECTURAL WOOD CASEWORK

Wood casework, laminated plastic casework, shop finished and complying with applicable requirements of Architectural Woodwork Standards (AWS) Cabinet hardware. Preparation for installing utilities.

All work to be coordinated with Section 12 3600 - Countertops.

MANUFACTURER

Single Source Responsibility: A single manufacturer shall provide and install the work described in this Section.

AWS membership and certificate are required for both fabrication and installation.

Laminated Plastic Casework: Low VOC non-formaldehyde plywood casework. High pressure decorative laminate.

Panolam “Woodgrains "Panolam Industries www.panolam.com

Formica Corporation: “180fx” www.formica.com

Wilsonart: www.wilsonart.com

PRODUCT DATA

Typical Cabinet Construction Style:

Style A, Frameless.

Door and Drawer Style: Flush Overlay.

Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Custom Grade.

Shelf Support Clips: Plated steel, with support pin for drilled hole in cabinet standard and shelf, with pre-drilled hole for seismic fastener to shelf. Hettich Sekura #1 or equal. Plastic clips will be rejected.

Door and Drawer Pulls: Provide at all doors and drawers, brushed stainless steel, 116 x 28 mm loop pull; Hafele, San Francisco, CA "Model 115.60.601", or equal.

Locks: Deadbolt Lock with Schlage Full Size IC Cores; 777 – Doors / 888 – Drawers Olympus Lock, Inc. www.olympus-lock.com

Catches: Magnetic.

Drawer Slides: Full extension, ball bearing. Side mounted. Positive stop type. Self closing/stay closed type. Heavy duty.

Accuride International, Inc: www.accuride.com.

Grass America Inc: www.grassusa.com.

Knape & Vogt Manufacturing Company: www.knapeandvogt.com.

Hinges: Stainless steel, five knuckle ANSI / BHMA Grade 1, non-removable pins, attached with screws that are inaccessible when closed, capable of 270 degree swing. black or chrome powder coated finish..

Manufacturer: Rockford Process Control "No. 376" or equal.

Grommets and covers: 2 inch diameter, ABS plastic; black

Submittal samples and shop drawings are required.

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07 2100 – BATT [BUILDING] INSULATION

Specifies acoustic batt insulation at interior wall construction and foam-in-place insulation for filling perimeter window and door shim spaces.

MANUFACTURER

Batt Insulation:

Dow Chemical Co: www.dow.com.

Owens Corning. www.owenscorning.com

Johns Manville, www.specjm.com/commercial/insulation.asp

PRODUCT DATA

Product manufacturer to provide GreenGuard or other LEED approved certification for Indoor Air quality.

Interior Wall Acoustic Insulation: All interior walls; unfaced fiberglass acoustic batts to full depth of framing member.

Other: Foamed-in-place Plastic Insulation: Polyurethane Foam Sealant, "Great Stuff" by Flexible Products, Joliet IL, www.itsgreatstuff.com, or approved equal.

SECTION 07 2500 – WEATHER BARRIERS

Vapor retarders: Materials to make slabs-on-grade water vapor- resistant and air tight.

PRODUCT DATA

Vapor Barriers under slabs-on-grade: Vapor retarder shall be an air-tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and sealed joints to adjacent surfaces. 15 mils Vapor retarder barrier sheet product by:

Epro Waterproofing Systems; ECOSHIELD-E15, 15-mil thick Sheet Membrane Vapor Retarder: www.eproserv.com

Stego Wrap Vapor Barrier www.stegoindustries.com

W.R. Meadows, Inc. "Perminator 15" www.wrmeadows.com

SECTION 07 2633 WATER VAPOR EMISSSION CONTROL COATING

Epoxy type, environmentally safe, 100 percent solids, water vapor emission and alkalinity control coating.

MANUFACTURER

Koster Waterproofing Systems; VAP I 2000; www.kosterusa.com

Allied Construction Technologies, Inc; A C Tech 2170; 757-855-5100

Aquafin; VapoTight SG3; www.aquafin.net

SECTION 07 4113 – PREFORMED METAL ROOF

Pre-formed roof panels. Clips, perimeter penetration flashing and closures. Flashings, fasteners and accessories as required for weatherproof installation.

MANUFACTURER

The Garland Company . www.garlandco.com

PRODUCT DATA

Metal Roofing shall be Class A rated 24 gauge, 18 inch wide Galvalume steel batten seam roof panels. Roof panels shall have factory fluorocarbon coating with 20 year warranty.

Certified test report that bear the stamp of a registered California PE to show compliance with specified performance criteria.

A coordinated 30 year warranty with Section 07 5100 is specified.

Color selected by Architect from the Manufacturer's standard color range.

SECTION 07 6200 – SHEET METAL FLASHING

Fabricated sheet metal items including flashings, counterflashings, fascias, edge metal, gutters, scuppers, and other sheet metal items. Work in conformance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Architectural Sheet Metal Manual (ASMM); and National Roofing Contractors Association (NRCA) Roofing Manual. General sheet metal materials shall be:

Galvanized Steel Sheet: ASTM A653/A653M with G90/Z275 zinc coating, 24 gauge minimum thickness and greater as required by referenced standards for specific applications indicated.

Pre-Finished Galvanized Sheet: Material supplied by Preformed Metal Roof Panel Manufacturer to match roof panels specified in 07 4113 ASTM A792 with G90/Z275 zinc coating, shop pre-coated with polyvinylidnene fluoride coating of selected color, 24 gauge minimum thickness and greater as required by referenced standards for specific applications indicated.

Stainless Steel: ASTM A666 Type 304, soft temper, 0.018 inch thick with smooth No. 4 finish.

Zinc Alloy Sheet: Ball Metal and Chemical "Microzinc 80", zinc with 0.6% copper and 0.14% titanium, standard (soft) temper, mill finish 21 gauge thick unless otherwise indicated.

Aluminum Sheet: ASTMB209, alloy 3003-H14, 0.040 inch thick, C22A41 clear anodized finish.

Flexible Flashing: 25 mil (0.64 mm), cold applied, self-adhering membrane consisting of a 3 mil (0.07 mm) high density, cross-laminated polyethylene film coated on one side with a 22 mil (0.56 mm) layer of rubberized asphalt adhesive.

MANUFACTURER

W. R. Grace "Vycor Plus". www.grace.com

Pipe flashing and boots shall be lead free.

SECTION 07 7100 –ROOF SPECIALTIES

Manufactured roof specialties, including copings, fascias, gravel stops, and vents; pipe penetration curbs and covers.

Pipe penetration curbs, attic vents, eave/soffit/frieze vents, and foundation vents are also specified.

SECTION 07 7200 – ROOF ACCESSORIES

Prefabricated roof hatches and smoke vents for access to roof mounted equipment and provision of code-required fire venting. Hatch material shall be galvanized primed steel for field painting, stainless steel, or mill finish aluminum for field painting (Coastal Option).

Single-leaf type roof hatch with integral steel curb and safety railing.

MANUFACTURER

Bilco Co., "Type S" www.bilco.com

O'Keeffe www.okeeffes.com

Approved equal

SECTION 07 9200 – JOINT SEALERS

Sealants and joint backing for the following applications:

Exterior and interior joints where indicated on drawings.

For sound isolation in partitions and ceilings.

To make building watertight and weatherproof.

To fill an exposed joint between materials which do not fit tightly together.

Performance requirements for building envelope:

Make watertight and weathertight.

General Purpose Sealants: Polyurethane multi-component.

BASF Building Systems, Sonolastic NP-2. www.chemrex.com

Sika Corporation, Construction Products Division; Sikaflex 2cNS.
http://usa.sika.com/en/group.html

General Purpose Interior Sealant: Acrylic emulsion latex

Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com

BASF Construction Chemicals-Building Systems; [Sonolac]: www.buildingsystems.basf.com

Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com

Acoustical Sealant: Acrylic single component, non-skinning, non-sag, paintable.

Pecora Corporation; AIS-919 Acoustical and Insulation Latex Sealant: www.pecora.com

Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com , at fire-rated construction

VOC Submittals: Product Data – VOC Limits: For adhesives, sealants, fillers and primers, documentation including printed statement of VOC contents, comply with limits specified in Section 01 6116

DIVISION 8 – OPENINGS

SECTION 08 1113 – HOLLOW METAL DOORS AND FRAMES

Steel doors and frames for both doors and windows.

All materials and products conforming to standards of the Steel Door Institute.

MANUFACTURER

Curries www.curries.com/en/site/curries/Products/

Ceco www.cecodoor.com/en/site/cecodoor/

Steelcraft us.allegion.com/Products/doors_frames/doors/Pages/default.aspx

PRODUCT DATA

Submittal samples and shop drawings are required.

Doors: Heavy duty, seamless, flush steel with reinforcing at hardware locations, factory primed for field painting.

Exterior: 14 gauge, galvanized and insulated.

Interior: 16 gauge steel.

Fire rated as required by prevailing codes, depending upon location, as indicated on the door schedule. Fire-Rated Openings: Comply with NFPA 80; UL or ITS (Warnock Hersey) listed.

Openings – Tempered glazing at all lites with minimum 18 ga glazing stops. . Provide inserted louvers of roll-formed steel, double flanged, with vandal-proof fasteners oriented to secure side, locations indicated; Anemostat, Air Louver or equal.

Frames: Fully welded with reinforcing welded in place at hardware attachment points and appropriate anchors for wall substrate materials indicated. Shop primed for field painting. Fire rated as required by prevailing codes, depending upon location, as indicated on the door schedule.

Exterior: 12 gauge steel, galvanized.

Interior: 14 gauge steel.

SECTION 08 3100 – ACCESS DOORS AND PANELS

Access door and frame units, fire-rated and non-fire-rated, in wall and ceiling locations wherever required for access to enclosed spaces or equipment.

Exterior doors to be insulated and weatherstripped. Fire ratings and self-closing options as required by prevailing codes, depending upon location.

MANUFACTURER

Acudor Products Inc.; www.acudor.comKarp

Karp Associates, Inc: www.karpinc.com

Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.co

PRODUCT DATA

Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

SECTION 08 3323 – OVERHEAD COILING DOORS

Exterior overhead coiling doors, operating hardware, non-fire-rated, exterior, electric operation

MANUFACTURER

The Cookson Company: www.cooksondoor.com

Overhead Door Corporation: www.overheaddoor.com

PRODUCT DATA

Exterior Coiling Doors

Exterior doors to be insulated and weatherstripped.

Materials:

Primed galvanized steel, for field painting

Operation to suit specific installation:

Remote controlled, motorized.

SECTION 08 5113 – ALUMINUM WINDOWS

Extruded aluminum windows with fixed sash and operating sash.

Factory glazing

Operating hardware.

Insect Screens.

MANUFACTURER

EFCO, a Pella Company; www.efcocorp.com.

Mercer Industries www.mercerwindows.com/architectural/index.html

Torrance Aluminum www.torrancealuminum.com/htdocs/torrance_prod_win.html

PRODUCT DATA

Aluminum windows shall conform to AAMA requirements.

Nail-on fin for wood framing applications.

Fluoropolymer "Kynar" color finish or Class I anodizing, 25 year warranty.

Finishes shall match storefronts or contrast at Architect's option.

SECTION 08 6200 – UNIT SKYLIGHTS

Skylight units will be provided and part of metal building system. See Section 13 3419 Metal Building Systems.

SECTION 08 6223 TUBULAR SKYLIGHTS

Tubular skylights.

Ceiling diffusers.

Counterflashings.

MANUFACTURER

Tubular Skylights:

Solatube. www.solatube.com/commercial

PRODUCT DATA

Pre-manufactured daylighting system components assembled per site-specific conditions. Integrated Power-Operated Daylight Dimmer Control System. Diffuser to suit ceiling conditions: domed at hard ceilings, 2x2 diffuser at suspended ceilings.

SECTION 08 7100 – DOOR HARDWARE

Door Hardware, fixed and operating trim, attachments, fasteners, locksets, hinges, thresholds and all other elements.

PRODUCT DATA

Fire Rated Assemblies: Provide hardware for fire rated assemblies in compliance with positive pressure standard UBC 7-2-1997 or UL 10C, current edition of NFPA 80 at locations required for compliance with prevailing codes and as indicated or scheduled.

Conform to CBC and ADA accessibility requirements.

Keying: Grand master keyed at the factory. Advise factory in advance of final keying.

Include construction keying.

New keying system will be by Owner

Door hardware shall consist of the following:

Exit Hardware: Von Duprin

Locksets: Schlage

Closers: LCN

Hinges: Stanley, ball bearing, stainless steel @ exterior.

Continuous Hinges: Stanley

Seals & Thresholds: Pemko

Door holders, stops, kickplates, etc.: Trimco

SECTION 08 8800 – GLAZING

Glass: Glazing of Windows, Interior windows, Door lights. Glazing compounds and accessories.

MANUFACTURER

Guardian Industries Corp: www.sunguardglass.com.

Pilkington North America Inc: www.pilkington.com/na .

PPG Industries, Inc: http://www.ppg.com/corporate/ideascapes/Pages/default.aspx is specified as basis of design.

PRODUCT DATA

Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

Other products of the basis of design manufacturer and products of other manufacturers will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.

All glazing is tempered.

Type Clear - Sealed Insulating Glass Units: Vision glazing, low-E.

Basis of Design: PPG Industries, Inc:.

Application(s): All exterior glazing unless otherwise indicated.

Thermal Resistance (U-Value): 0.29, maximum.

Total Solar Heat Gain Coefficient: 0.39, maximum.

Total Visible Light Transmittance: 0.70 percent, minimum.

Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.

Coating: PPG Solarban 70 on # 2 surface, no coating on #3 surface.

Tint: None (clear).

Inboard Lite: Fully tempered float glass, 1/4 inch thick.

Tint: None (clear).

Total Thickness: 1 inch.

Single Safety Glazing: Non-fire-rated.

Glazed lites in doors, except fire doors.

Glazed sidelights to doors, except in fire-rated walls and partitions.

Other locations required by applicable federal, state, and local codes and regulations.

Other locations indicated on the drawings.

Type: Fully tempered float glass as specified.

Tint: Clear.

Thickness: 1/4 inch.

Interior Glazing

Provide single manufacturer for interior and exterior glazing.

SECTION 08 9100 –LOUVERS

Shop fabricated and manufactured metal louvers and vents which are not an integral part of the mechanical systems. Rain guard at exterior locations. Metal mesh screens are also specified.

MANUFACTURER

Metal-Air Louver, www.metalairelouver.com

Air-O—Lite Louver, www.airolite.com

DIVISIONS 9 – FINISHES

SECTION 09 0511 CONCRETE FLOOR PREPARATION

Mechanical cleaning of new concrete floor surfaces for application of sealers and coatings.

SECTION 09 0512 CONCRETE FLOOR MOISTURE CONTENT AND PH TESTING

Concrete moisture content testing using relative humidity method.

Concrete pH testing

MANUFACTURER RELATIVE HUMIDITY TEST EQUIPMENT

Vaisla www.vaisala.com

Wagner Moister Meters, www.wagnermeters.com

MANUFACTURER PH TEST MATERIALS

Micro Essential Laboratory, www.micoressentiallab.com

SECTION 09 2116- GYPSUM BOARD ASSEMBLIES

Metal stud wall framing. Metal channel ceiling framing. Gypsum board furring systems. Shaft wall system. Gypsum sheathing. Gypsum wallboard. Joint treatment and accessories. Tackable mineral fiber board backing for wallcoverings. For Cementious Backer Board See Section 09 3000 Tiling.

Typical gypsum wall board shall be 5/8" Type 'X' gypsum board screwed to studs with textured finish. Fire rated assemblies installed as required for the fire rating required by prevailing codes, depending upon location, as indicated on the drawings.

Proprietary Fire Resistive Gypsum Board – limit use unless required.

Gypsum Ceiling Board

Moisture- and Mold-Resistant Gypsum Board where indicated

Water-Resistant Gypsum Board at damp or wet areas such as kitchens, custodial rooms, locker rooms and toilets

Exterior Glass-Mat Gypsum Sheathing Board where indicated

Exterior Gypsum Board for Ceilings and Soffits as applicable

MANUFACTURER

Georgia-Pacific Gypsum: www.gpgypsum.com.

National Gypsum Company: www.nationalgypsum.com.

PABCO Gypsum: www.pabcogypsum.com.

USG Corporation: www.usg.com.

PRODUCT DATA

Fire Rated and Moisture-Resistant Fire Rated Gypsum Wallboard: ASTM C 36; Type X, UL or WH rated; sizes to minimize joints in place; ends square cut.

Thickness: 5/8 inch.

Edges: Tapered.

Impact-Resistant Gypsum Board National Gypsum "Fire-Shield Hi-Impact Brand 2000" with 0.020 inch lexan sheet reinforcement bonded to the back side of the panel. Use limited to specific areas indicated. Coordinate with insulation requirements at exterior walls.

Tackboard: Listed and classified by UL in File No. R-4019 having Class A surface burning characteristics and tested in conformance with ASTM E 84.

"Industrial Insulation Board" conforming to FS LLL-I-535 as manufactured by Masonite Building and Industrial Products, Chicago, IL.

"Micore" Mineral Fiber Board 300 by USG, Chicago, IL, www.micore.com

Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, size and gage to comply with ASTM C 754 at spacing indicated; maximum deflection L/240 at 5 psf.

FINISH LEVELS Finish gypsum board as follows:

Level 3: Per Owner's (LUHSD) direction, level 3 finish is acceptable for all walls and ceilings to receive paint finish in Transportation and M&O facility.

Level 2: Behind cabinetry and on backing board to receive tile finish.

Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

SECTION 09 3000 - TILING

Ceramic tile for wall application.

Cementitious backer board.

Ceramic trim

Tile Accessories.

Work conforming to ANSI A108 Series/A118 Series/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) and TCA (HB) - Handbook for Ceramic Tile Installation; Tile Council of America, Inc.

MANUFACTURER

All products by the same manufacturer unless specifically noted otherwise.

Dal-Tile Corp. www.daltile.com

American Olean Tile Co. www.daltile.com

PRODUCT DATA

Color Selections shall be based on manufacturer's premium colors for accents, standard colors for field tiles. Dal-Tile products are specified as standard of quality. Patterns and accents will be detailed.

Glazed Wall Tile: Dal-Tile "Semi-gloss" Wall tile: 4'"x 4" and 2" x 2" accent bands glazed porcelain wall tile set per TCA Handbook Method W244, with non-sanded grout. Field colors to be selected from manufacturer's standard range Price Group 2, and two accent colors selected from premium Price Group.

Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile

Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

SECTION 09 5100 – SUSPENDED ACOUSTICAL CEILINGS

Suspended metal grid ceiling system, seismically restrained, with acoustical units.

Acoustic ceilings shall have a minimum acoustical rating in the range of NRC = 0.65 to 0.75. Class A Fire Hazard Classification.

Install suspension system in accordance with ASTM C 636 and manufacturer's instructions , California Building Code, DSA IRs and as supplemented in this section.

MANUFACTURER

Suspension System: Heavy Duty. Manufacturer provided seismic and wall clips.

Donn " DX 26 Heavy Duty" ICC-ESR-1222

Armstrong "Prelude XL" ICC ESR 1308

Chicago Metallic "Seismic 1200" ICC-ESR 1222

Acoustical units

Armstrong World Industries, Inc. www.armstrong.com/commceilingsna

USG Interiors, Inc.vwww.usg.com

Approved equal.

PRODUCT DATA

Acoustical Panels Type :1: Painted mineral fiber, fine textured non-directional washable panels. 2x4 lay in panels standard, other sizes as indicated. Armstrong "Cortega 769" or approved equal.

SECTION 09 6500 – RESILIENT FLOORING

Resilient sheet flooring, Resilient base

PRODUCT DATA

All flooring materials shall be compliant with Green Guard, Floor Score, or equivalent LEED low-emittance requirements.

Linoleum Sheet Flooring or Tile: Homogeneous wear layer bonded to backing, with color and pattern through out.

Armstrong World Industries, Inc; Product [Marmorette]: www.armstrong.com

Forbo Linoleum, Inc; Product [Global 3 Linoleum, all product lines]: www.forbo-industries.com

Linoleum Welding Rod at sheet installations: Solid color linoleum produced by flooring manufacturer for heat welding seams, in color in color matching predominant flooring color

Base: Rubber; topset, coved.

Burke Flooring Products, Inc. www.burkeflooring.com

Johnsonite, Inc. www.johnsonite.com

Roppe Corp. www.roppe.com

SECTION 09 6700 – FLUID APPLIED FLOORING

Fluid-Applied Flooring and base: Epoxy based decorative colored quartz broadcast flooring system. Medium Duty. Divider strips and accessories.

MANUFACTURER

BASF Construction Chemicals – building Systems www.buildsystems.basf.com

Crossfield Products Corp, www.crossfieldproducts.com

Tera-Lite, Inc; www.tera-lite.com

Stonhard; www.stonhard.com

PRODUCT DATA

VOC limits for adhesive sealants, fillers, coatings and primers. Comply with limits in Section 01 6116.

Color selected from full range of available colors Minimum of 7 colors in product line.

Fluid Applied Toweled Flooring System, Light Duty, Epoxy, polymer composite, three component, nominal 1/8 inch thickness.

BASF; Selbatwede 41 www.buildingsystems.basf.com.

Crossfield; Décor-Flor www.dex-o-tex.com/products/details/CheminertCFSFlooring

Tera-Lite; Tera-Gem III Special Seamless Flooring Troweled www.tera-lite.com

Stonehard; Stoneshield SLT www.stonhard.com

Topical Vapor Control Coating: Cementitious polymer-modified compatible with fluid-applied flooring.

Accessories: Cant Strips, Base Caps primer, patching and fill material.

SECTION 09 6800 - CARPETING

Carpet, direct-glued. Accessories

MANUFACTURER

Tandus; Product www.tandus.com

Mohawk, Product "Lees Faculty IV", www.themowhaekgroup.com

PRODUCT DATA

Direct glued twenty-year warranty, minimum.

Patterned level loop, 28 oz., solution dyed Antron nylon, with primary backing. All substrates shall be prepared and primed prior to installation as required by carpet manufacturer.

Product shall conform to Flooring Radiant Panel. ASTM E-648 or NFPA 253.

Product shall meet requirements of CBC Title 24 Chapter 11B requirements.

SECTION 09 7200 – WALL COVERING

Wall covering for tackable and non-tackable surfaces.

MANUFACTURER

Roos International; Product Envision: www.roosintl.com

Koroseal; Product Optione. www.koroseal.com

Lentex, Product Surface iQ. www.lentexcorp.com

PRODUCT DATA

Monolithic wall covering shall not contain chlorine or other halogen compounds or plasticizers including phthalates. Greenguard certification required.

Install wall covering over tackable substrates specified in Section 09 2116.

SECTION 09 7723 – WALL PANELS

Fiberglass reinforced composite panels.

MANUFACTURER

Fiberglass reinforced composite panels:

Crane Composites; www.cranecomposites.com

Marlite; www.marlitefrp.com

PRODUCT DATA

Fiberglass reinforced composite panels: Embossed pebbled textured finish from manufacturer's full range of colors. Surface burning classification Class A.

SECTION 09 9113 – EXTERIOR PAINTING

Surface preparation.

Field application of paints, stains, varnishes, and other coatings at all exposed and semi-exposed surfaces at exterior and interior surfaces, unless fully factory-finished. Materials for back priming wood work.

MANUFACTURER

Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

Dunne Edwards Paints Basis of Design
http://www.dunnedwards.com/ArchitectsDesigners/ArchitectsDesigners.aspx

Benjamin Moore & Co. http://www.benjaminmoore.com/en-us/for-architects-and-designers

PRODUCT DATA

Provide products conforming with local, State and Federal government requirements limiting the amount of volatile organic compounds contained in the product, for its intended application.

Colors: To be selected from manufacturer's full range of available colors. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.

Exterior Systems

Wood – Painted: 3 coat Acrylic Latex. Gloss or Semi-Gloss.

Acrylic Modified Cement Plaster: Refer to 09

Steel - Shop Primed: 3 coat Exterior Alkyd Semi-Gloss Enamel.

Steel – Galvanized: 3 coat Exterior Alkyd Semi-Gloss Enamel.

Steel Handrails Guardrails and Fences: 3 coat Exterior Alkyd Semi-Gloss Industrial Enamel.

Fiber Cement Siding or Paneling: 3 coat Acrylic Latex. Gloss, Semi-Gloss or Flat.

SECTION 09 9123 – INTERIOR PAINTING

Surface preparation.

Field application of paints, stains, varnishes, and other coatings at all exposed and semi-exposed surfaces at interior surfaces, unless fully factory-finished. Materials for back priming wood work.

MANUFACTURER

Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

Dunne Edwards Paints Basis of Design
http://www.dunnedwards.com/ArchitectsDesigners/ArchitectsDesigners.aspx

Benjamin Moore & Co. http://www.benjaminmoore.com/en-us/for-architects-and-designers

PRODUCT DATA

Volatile Organic Compound (VOC) Content: Indoor Air Quality Certification: Interior Paints and Coatings must meet one of the following, or approved equivalent certifications.

Interior Systems: Finish sheen to be coordinated with Section 09 2116 finish levels.

Wood – Painted: 3 coat Interior Acrylic Semi-Gloss Enamel.

Wood, transparent: 3 coat Sealer and Varnish, semi-gloss.

Concrete/Masonry: 3 coat Interior Latex enamel.

Steel – Primed: 3 coat Interior Alkyd Semi-Gloss Enamel, (latex enamel above 8 feet).

Steel – Galvanized: 3 coat Interior Alkyd Semi-Gloss Enamel, (latex enamel above 8 feet).

Gypsum Board: 3 coat Interior Acrylic Enamel, Eggshell finish typical, Semi-Gloss at food Service, toilet rooms, custodial, and other similar locations.

Gypsum Veneer Plaster: 3 coat Acrylic Epoxy Enamel, Semi-Gloss.

Acoustic tile, existing suspended and glue-applied, Non-Bridging Latex.

DIVISION 10 - SPECIALTIES

SECTION 10 1101 – VISUAL DISPLAY BOARDS

Markerboards will be furnished and installed by Owner (LUHSD).

SECTION 10 1400 –SIGNAGE

Plaque signs with raised tactile letters and braille to be furnished and installed by Owner (LUHSD)

Luminescent exit signs.

MANUFACTURER

Luminescent exit signs:

Active Safety, activesafety.com

Evenlite, www.evenlite.com

Everglow, www.everglow.us

PRODUCT DATA

Plaque Signs: One piece magnesium metal construction with raised copy and braille and thermal-set, polyurethane finish. Tactile legends and Braille shall comply with Americans with Disabilities Act (ADA), Califiornia Building Code (CBC) and requirements indicated for quantities, sizes, layouts, materials, finishes, color, etc.

Luminescent exit signs: Base Material: Brushed Aluminum, Vandal Resistant, Active Safety Model 16.

SECTION 10 2113 – REINFORCED COMPOSITE TOILET PARTITIONS

Reinforced Composite toilet compartments. Urinal and Vestibule screens.

MANUFACTURER

Reinforced Composite Toilet Compartments: "Sierra™ Series 1092.67 " as manufactured by Bobrick Washroom Equipment, Inc., www.bobrick.com , as represented by R. E. Edwards, 925-829-2942.

PRODUCT DATA

Toilet Compartments: Solid reinforced composite panels, doors, and pilasters, floor-mounted headrail-braced.

Urinal Screens: Urinal screens are to be floor-anchored with 6" stile mounted to panel. Stile to be ¾"thick material, with urinal panel made of ½" thick material attached to wall with two mounting brackets.

Accessories: Polished stainless steel, vandal resistant continuous piano hinge, self closing with vandal resistant latch and two door stops per door.

SECTION 10 2800 –TOILET ACCESSORIES

Accessories for toilet rooms will be furnished and installed by Owner (LUHSD).

SECTION 10 4400 – FIRE PROTECTION SPECIALTIES

Hand-portable Fire Extinguishers and Cabinets.

MANUFACTURER

Larsen's Manufacturing Company, www.larsensmfg.com.

J.L. Industries, www.jlindustries.com

Potter-Roemer Inc. www.potterroemer.com

PRODUCT DATA

Fire Extinguishers: Multi-purpose dry-chemical ammonium phosphate, UL rated as scheduled.

Location: Kitchens and food preparation areas, Type K.

Location: Classrooms and Administrative areas: Type 2A-10-BC.

Fire Extinguisher Cabinet: Metal: Cabinet Configuration: Semi-recessed type. Larsen "Cameo" or equal. UL rated cabinet at rated walls.

Fire Extinguisher Bracket: Wall mounting bracket: Type specified in manufacturer's product literature for indicated tank size, with wall anchoring devices for indicated wall type. Verify with Owner appropriate locations.

Conform to requirements of 29 CFR 1910.157, NFPA 10, and UL 711. Attach manufacturer's standard metal foil label to cylinder, with printing and graphics indicating information and instructions required by local authorities having jurisdiction. Include current certification tag.

SECTION 10 5100 - LOCKERS

Locker units will be furnished and installed by Owner (LUHSD).

DIVISION 11 - EQUIPMENT

SECTION 11 3100 – RESIDENTIAL APPLIANCES

Refrigerators, microwave and vending machine will be furnished and installed by Owner (LUHSD).

SECTION 11 5200 – AUDIO VISUAL EQUIPMENT

Ceiling mounted projectors and electrically operated projection screens will be furnished by Owner (LUHSD).

SECTION 11 9000 – FUEL TANKS

Diesel Fuel Tank.

MANUFACTURER

Modern Welding Company or approved equal.

PRODUCT DATA

Modern's AST 20, Double Wall Construction, Fireguard 2-hours Fire Rated Configuration or approved equal. Capacity: 10,000 gallons.

Gasoline Fuel Tank.

MANUFACTURER

Modern Welding Company or approved equal.

PRODUCT DATA

Modern's AST 20, Double Wall Construction, Fireguard 2-hours Fire Rated Configuration or approved equal. Capacity: 5,000 gallons.

DIVISION 12 - FURNISHINGS

SECTION 12 2113 – WINDOW COVERINGS

Window shades and treatment will be furnished and installed by Owner (LUHSD).

SECTION 12 3600 – COUNTERTOPS

Countertops for architectural cabinetwork.

MANUFACTURER

Plastic Laminate Countertops: Single source manufacturer match to casework manufacturer.

PRODUCT DATA

Plastic Laminate Countertops: Single source manufacturer match to casework manufacturer.

DIVISION 13 – SPECIAL CONSTRUCTION

SECTION 13 3419 –METAL BUILDING SYSTEM

MANUFACTURER

Butler Manufacturing Company, www.butlermfrg.com

Garco Building Systems, www.garcobuildings.com

Nucor Building Systems, www.nucorbuildingsystem.com

METAL BUILDING

Single span rigid frame design, with bay spacing as indicated on plans.

Primary Framing: Rigid Moment Frames of beams and columns, end wall frames, columns, and lateral bracing.

Secondary Framing: Purlins and Girts, and other items as required for complete framing system.

Wall System: Preformed metal panels of vertically oriented deep corrugations (Butler Shadow Wall System or approved equal) with girt framing/anchorage assembly, blanket insulation, and accessory components. Panel size:

Roof System: Preformed standing-seam metal panels oriented parallel to slope (Butler MR-24 Roof System or approved equal), with girt framing/anchorage assembly, blanket insulation, and accessory components.

Daylighting Component: Prefabricated skylight system (Butler Sunlite Stripe Daylighting System or approved equal. Installed per manufacturer standards.

DIVISION 14 – CONVEYING DEVICES

None.

DIVISION 21 - FIRE PROTECTION

SECTION 21 1301 – HANGERS AND BRACING

Pipe hangers, supports and seismic bracing too fire sprinklers installations, UL listed.

MANUFACTURER

Tolco/Cooper Bline

PRODUCT DATA

Figure 200 Band Hanger

Figure 4A Pipe clamp to sway bracing

Figure 909 No-Thread swivel sway brace attachment

Figure 1001 Sway brace attachment

Figure 51 Side beam angle bracket

Figure 58 Threaded side beam bracket

Figure 100 All thread rod.

SECTION 21 1302 – IN- BUILDING RISER

Stainless steel underground transition fitting to bring water supple inside the building.

MANUFACTURER

Ames

PRODUCT DATA

Ames 6" In – Building Riser

SECTION 21 1303 – SPRINKLERS

Standard spray upright and semi-recessed pendent quick response, K 5.6 sprinkler heads

MANUFACTURER

Tyco

PRODUCT DATA

Tyco Series TY-FRB

SECTION 21 1304 – PIPE

UL listed pipe for fire sprinkler installations.

MANUFACTURER

Allied Tube and Conduit

PRODUCT DATA

Schedule 10/Schedule 40 M-Coat

SECTION 21 1305 – FITTINGS

UL listed fittings for fire sprinkler installations

MANUFACTURER

Anvile, Grinell, Metraflex

PRODUCT DATA

Anvil cast iron class 125 threaded fittings and Grinnell G-Fire Ductile iron grooved fittings and couplings. Metraflex fireloop seismic loop joint MLUG80XX shall accomodate a minimum of +/- 4" movement.

SECTION 21 1306 – VALVES

UL listed valves for fire sprinkler installations.

MANUFACTURER

AGF, TYCO

PRODUCT DATA

AGF Model 1011A 2" riser test and drain with pressure relief valve.

AGF Model 7200 remote test and drain.

TYCO BFV-N butterfly valve.

TYCO – Model CV-1F riser check valve.

SECTION 21 1307 – HANGERS AND BRACING

UL listed hangers for fire sprinkler installations

MANUFACTURER

Tolco/Copper B-Line

PRODUCT DATA

Tolco fig 4A Sway brace attachment

Tolco fig 200 Band hangers

Tolco fig 909 No thread sway brace attachment

Tolco fig 1001 Sway brace attachment

Tolco fig 100 Threaded rod

Tolco fig 51 Side beam clip

Tolco fig 58 Threaded side beam bracket

SECTION 21 1308 – ACCESSORIES

Recessed sprinker escucheons

MANUFACTURER

Tyco, Viking

PRODUCT DATA

Tyco Style 10-50 semi recessed escutcheons

Tyco wide adapter plates signal white finish

Tyco 6 spare head sprinkler cabinet TFP785

SECTION 21 1309 – ALARM RELATED COMPONENTS

Flow switch and alarm bell CSFM listed

MANUFACTURER

Potter

PRODUCT DATA

Potter VSR Flow switch

Potter PBA 120.10 Alarm Bell

DIVISION 22 – PLUMBING

SECTION 22 0000 – PLUMBING

SEE APPENDIX B – COSTA MECHANICAL ENGINEER SPECIFICATIONS

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

SECTION 23 0000 – HEATING, VENTILATION, AIR CONDITIONING

SEE APPENDIX B – COSTA MECHANICAL ENGINEER SPECIFICATIONS

SECTION 23 0500 – GENERAL MECHANICAL

SEE APPENDIX B – COSTA MECHANICAL ENGINEER SPECIFICATIONS

SECTION 23 0593 – TESTING, ADJUSTING AND BALANCING

SEE APPENDIX B – COSTA MECHANICAL ENGINEER SPECIFICATIONS

SECTION 23 0923 – ENERGY MANAGEMENT SYSTEM FOR HVAC (EMS)

SEE APPENDIX B – COSTA MECHANICAL ENGINEER SPECIFICATIONS

DIVISION 26- ELECTRICAL

SECTION 26 0500 - BASIC ELECTRICAL REQUIREMENTS

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

SECTION 26 0800 - TESTING

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

SECTION 26 2400– SERVICE AND DISTRIBUTION EQUIPMENT

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

SECTION 26 2700 – BASIC ELECTRICAL MATERIALS AND METHODS

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

SECTION 26 5100 – LIGHTING

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

SECTION 26 5700 – LIGHTING CONTROL SYSTEM

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

DIVISION 26 – PRODUCT CUT SHEETS AND ADDITIONAL INFORMATION

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

DIVISION 27 - COMMUNICATIONS

SECTION 27 000 – TELE-COMMUNICATIONS SYSTEM

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 28 3101 – FIRE ALARM SYSTEM

SEE APPENDIX C – OM&M ELECTRICAL ENGINEER SPECIFICATIONS

DIVISION 31 - EARTHWORK

SECTION 31 1000 – SITE CLEARING

Remove all objectionable material from within the construction areas. Grind and stockpile asphalt pavements and base from phase 2B for reuse.

Properly dispose of all objectionable material.

Strip all areas containing organic material, and stockpile onsite for use in planting areas.

Install and maintain erosion control devices.

Carry out the work in phases.

PRODUCT DATA

Cleared Material: The objectionable cleared material shall be removed from the project site and disposed of properly.

Stripped Material: All stripped material shall be removed from the project site and disposed of properly.

SECTION 31 2000 - EARTHWORK

SECTION 31 2316 – TRENCHING, BACKFILLING AND COMPACTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 32 0117 – PAVEMENT REPAIR

Repair of existing asphalt concrete pavement.

Aggregate base course, Class 2 conforming to Caltrans Standards Specifications.

Asphalt concrete paving conforming to Section 39 of the Caltrans Standards Specifications.

Slurry seal conforming to Caltrans Standards Specifications.

SECTION 32 1100 – SUBGRADE PREPARATION

SECTION 32 1216- ASPHALTIC CONRETE PAVING AND BASE

SECTION 32 1313 –CONCRETE PAVING

SECTION 32 1613 - CONCRETE CURBS, GUTTERS, SIDEWALKS, PAVING

SECTION 32 1223 - PAVEMENT MARKING AND SIGNS

SECTION 32 1726– CAST IN PLACE DETECTABLE/TACTILE WARNING SURFACES

Install Cast in Place Detectable/Tactile Warning Surface Tiles where indicated. Not recommended for asphalt applications.

MANUFACTURER

Armor-tile manufactured by Engineered Plastics Inc. (800-682-2525), www.armor-tile.com

Advantage Tactile Systems (800-679-4022), www.advantagetactile.com

ADA Solutions, Inc. (800-372-0519), www.adatile.com

PRODUCT DATA

Americans with Disabilities Act (ADA): Provide Surface Applied Detectable/Tactile Warning Surface Tiles which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA STANDARDS FOR ACCESSIBLE DESIGN, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES).

California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR) Title 24, Part 2, Section 205 definition of "Detectable Warning". Section 1117A.4 and 1127B.5 for "Curb Ramps" and Section 1133B.8.5 for "Detectable Warnings at Hazardous Vehicular Areas".

SECTION 32 3113 – CHAIN LINK FENCES AND GATES

Fence framework, fabric and accessories.

Corner posts, gate posts and line posts.

Hardware and accessories.

Fence fabric and placement.

MANUFACTURER

Master-Halco, Inc. www.fenceonline.com

Builders Fence Company, www.buildersfence.com

PRODUCT DATA

Conform to CLFMI Product Manual, Commercial/Industrial service.

1 inch mesh (no climb)

2 inch mesh (standard)

Galvanized steel mesh and posts

SECTION 32 8000-IRRIGATION SYSTEM

Installation of automatic irrigation system, which will operate in an optimum manner to conserve and manage water use.

Master Control System, Controller Enclosure, Controller Cabinet, Handheld Remote.

MANUFACTURER

Controller

Rainmaster, Product "DX2 Evolution", www.rainmaster.com

Irrigation Heads selection Standard Product List

Hunter, www.hunterindustries.com

Rain Bird, www.rainbird.com

PRODUCT DATA

Materials

PVC-pressurized pipe and QCV's.

PVC non-pressurized pipe

Sleeving and conduit

In-line drip system connections and assembly.

Control valves and sprinkler heads.

Controller and power.

Trenching and backfill.

Testing of system.

Maintenance of system.

SECTION 32 9000 – LANDSCAPE PLANTING

Planting of trees, shrubs, groundcover and sodded turf and seed.

Soil testing and imported topsoil placement and amendments.

Fertilizer and amendments.

Protection of existing plants to remain.

Mulch for planting area.

Root barriers.

Turf Sod.

Tree staking and pruning.

365 day Maintenance.

Guarantee and replacement.

DIVISION 33 - UTILITIES

SECTION 33 1100 – WATER UTILITY DISTRIBUTION PIPING AND APPRUTENANCES

Provide and install potable and fire suppression water system pressure pipe, fittings, and appurtenances.

Connect new water system to existing distribution lines.

PRODUCT DATA

Water Service Pipe and Fittings: All water service tubing 3-inch diameter and smaller shall be PVC Sch. 80, with fittings compatible with the pipe.

All water main and fire pipe 4-inch diameter and larger shall be PVC C900, Cl 200.

Water System Appurtenances: Water system appurtenances shall be in accordance with applicable City of Brentwood standards.

All service line valves shall be bronze body ball valves centered in a valve box.

All main line and fire line valves shall be resilient wedge gate vales with non-rising stems.

Include provisions for treated water systems for secondary non-potable uses.

SECTION 33 3100– SANITARY SEWAGE PIPES AND APPURTENANCES

Locate and verify invert elevations of all pipes to be extended.

Gravity sewer pipe materials and installation

Service lateral cleanouts and manholes.

PRODUCT DATA

Gravity Sewer Pipe and Service Laterals: Sewer pipe shall be either ABS Gravity Sewer Pipe, SDR 35; PVC sewer pipe, SDR 35; or ductile iron pipe.

Manholes: Manholes shall be 48-inch diameter precast concrete barrel and cone sections with precast or cast in place bases, and 24-inch diameter cast iron ring and cover.

Cleanouts: Service lateral cleanouts shall be vertical risers off wye fittings, recessed in a service casting flush with finished surfaces.

SECTION 33 4100– STORM DRAINAGE SYSTEM

Provide and install storm and roof drain pipe and appurtenances.

Provide and install storm and roof drainage system structures.

Provide and install storm water infiltration units.

PRODUCT DATA

Storm Drain Pipe: Polyvinyl Chloride Pipe (PVC), SDR 35, Series 46, or HDPE Type S, smooth interior wall.

HDPE plastic pipe shall conform to the requirements of Section 64 of the Caltrans Standard Specifications for Type S, smooth interior wall, and shall be furnished with "silt tight" gasketed couplings.

PVC drainage pipe shall be SDR 35, with water tight couplings.

Drainage Structures: Drop inlets (DI) shall be precast or cast in place units, and shall be the sizes indicated on the plans. Grates shall be heavy duty galvanized steel with ½" maximum openings in hard surfaced areas and shall be standard duty with standard openings in all landscaped areas. Grates shall be provided with bolt down feature.

Drainage Infiltration Units: Drainage infiltration units shall be modular high density polyethylene units with 2-foot by 2-foot by 2-foot modules, installed on a bed of filter fabric and granular material, in accordance with the manufacturer's recommendations.

APPENDICES

SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: All labor, materials and equipment and all operations required to complete all formwork as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:

1. Forms, shores, bracing, removal and other operations as necessary for all cast-in-place concrete and masonry placed.
2. Setting and securing anchor bolts and other metal items embedded in concrete into formwork, using materials and layouts furnished and delivered to jobsite as specified under other sections.

B. Related Sections:

1. Pertinent Sections of Division 03 specifying concrete construction.
2. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete foundations and formwork.

1.02 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19A Concrete.

B. American Concrete Institute (ACI) 347 "Recommended Practice for Concrete Formwork".

C. American Plywood Association (APA) “Concrete Forming Guide”.

D. West Coast Lumberman Inspection Bureau (WCLIB) “Standard Grading Rules for West Coast Lumber”.

E. ACI SP-066 “ACI Detailing Manual”.

F. ACI 301 “Specifications for Structural Concrete”.

G. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

1.03 DESIGN REQUIREMENTS

A. Design, engineer, and construct formwork, shoring and bracing to conform to design and code requirements, resist imposed loads; resultant concrete to conform to required shape, line and dimension.

1.04 SUBMITTALS

A. Limitation of review: Structural Engineer's review will be required only where specifically requested for general architectural applications and features only. Contractor is responsible for structural stability, load-resisting characteristics and sufficiency of form work design.

1.05 QUALITY ASSURANCE

A. General: All form materials shall be new at start of work. Produce high quality concrete construction. Minimize defects due to joints, deflection of forms, roughness of forms, nonconforming materials, concrete or workmanship.

B. Reuse of Forms: Plywood forms may be reused, if thoroughly cleaned of all dirt, mortar, and foreign materials, and undamaged at edges and contact face. Reuse shall be subject to permission from the Architect without exception, and issued in writing. Reuse of any panel which will produce a blemish on exposed concrete, will not be permitted.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Form Materials:

1. Non-Exposed Surface Formwork Facing: Forms for concrete which is not exposed to view, may be of plywood as specified for exposed surfaces, or square edge 1x nominal Douglas Fir, Construction Grade, S4S.
2. Exposed Surface Formwork Facing:
   a. Forms for all exterior and interior concrete flat surfaces unless otherwise specified as board formed shall be new Douglas Fir Plywood (APA) ply, 5/8-inch, B-B Plyform, Class 1, Exterior Type, oiled and edged and edge-sealed conforming to U.S. Product Standard PS 1 in large sheet sizes to achieve joint patterns shown.
   b. All exposed concrete edges shall be chamfered 3/4" minimum or as noted on the drawings.
3. Exposed Surface Formwork - Special Pattern Form Liner:
   a. Forms for all exterior and interior concrete flat surfaces indicated shall be as designated by Architect.

B. Earth Forms: Allowed, subject to soil standing in excavations without ravel or caving.

C. Form Release Agent: Spray-on compound, not affecting color, bond or subsequent treatment of concrete surfaces. Maximum VOC content shall comply with local requirements and California Green Building Code.

D. Accessories: Types recommended by manufacturers or referenced standards to suit conditions indicated;

1. Anchors, spacers, void in-fill materials: sized to resist imposed loads.
2. Form Ties: Prefabricated rod, flat band, or wire snap ties with 1" break-back or threaded internal disconnecting type with external holding devices of adequate bearing area. Ties shall permit tightening and spreading of forms and leave no metal closer than 1" to surface.

E. Corner Chamfers and Rustications: Filleted, wood strip or foam type; sizes and shapes as detailed, or 3/4 x 3/4 inch size minimum if not detailed; maximum possible lengths.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Inspect the substrate and the conditions under which concrete formwork is to be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates and conditions.

B. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. If natural soil or compacted fill can be accurately cut and maintained, foundations and grade beams may be poured against earth without forming. Provide positive protection of trench top corners.

B. Maintain earth forms free of water and foreign materials.

3.03 ERECTION – FORMWORK

A. General: Construct formwork in accordance with calculations, and recommendations of Section 401 of ACI 347. Construct forms to the sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in finished structure. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

1. Construct cambers specified in concrete members and slabs in the formwork.
2. Schedule the work and notify other trades in ample time so that provisions for their work in the formwork can be made without delaying progress of the project. Install all sleeves, pipes, etc. for building services systems, or other work. Secure information about and provide for all openings, offsets, recessed nailing blocks, channel chases, anchors, ties, inserts, etc. in the formwork before concrete placement.
3. Deflection: Formwork and concrete with excessive deflection after concrete placement will be rejected. Excessive deflection is that which will produce visible and noticeable waves in the finished concrete.
4. Measure formwork for elevated structural slabs, columns, wall elevations points of maximum camber and submit in writing to the Architect/Engineer prior to placing concrete.

B. Formwork Construction: Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301. Uniform, substantial and sufficiently tight to prevent leakage of concrete paste, readily removable without impact, shock or damage to cast-

in-place concrete surfaces and adjacent materials. Tie, brace, shore, and support to insure stability against pressures from any source, without failure of any component part and without excessive deflection. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

C. Provide all openings, offsets, inserts, anchorages, blocking, and other features of the work as shown or required. See INSERTS, EMBEDDED PARTS, AND OPENINGS for detailed requirements.

D. Warped, checked, or scuffed forms will be rejected.

E. Maintain membranes, reinforcing and other work free of damage; protect with plywood runway boards or other positive, durable means.

F. Align joints and make watertight. Keep form joints to a minimum.

G. Provide fillet and chamfer strips on external corners of exposed locations and as indicated to form patterns in finished work. Extend patterns around corners and into alcoves, on backs of columns and similar locations not otherwise shown.

1. Produce beveled, smooth, solid, unbroken lines, except as otherwise indicated to conform to patterns.
2. Form corners and chamfers with 3/4 inch x 3/4 inch strips, unless otherwise indicated, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer at changes in direction.

H. Unexposed corners may be formed either square or chamfered.

I. Ties and Spreaders: Arrange in a pattern acceptable to the Architect when exposed. Snap-ties may be used except at joints between pours where threaded internal disconnecting type shall be used.

J. Coordinate this section with other sections of work that require attachment of components to formwork.

K. Reglets and Rebates: Accurately locate, size, and form all reglets and rebates required to receive work of other trades, including flashing, frames, and equipment.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not allow excess form coating material to accumulate in the forms or to come into contact with reinforcement or surfaces which will be bonded to fresh concrete.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork will be rejected.

E. Leave no residue or stain on the face of the concrete, nor affect bonding of subsequent finishes or work specified in other sections.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

1. Provide openings in concrete formwork to accommodate work of other sections including those under separate contracts (if any). Size and location of openings, recesses and chases shall be in accordance with the section requiring such items. Accurately place and securely support items to be built into forms.

B. Construction Joints: Construct and locate generally as indicated on Drawings and only at locations approved by Structural Engineer, so as not to impair the strength of the structure. Form keys in all cold joints shown or required.

C. Locate and set in place items that will be cast directly into concrete.

D. Rough Hardware and Miscellaneous Metal: Set inserts, sleeves, bolts, anchors, angles, and other items to be embedded in concrete. Set embedded bolts and sleeves for equipment to template and approved shop drawings prepared by trades supplying equipment.

E. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

F. Wood Inserts and Nailers: Provide approved preservative-treated lumber. Set all required nailing blocks, grounds, and other inserts as required to produce results shown. Wood plugs shall not be used.

G. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

H. Piping: Do not embed piping in structural concrete unless locations specifically approved by Structural Engineer.

I. Conduit: Place conduit below slabs-on-grade and only as specifically detailed on structural drawings. Minimum clear distance between conduits shall be 3 diameters. Location shall be subject to Engineer's written approval and shall not impair the strength of the structure.

J. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

1. Provide openings for the introduction of vibrators at intervals necessary for proper placement.
2. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

K. Install Form Liner inserts in accordance with manufacturer's recommendations, to produce patterns and textures indicated.

L. Install waterstops in accordance with manufacturer's recommendations to provide continuous waterproof barrier.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Remove all dirt, chips, sawdust, rubbish, water and foreign materials detrimental to concrete.
2. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.07 FOOTINGS

A. Verify elevations and provide final excavation required for footings prior to placing of concrete.

3.08 EQUIPMENT BASES

A. Form concrete bases for all mechanical and electrical equipment in accordance with approved shop details furnished by other sections.

B. Sizes and locations as indicated and as required to produce results shown.

C. Provide coved base for all equipment bases placed on concrete slabs.

3.09 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.10 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

C. Clean and repair surfaces to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

D. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.11 FORM REMOVAL

A. Do not loosen or remove forms before minimum curing period has elapsed without employment of appropriate alternate curing methods, approved by the Architect in writing.

B. Remove forms without damage to the concrete using means to insure complete safety of the structure and without damage to exposed beams, columns, wall edges, chamfers and inserts. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Do not remove forms until the concrete has hardened sufficiently to permit safe removal and the concrete has attained sufficient strength to safely support imposed loads. The minimum elapsed time for removal of forms after concrete has been placed shall be as follows:

1. Columns and Walls: 7 days, provided members are not subjected to overhead loads.
2. Retaining Walls: 21 days minimum.
3. Footings: 7 days minimum. If backfilled immediately, side forms may be removed 24 hours after concrete is placed.
4. Beams, elevated slab, and similar overhead conditions: 28 days unless adequate shoring is provided.

D. Durations listed above are minimums and are subject to extension at the sole judgment of the Architect/Engineer.

E. Reshoring: Reshore members where and if required by Formwork Design Engineer.

F. Do not subject concrete to superimposed loads (structure or construction) until it has attained full specified design strength, nor for a period of at least 14 days after placing.

G. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.12 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 2000

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Reinforcing steel work for all concrete and masonry work as indicated on the drawings and specified herein.
2. Coordinate this work with other work affected by these operations, such as forms, electrical work, mechanical work, structural steel, masonry and concrete.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
2. Pertinent Sections of Divisions 03 specifying concrete construction.
3. Pertinent Sections of Divisions 04 specifying masonry construction.
4. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete work.

1.02 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19A Concrete.

B. American Concrete Institute (ACI) 301 "Specifications for Structural Concrete for Buildings".

C. ACI 318 "Building Code Requirements for Reinforced Concrete and Commentary".

D. ACI SP-066 "ACI Detailing Manual".

E. American Society for Testing and Materials (ASTM) A185 "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete".

F. ASTM A615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement".

G. ASTM A706 "Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement".

H. American Welding Society (AWS) D1.4 – "Structural Welding Code for Reinforcing Steel".

I. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".

1.03 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.

C. Shop Drawings: Show complete fabrication and placing details of all reinforcing steel. Comply with requirements of ACI SP-66. Include:

1. Bar sizes and schedules;
2. Shapes of bent bars, layout and spacing of bars, location of splices.
3. Stirrup spacing, arrangements and assemblies,
4. References to Contract Document detail numbers and designations.
5. Wall elevations corresponding to elevations shown in Contract Documents.

D. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

E. Certificates: Submit all certifications of physical and chemical properties of steel for each heat number as manufactured, including location of material in structure as specified below in Article titled QUALITY ASSURANCE. All materials supplied shall be tagged with heat numbers matching submitted Mill Test Report analyses.

F. Samples: Provide to the Owner's Testing laboratory as specified in Article SOURCE QUALITY CONTROL.

1.04 QUALITY ASSURANCE

A. Perform work of this Section in accordance with CRSI DA4, CRSI P1, ACI 301, and ACI 318.

B. Requirements of Regulatory Agencies, refer to pertinent Sections of Division 01 and CBC.

C. Certification and Identification of Materials and Uses: Provide Owner's Testing Agency with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.

1. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
2. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each grade of reinforcing and/or heat number in the project (i.e. foundations, walls, etc.).
3. Unidentified Material Tests: Where identification of materials by heat number to mill tests cannot be made, Owner's Testing Agency shall test unidentified materials as described below.

D. Testing and Inspection: Tests and Inspections required by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent Sections of Division 01.

1.05 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent requirements of Division 01.

B. Deliver reinforcement to project site in bundles marked with durable tags indicating heat number, mill, bar size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

C. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel: Deformed billet steel bars, ASTM A706 Grade 60 or ASTM A615 Grade 60.

1. Exception: Bars #3 and smaller shall be Grade 40 minimum, unless otherwise noted on the drawings.
2. Welded reinforcement shall be ASTM A706, or A615 meeting carbon requirements of AWS D1.4. Welding shall conform with AWS D1.4.
3. All reinforcement to be unfinished.
4. ASTM A615 reinforcement at special structural concrete walls, concrete coupling beams, and special concrete moment frames shall have maximum yield stress of 78,000 psi and the tensile strength shall be greater than 125% of the actual yield strength. Test ASTM A615 reinforcement for conformance to these criteria prior to fabrication and/or installation.

B. Welded Wire Reinforcement: ASTM A185.

C. Tie Wire: No. 16 AWG or heavier, black annealed.

D. Concrete Blocks: Slab-on-grade conditions only, as required to support reinforcing bars in position.

E. Reinforcing Supports: Plastic or galvanized steel chairs, bolsters, bar supports, or spacers sized and shaped for adequate support of reinforcement and construction loads imposed during concrete placement, meeting ACI and CRSI standards.

1. For use over formwork: Galvanized wire bar type supports complying with CRSI recommendations. Provide plastic tips where exposed to view or weather after removal of formwork. Do not use wood, brick, or other unacceptable materials.
2. For slabs on grade: Supports with sand plates or horizontal runners where base material will not support chair legs.

F. Reinforcement Splice Couplers: For use only where specified on drawings. Submit other locations proposed for use to Engineer for review. "L-Series Bar Lock" Coupler Systems for Splicing Reinforcement Bars, ESR-2495, by Dayton-Superior Corporation.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4), unless specifically shown otherwise. Details not specifically shown or indicated shall conform to SP-066 and specified codes and standards.

1. Accurately shop-fabricate to shapes, bends, sizes, gauges and lengths indicated or otherwise required.
2. Bend bars once only. Discard bars improperly bent due to fabricating or other errors and provide new material; do not re-bend or straighten unless specifically indicated. Rebending of reinforcement in the field is not allowed.
3. Do not bend reinforcement in a manner that will injure or weaken the material or the embedding concrete.
4. Do not heat reinforcement for bending. Heat-bent materials will be rejected.

B. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work.

1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
2. Bends or kinks not indicated on Drawings or final shop drawings.
3. Bars with reduced cross-section due to rusting or other cause.

C. Tag reinforcement with durable identification to facilitate sorting and placing.

2.03 SOURCE QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following:

1. Sampling and Tests of Reinforcing Bars per CBC 1910A.2.
2. Material Testing:
   a. Identified Steel: When samples are taken from bundled steel identified by heat number, matched with accompanying mill analyses as delivered from the mill, Owner's Testing Agency will perform one tensile test and one bend test per each ten tons or fraction thereof for each required size of reinforcing steel.
   b. Unidentified Steel: When identification of materials by heat number matched to accompanying mill analyses cannot be made, perform one tensile test and one bend test per each two and one-half tons or fraction thereof for each required size of reinforcing steel. Tests of unidentified steel shall be performed by the Owner's Testing Agency and costs for these tests shall be paid by the Contractor by deductive change order.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect the conditions under which concrete reinforcement is to be placed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Coordinate with work of other sections to avoid conflicts or interference. Bring conflicts between reinforcement and other elements to Architect's attention. Resolve conflicts before concrete is placed.

C. Notify Architect, Structural Engineer, and Authority Having Jurisdiction for review of steel placement not less than 48 hours before placing concrete.

3.02 PLACEMENT

A. General: Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean bars free of substances which are detrimental to bonding. Maintain reinforcement clean until embedded in concrete.

C. Place reinforcement to obtain the minimum coverages for concrete protection. Do not deviate from required position. Maintain required distance, spacing and clearance between bars, forms, and ground.

D. Location and Support: Provide metal chairs, runners, bolsters, spacers and hangers, as required.

E. Provide additional steel reinforcement as necessary or as directed, to act as spreaders or separators to maintain proper positioning.

F. Tying and Attachment: Securely tie at all intersections and supports with wire. Prevent dislocation or movement during placement of concrete. Direct twisted ends of wire ties away from exposed concrete surfaces.

G. Separate reinforcing from pipes or conduits with approved non-metallic separators. Do not use wood or steel form stakes or reinforcement used as stakes as support for reinforcement.

H. Accommodate placement of formed openings required by other sections.

I. Obstructions:

1. Where obstructions, block-outs, or penetrations (conduits, raceways, ductwork) prevent continuous placement of reinforcement as indicated, provide additional reinforcing as detailed and as directed by the Structural Engineer to supplement the indicated reinforcement around the obstruction.
2. Place additional trim bars, ties, stirrups, or other elements as detailed and as directed at all opening, sleeves, pipes or other penetrations through structural elements.

J. Welded Wire Reinforcement: Reinforce slabs with 6"x 6"-W1.4 x W1.4 welded wire reinforcement reinforcing, unless otherwise noted on drawings.

1. Provide flat sheets only, no rolls. Straighten, cut to required size, and lay out flat in place.

2. Securely wire-tie reinforcement to other reinforcement at frequent intervals.
3. Extend reinforcement over supporting beams and walls, and to within 1 inch of edge of slabs, construction joints, and expansion joints.
4. Support reinforcement in mid-depth of slab.
5. Lift reinforcement at intervals as slab concrete is placed, ensure proper embedment

3.03 REINFORCING SPACING AND COVERAGE

A. Spacing: Do not space bars closer than four (4) diameters of the largest of two adjacent bars, except at bar laps, which shall be placed such that a minimum of 2 bar diameters is clear between bars.

B. Where reinforcing in members is placed in two layers, the distance between layers shall not be less than four bar diameters of the largest bar and the bars in the upper layers shall be placed directly above those in the bottom layer, unless otherwise detailed or dimensioned.

C. Coverage of bars (including stirrups and columns ties) shall be as follows, unless otherwise shown:

1. Footings and Mat Foundation: 3 inches to any soil face, 2 inches to top.
2. Slabs (on grade): 2 inches to grade face, 1-1/2 inches to top face.
3. Slabs (elevated): 1-1/2 inches top and bottom.
4. Beam & Column: 1-1/2inches to form.
5. Walls: 1-1/2 inches clear to form and 2 inches clear to form at soil face.

3.04 DOWELS, SPLICES, OFFSETS AND BENDS

A. Provide standard reinforcement splices at splices, corners, and intersections by lapping ends, placing bars in contact, and tightly tying with wire at each end. Comply with details shown on structural drawings and requirements of ACI 318.

B. Provide minimum 1-1/2 inch clearance between sets of splices. Stagger splices in horizontal bars so that adjacent splices will be 4 feet apart.

C. Laps of welded wire reinforcement shall be at least two times the spacing of the members in the direction lapped but not less than twelve inches.

D. Splices of reinforcement shall not be made at points of maximum stress. Provide splice lengths as noted on the structural drawings, with sufficient lap to transfer the stress between bars by bond and shear.

E. Spacing:

1. Space bars minimum distance specified and all lapped bars 2 bar diameters (minimum) clear of the next bar.
2. Stagger splices of adjacent bars where possible and where required to maintain bar clearance.
3. Beam or slab top bars shall be spliced mid-span of column support and bottom bars spliced at column supports.
4. Request Architect/Engineer review prior to placement for all splices not shown on the drawings.

F. Reinforcement Couplers: Install at all locations indicated and may be used as an alternate to lap splices in general. Install couplers in accordance with manufacturer's recommendations.

3.05 WELDING

A. No reinforcing shall be welded unless specifically indicated or without prior approval of the Structural Engineer and the Authority Having Jurisdiction.

B. Only when so approved for use as noted above, all welding shall conform to AWS D1.4, ACI 318 Section 26.6.4, and CBC 1903A.8 and the following;

1. All welding performed by certified welders.
2. All reinforcement requires preheat prior to welding. All preheat and welding shall be continuously inspected by the Testing Agency.

3.06 MISPLACED REINFORCEMENT

A. Notify Architect/Engineer immediately if reinforcing bars are known to be misplaced after concrete has been placed.

B. Perform no correction or cutting without specific direction. Do not bend or kink misplaced bars.

C. Correct misplaced reinforcing only as directed in writing by the Architect/Engineer. Bear all costs of redesign, new, or additional reinforcing required because of misplaced bars at Contractor's expense.

3.07 FIELD QUALITY CONTROL

A. The Testing Agency as specified in the Article QUALITY ASSURANCE, will inspect the work for conformance to contract documents before concrete placement.

1. Inspection: Provide inspection and verification of installed reinforcement. Confirm that the surface of the rebar is free of form release oil or other coatings.
2. Inspect all preheat and welding activities for steel reinforcement, when these occur.
3. Exception: Non-structural patios, driveways, and sidewalks do not require special inspection.

3.08 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Provide all labor, materials, equipment and services to complete all concrete work required, including, but not limited to, the following:

1. Foundations, beams, columns, elevated slabs, slabs-on-grade, walls, and retaining walls.
2. Installation of all bolts, inserts, sleeves, connections, etc. in the concrete.
3. Joint devices associated with concrete work.
4. Miscellaneous concrete elements, including, but not limited to: equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
5. Concrete curing.
6. Coordination with other sections:
   a. Make all preparations and do all work necessary to receive or adjoin other work. Install all bolts and anchors, including those furnished by other sections, into formwork and provide all required blocking.
   b. Install all accessories embedded in the concrete and provide all holes, blockouts and similar provisions necessary for the work of other sections. Provide all patching or cutting made necessary by failure or delay in complying with this requirement at the Contractor's expense.
   c. Coordinate with other sections for the accurate location of embedded accessories.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
2. Pertinent Sections of Division 03 specifying concrete construction.
3. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete.
4. Pertinent sections of other Divisions specifying floor finishes and sealants applied to concrete substrates.

1.02 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19A Concrete.

B. American Concrete Institute (ACI) 211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete”; ACI 211.2 “Standard Practice for Selecting Proportions for Lightweight Concrete”.

C. ACI 301 “Specifications for Structural Concrete”.

D. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.

E. ACI 304R "Guide for Measuring, Mixing, Transporting, and Placing Concrete".

F. ACI 305R "Hot Weather Concreting".

G. ACI 306R "Cold Weather Concreting".

H. ACI 308 "Standard Practice for Curing Concrete".

I. ACI 318 "Building Code Requirements for Reinforced Concrete and Commentary".

1.03 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials such as bond breakers, cure/sealer, admixtures, etc. Demonstrate compliance with specified characteristics. Provide samples of items upon request. Submit material certificates for concrete aggregates and cementitious materials. Certificates shall show compliance to applicable ASTM's, the CBC, and additional requirements stated herein.

D. Mix Designs: Submit Mix Designs for each structural concrete type required for work per requirements of articles CONCRETE MIXES and QUALITY ASSURANCE. Resubmit revised designs for review if original designs are adjusted or changed for any reason. Non-Structural mixes need not be submitted for review by Structural Engineer.

E. Shop Drawings: Proposed location of construction and cold joints. Proposed location of all slab construction/dowel joints, control joints, and blockouts.

F. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

G. Batch Plant Certificates: Include with delivery of each load of concrete. Provide Certificates to the Testing Agency and the Architect/Engineer as separate submittals. Concrete delivered to the site without such certificate shall be rejected and returned to the plant. Each certificate shall include all information specified in Article SOURCE QUALITY CONTROL below.

H. Engineering Analysis: Prepared by a California-licensed Civil or Structural Engineer, justifying construction-imposed loads on slabs, beams, and walls which exceed those allowed by CBC for the specified use.

1. 2000 lbs maximum allowable construction load without analysis.
2. 10,000 lbs maximum allowable construction load with analysis.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Concrete construction verification and inspection to conform to CBC 1705A.3.

C. Common Sourcing: Provide each of the following materials from a single source for entire project.

1. Cement.
2. Fly ash.
3. Aggregate.

D. Follow recommendations of ACI 305R when concreting during hot weather. Follow recommendations of ACI 306R when concreting during cold weather.

E. Services by the Independent Testing Agency (includes "Special" Inspections) as specified in this Section and as follows:

1. Perform tests and inspections specified below in articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and reports to be in conformance with pertinent Sections of Division 01.

F. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials specified by brand name shall be delivered in unbroken packages bearing manufacturer's label and shall be brand specified or an approved equal.

B. Delivery, Handling and Storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.

C. Protect materials from weather or other damage. Sort to prevent inclusion of foreign materials.

D. Specific Requirements:

1. Cement: Protect against dampness, contamination, and warehouse set. Store in weather tight enclosures.
2. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregates. Use only one supply source for each aggregate stock pile.
3. Admixtures:
   a. Store to prevent contamination, evaporation, or damage.
   b. Protect liquid admixtures from freezing and extreme temperature ranges.
   c. Agitate emulsions prior to use.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather (Freezing or near-freezing temperatures) per ACI 306R:

1. Heat concrete materials before mixing, as necessary to deposit concrete at a temperature of at least 50°F but not more than 90°F.
2. Do not place concrete during freezing, near-freezing weather, snow, rain or sleet unless protection from moisture and/or cold is provided.
3. Protect from freezing and maintain at a temperature of at least 50°F for not less than seven days after placing. Take special precautions to protect transit-mixed concrete.
4. No salts, chemical protection or admixture are permitted without written approval of Architect/Engineer.
5. Contractor shall maintain an air temperature log for the first 7 days after placement with entry intervals not to exceed 8 hours.

B. Hot Weather per ACI 305R:

1. Cool concrete materials before mixing, or add ice in lieu of mix water as necessary to deposit concrete at a temperature below 85°F.
2. Do not place concrete in hot/windy weather without Architect/ Engineer review of procedures.
3. Provide sunshades and/or wind breakers to protect flat work during finishing and immediate curing operations. Do not place flatwork concrete at air temperature exceeding 90°F.
4. Provide modified mix designs, adding retarders to improve initial set times and applying evaporation reducers during hot/windy weather for review by Independent Testing Agency prior to use.

1.07 MOCK-UP

A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish, as result of formwork.

1. Panel Size: Sufficient to illustrate full range of treatment.
2. Number of Panels: 2.
3. Locate as indicated on drawings.

B. If requested by Architect / Engineer, cast concrete against mock-up panel. Obtain acceptance of resulting surface finish prior to erecting formwork.

C. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.

D. Mock-up may remain as part of the Work.

1.08 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 1000.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03 2000.

2.03 MATERIALS

A. General Requirements: All materials shall be new and best of their class or kind. All materials found defective, unsuitable, or not as specified, will be condemned and promptly removed from the premises.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type II, low alkali conforming to CBC 1903A.1.
2. Fly Ash (Pozzolan): ASTM C618, Class F.

C. Concrete Aggregates:

1. Coarse and Fine Aggregates: ASTM C33; Stone aggregate and sand. Specific source aggregate and/or sand or shrinkage characteristics as required for class of concrete specified.
2. Lightweight aggregate: ASTM C330 and C332.
3. Source shall remain constant throughout the duration of the job. The exact portions of the fine aggregates and coarse aggregates to be used in the mix shall be determined by the mix design.
4. Aggregates shall be tested for alkali reactivity per CBC section 1903A.6. Where test results exceed allowable limits, additional testing of mitigation procedures shall be provided, as outlined per CBC section 1903A.6.

D. Water: Potable, clean, from domestic source.

E. Admixtures: All admixtures shall be used in strict accordance with the manufacturer's recommendations. Admixtures containing calcium chlorides or other accelerators shall not be used without the approval of the Architect/Engineer and the Owner's Testing Laboratory.

1. Mid Range Water Reducing Admixtures: ASTM C494 Type A, "MasterPolyHeed" (formerly “PolyHeed”) series by BASF, "WRDA" series by W.R. Grace, or equal.
2. High Range Water-Reducing Admixtures: ASTM C494 Type F, "MasterRheoBuild 1000" (formerly “RheoBuild 1000”) or “MasterGlenium” (formerly “Glenium”) series by BASF or equal.

3. Water Reducing Admixture and Retarder: ASTM C494 Type B or D, "MasterPozzolith" (formerly “Pozzolith”) series or “MasterSet DELVO” (formerly “DELVO”) series by BASF, "Plastiflow-R" by Nox-crete, or equal.
4. Air Entraining Admixtures: ASTM C260, product suit condition by BASF or equal.
5. Viscocity Modifiers: ASTM C494 Type S.

F. Slurry: Same proportion of cement to fine aggregates used in the regular concrete mix (i.e. only coarse aggregate omitted); well mixed with water to produce a thick consistency.

G. High Strength Grout: See section 05 1200 or 05 1100 for requirements.

H. Dry Pack: Dry pack (used only for cosmetic concrete repairs) shall consist of:

1. One part cement to 2-1/2 parts fine aggregate (screen out all materials retained on No.4 sieve), mixed with a minimum amount of water, added in small amounts.
2. Mix to consistency such that a ball of the mixture compressed in the hand will retain its shape, showing finger marks, but without showing any surface water.

2.04 ACCESSORIES

A. Bonding Agent: ASTM C881, Type II Grade 2 Class B or C. Do not allow epoxy to set before placing fresh concrete.

1. “MasterEmaco ADH 326” (formerly “Concresive Liquid LPL”) by BASF;
2. “Rezi-Weld 1000” by W.R. Meadows.

B. Chemical Hardener: Fluorosilicate solution designed for densification of cured concrete slabs. “MasterKure HD 300 WB” (formerly “Lapidolith”) by BASF, "LIQUI-HARD" W.R. Meadows Co, or equal.

C. Moisture-Retaining Cover: ASTM C171, type 1, one of the following;

1. Regular Curing Paper, Type I, reinforced waterproof: Fortifiber Corporation "Orange Label Sisalkraft", "Pabcotite" paper, or equal.
2. Polyethylene Film: ASTM D 2103, 4 mil thick, clear or white color.
3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd.

D. Liquid Curing Compound: ASTM C 309, Type 1, Class B, clear or translucent, 25% minimum solids, water base acrylic cure/sealer which will not discolor concrete and compatible with bonding of finishes specified in related sections. W.R. Meadows Co. “Vocomp 25” or equal. Maximum VOC content shall comply with local requirements and California Green Building Code.

E. Underslab Water Vapor Retarder: See Section 07 2500 “Weather Barriers”.

F. Evaporation Reducer: "MasterKure ER 50” (formerly Confilm), by BASF.

G. Permeability Reducer: Use only where specifically referred to.

1. Admixture Type: Xypex Chemical Corporation "XYPEX Admix C-500". Dosage: 2-3% of cement content by weight; 15 lb/cu. yd. max. or BASF “MasterLife 300D” (formerly “Rheomac 300D”). Dosage: 2% of cement content by mass.
2. Surface-Applied Type: Xypex Chemical Corporation "XYPEX Concentrate. Brush application: 1.25-1.50lb/sq. yd., 5 parts powder to 2 parts water. BASF “MasterSeal 500” (formerly “Tegraproof”). Slurry coat: one part water to 2.25-2.5 parts powder by volume.
3. Approved equal.

2.05 JOINT DEVICES AND MATERIALS

A. Waterstops: Resilient type, meeting Corps of Engineers CRD-C 572. Consult manufacturer for appropriate product for specific use. Submit for review. Install per manufacturers recommendation. Provide W. R. Meadows “Seal Tight” PVC waterstop, Sika “Greenstreak” PVC waterstop, or approved equal.

B. Expansion Joint Filler: ASTM D1751, Nonextruding, resilient asphalt impregnated fiberboard or felt, 3/8 inch thick and 4 inches deep; tongue and groove profile.

1. Products: "Servicised Products", W.R. Meadows, Inc., "National Expansion Joint Company", "Celotex Corporation", or equal.

C. Joint Filler: ASTM D944, Compressible asphalt mastic with felt facers, 1/4 inch thick and 4 inches deep.

D. Sealant and Primer: As specified in Section 07 9105.

E. Slab Joint Sealant: Compatible with floor finishes specified in related sections.

2.06 CONCRETE MIXES

A. General requirements for mix design and submittal of structural class concrete:

1. Provide Contractor submittals to Architect/Engineer not less than 15 days before placing concrete.
2. Contractor shall review mix designs and proposed placing requirements prior to submittal for compatibility to ensure that the concrete as designed can be placed in accordance with the drawings and specifications.
3. Changes or revisions require re-submittal: All variations to approved mix designs, including changing type and/or quantity of admixtures shall be resubmitted to the Architect/Engineer for review prior to use.
4. Mix design(s) for all structural classes of concrete to be prepared by qualified person experienced in mix design. Allow for time necessary to do trial batch testing when required.
5. Preparer to provide backup data and certify in writing that mix design meets:
   a. Requirements of the specifications for concrete durability and quality;
   b. Requirements of the California Building Code and ACI 318 Section 26.4, including break histories, trial batching test results, and/or a mix designed by a California Registered Civil Engineer per ACI 318 Section 26.4.3.1(b) and bearing the Engineer’s seal & signature.

6. Clearly note on mix designs with specified maximum WCR if design permits addition of water on site, or clearly identify in the mix design that no water is to be added on site.
7. Deviations: Clearly indicate proposed deviations, and provide written explanation explaining how the deviating mix design(s) will provide equivalent or better concrete product(s) than those specified.
8. Include adjustments to reviewed mix designs to account for weather conditions and similar factors.

B. Proportioning - General: The following provisions apply to all mix designs:

1. Proportion concrete mixes to produce concrete of required average strength (as defined by California Building Code Section 1904A and ACI 318 Section 19.2.1). Select slump, aggregate sizes, shrinkage, and consistency that will allow thorough compaction without excessive puddling, spading, or vibration, and without permitting the materials to segregate, or allow free water to collect on the surface.
2. Select aggregate size and type to produce dense, uniform concrete with low to moderate shrinkage, free from rock pockets, honeycomb and other irregularities.
3. Mix designs may include water reducing and retarding admixtures to meet or exceed minimum set times (time required to place and finish) and to minimize Water Cement Ratios (WCR). Minimum and maximum criteria presented in this section are guidelines and do not represent a specific mix design.
4. Cement Content: Minimum cement content indicates minimum sacks of cementitious material. Increasing cement content to increase early strengths or to achieve specified WCR while maintaining water content is discouraged in order to minimize effects of shrinkage.
    a. Substitution of fly ash for Portland cement on an equivalent weight basis up to 25% replacement is permitted, except at high early strength concrete. Replacement in excess of 25% is not permitted unless part of a specified mix design that has been submitted for review.
    b. Such substitution requests may be denied by the Engineer.
5. Water Content: Mix designs with a specified maximum Water Cement Ratio (WCR) may be designed with a lower WCR than specified in order to allow addition of water at the site.
6. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301 and this section.
    a. For trial mixtures method, employ independent testing agency acceptable to Architect/Engineer for preparing and reporting proposed mix designs.
7. Placement Options: Mix designs may, at the Contractor's option, be designed for either pump or conventional placement with aggregate size, slumps, etc. to be maintained as specified in this section.

C. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations and this section.

D. Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations and this section. Maximum cured weight of lightweight concrete shall be 110 pounds per cubic feet.

E. Special mix design requirements for interior concrete floor slabs on grade to receive floor coverings or coatings:

1. Proportion concrete mixes per this specification, ACI 211.1, and the requirements below:
2. Minimum strength at 28 days to be 3000 psi; minimum strength at 56 days to be 4000 psi.
3. Fly Ash Type F, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 25% and a maximum of 35%. Mix design must comply with CBC 1903A.5 requirements.
4. 200 lbs. of 3/8(-) aggregate shall be added to reduce total sand.
5. Reduce total sand to minimum practical.
6. Admixture dosage shall be per manufacturer's recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.

F. Special mix design requirements for high volume fly ash concrete:

1. Proportion concrete mixes per this specification, ACI 211.1, and the requirements below:
2. Fly Ash Type F, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a replacement of 50%.
3. Minimum strength at 28 days to be 2500 psi; minimum strength at 56 days to be 3000 psi.
4. Add 200-300 pounds 3/8" aggregate to replace portion of fine aggregate.
5. Admixture dosage shall be per manufacturer's recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.
6. Concrete shall be wet cured per CONCRETE CURING.

G. Mix Design Minimum Requirements:

Concrete Class	Coarse Aggregate Size (Inches) & Fine Aggregate[3]	Maximum WCR or Maximum Nominal Slump & Tolerance (Inches)[1,2]	Minimum 28-Day Design Strength	Minimum Cement Sacks/per yd[4]
NON-STRUCTURAL				
1) Lean Concrete (use only where specified)	---	---	---	3.0
2) Slab on Grade Exterior (Walks & Patios)	1" x #4	4" ± 1"	2,500	4.5
STRUCTURAL				
3) Interior Slab on Grade w/floor coverings/coatings[5]	1″ x #4	WCR = .45	__	6.1
4) Interior Slab on Grade w/o floor coverings/coatings	1" x #4	WCR = .45	3,000 (4,000 at 56-days)	5.0
5) Foundation (including stem walls)	1" x #4	WCR = .53	3,000	5.0
6) High Volume Fly Ash Concrete[6]	1" x #4	WCR = .45	__	6.0

1. The tolerance is the maximum deviation allowable without rejection. The mix design shall be based on the nominal value specified and is without water reducing mixtures. Slump to be measured at the end of the hose.
2. The maximum water cement ratio (WCR) is limited at time of placement as noted. No water is to be added on site such that the specified WCR or maximum slump is exceeded without approval of the testing laboratory and the Architect/Engineer. Workability is to be achieved utilizing an acceptable mid range to high range water reducing admixture.
3. Gradation of aggregate is per CBC Section 1903A, ACI 318 section 26.4.1.2, and ASTM C33.
4. Minimum cement content includes all cementitious materials.
5. See Article 2.06E for additional requirements at slabs on grade with coverings/coatings.
6. See article 2.06F for additional requirements at high volume fly ash concrete.

2.07 MIXING CONCRETE

A. Batch final proportions in accordance with approved mix designs. All adjustments to approved proportions, for whatever reason, shall be reviewed by the Architect/Engineer prior to use.

B. Batch and mix concrete in accordance with ASTM C94, at an established plant. Site mixed concrete will be rejected.

C. Provide batch and transit equipment adequate for the work. Operate as necessary to provide concrete complying with specified requirements.

D. Place mixed concrete in forms within 1-1/2 hours from the time of introduction of cement and water into mixer or 300 revolutions of the drum whichever comes first. Use of, re-mixing, and/or tempering mixed concrete older than 1 hour will not be permitted.

E. Do not add water at the site to concrete mixes with a maximum specified WCR unless the water content at batch time provides for a WCR less than specified and this provision, including the quantity of water which may be added at the site, is specifically noted on the mix design and certification by the mix preparer. See ASTM C94 for additional requirements.

2.08 SOURCE QUALITY CONTROL

A. Services by independent Testing Agency:

1. Where aggregate alkali reactivity testing (and, when applicable, mitigation testing) per the MATERIALS section is not available, the Testing Agency shall perform this testing to verify materials conformance to CBC section 1903A.5.
2. Batch Plant inspection at automated plants to occur at commencement of concrete work each day (first truck). Batch Plant inspection at non-automated plants and when accuracy is questionable shall be continuous. Additionally, water cement ratio (WCR) is to be verified where a WCR is specified herein. The computed WCR is to be written on the Batch Plant Certificate to be taken to the job site prior to the truck leaving the plant. See requirements of CBC 1705A.3.3.
3. Batch Plant Certificates: Obtain the weighmaster's Batch Plant Certificate at arrival of truck at the site. If no batch plant certificate is provided, recommend to the General Contractor that the truckload of concrete be rejected. So note in daily log, along with the location of the load of concrete in the structure if the load is not rejected. See requirements of CBC 1705A.3.3.
    a. Laboratory's inspector shall obtain for each transit mixer Batch Plant Certificates to verify mix design quantities and condition upon delivery to the site.
    b. Certificates to include: Date, time, ingredient quantities, water added at plant and on job, total mixer revolutions at time of placement, and time of departure.
    c. Concrete with specified water cement ratio: Add no water on site unless mix design and batch records each show additional water may be added. See ASTM C94 for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Verify work of other sections is complete and tested as required before proceeding.

3.02 PREPARATION

A. Observation, Inspection and Testing:

1. Architect/Engineer: Notify not less than 2 working days before each concrete placement, for observation and review of reinforcing, forms, and other work prior to placement of concrete.
2. Testing Agency: Notify not less than 24 hours before each placement for inspection and testing.

B. Placement Records: Contractor shall maintain records of time, temperature and date of concrete placement including mix design and location in the structure. Retain records until completion of the contract. Make available for review by Testing Agency and Architect/Engineer.

C. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

D. Verify location, position and inclusion of all embedded and concealed items.

E. Verify installation of vapor retarder under interior slabs on grade, as specified in related section, is complete.

F. Cleaning and Preparation:

1. Remove loose dirt, mud, standing water, and foreign matter from excavations and cavities.
2. Close cleanout and inspection ports securely.
3. Thoroughly clean reinforcement and other embedded items free from loose rust and foreign matter. Maintain reinforcing securely in place. Do not place concrete on hot reinforcing.
4. Dampen form materials and substrates on which concrete is to be placed at least 1 hour in advance of placing concrete; repeat wetting as necessary to keep surfaces damp. Do not saturate. Do not place concrete on saturated material.
   a. Thoroughly wet wood forms (except coated plywood), bottom and sides of trenches, adjacent concrete or masonry and reinforcement.
   b. Concrete slabs on base rock, dampen rock.
   c. Concrete slabs on vapor retarder, do not wet vapor retarder.
5. Verify that metal forms are clean and free of rust before applying release agent.
6. Thoroughly clean metal decking. Do not place concrete on wet deck surface.
7. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

G. Drill holes in existing concrete at locations where new concrete is doweled to existing work. Insert steel dowels and prepare connections as detailed.

H. Do not overcut at existing concrete work to remain. Contractor is responsible for repair/replacement of overcut concrete to the Owner’s satisfaction.

3.03 PIPES AND CONDUITS IN CONCRETE

A. Slabs-on-Grade:

1. No pipe or conduit exceeding 1 inch outside diameter shall be embedded within the specified slab thickness except as specifically detailed.
2. Do not stack or abut pipes, maintain 3 inches minimum clearance.

B. Sleeving and Wrapping:

1. Foundations: Sleeve or wrap all individual pipe penetrations, minimum 1-1/2 inches clear to reinforcing all around.

a. Sleeves: PVC. Provide 1 inch minimum clear all around O.D. pipe to I.D sleeve, UNO at ends, fill void space with mastic or plastic bituminous cement.
b. Wrapped Vertical Pipes: Provide 1/8 inch nominal sheet foam with three wraps minimum, UNO.
c. Wrapped Horizontal Pipes: Provide 1/8 inch nominal sheet foam with eight wraps minimum, UNO.
d. Underground Fire Lines 4" and Larger: At sleeves provide 2 inch minimum clear all around O.D. pipe to I.D sleeve. At wrapped pipes, provide 1/8 inch nominal sheet foam with sixteen wraps minimum.

2. Slabs or Curbs: Wrap pipes as described above.

C. Space groups of pipes/conduits at least 3 sleeve diameters apart, do not interrupt specified concrete and reinforcement.

1. Provide block-outs as detailed when grouping of pipes/conduits in foundation or other structural member prevents spacing as described. Notify Architect/Engineer for review of any conditions not conforming to details.
2. Center pipe/conduit penetrations in the depth and/or thickness of foundations.
3. Maximum size of pipe/conduit penetrations shall not exceed the least dimension of concrete divided by 3.

D. Do not embed pipes/conduits in concrete slabs on metal deck.

E. Provide the following at pipes/conduits detailed to be embedded in a concrete beam, wall or column:

1. Place as near as possible to center of member with reinforcing as specified on each side.
2. Where reinforcing is located near or at center of member, place pipe or conduit 1 inch minimum clear from reinforcing and provide #3 at 12 inches on center perpendicular to the pipe/conduit. Reinforcing to extend 12 inches minimum past pipe/conduit each side.
3. Maintain ¾ inch clear minimum from added reinforcing to face of concrete where not exposed to weather and 1-1/2 inches clear where exposed to weather.
4. Space embedded items (groups of pipe/conduit, junction boxes or other elements) minimum 3 inches apart.
5. Provide reinforcing in walls, beams, columns as detailed for groups of pipe/conduit. Provide minimum replacement reinforcement of same size and number for interrupted or displaced reinforcement for the full height, length, width of the wall, beam, and/or column on each side of the "effective opening."

3.04 CONCRETE PLACEMENT

A. Transporting:

1. Provide clean, well-maintained equipment of sufficient quantity and capacity to execute the work and produce concrete of quality specified.
2. Handle and transport concrete from mixer to final deposit location as rapidly as practicable. Prevent separation or loss of ingredients.

B. Perform concrete placement by methods which will not puncture, damage or disturb vapor retarder membrane. Repair all damage to vapor retarder membrane before covering.

C. Placement - General: Placement, once started, shall be carried on as a continuous operation until section of approved size and shape is completed. Provide construction joints as detailed on the drawings. Engineer's written approval required for all deviations.

1. Deposition:
   a. Deposit concrete to maintain an approximately horizontal plastic surface until the completion of the unit placement.
   b. Deposit as neatly as practicable in final position, minimize re-handling or flow.
   c. Do not drop concrete freely where reinforcing bars, embeds, or obstructions occur that may cause segregation. Provide spouts, elephant trunks, or other means to prevent segregation during placement.
2. Depth: Layered placement in columns and walls shall not exceed ten feet vertical depth.
   a. Place concrete in minimum 32 inch horizontal lifts.
   b. Schedule placement to ensure that concrete will not take initial set before placement of next lift.
   c. No horizontal cold joints are allowed in columns or walls.
3. Progress Cleaning: Remove all concrete spilled on forms or reinforcing steel in portions of structure not immediately concreted. Remove completely before concrete sets.
4. Interruptions: Shut down placement operations and dispose of all remaining mixed concrete and concrete in hoppers or mixers following all interruption in placement longer than 60 minutes.
   a. If such interruption occurs, provide new or relocate existing construction joints as directed by Engineer.
   b. Cut concrete back to the designated line, cleaning forms and reinforcing as herein specified.
   c. Prepare for resumption of placement as for new unit when reason for interruption is resolved.

D. Placement - Elevated Structural Systems: Place as noted for "General" above and as follows:

1. Metal Decking and Structural Steel Beam Systems that are not to be shored: Locate screed lines on primary structural members. Review proposed screed line locations and expected structural deflections with the Architect/Engineer prior to placement of concrete.
2. Place screed lines to match camber of primary girders made of material other than concrete. Locate screeds to provide the minimum specified thickness of concrete at all locations.
3. Compensate for deflection of intermediate structural members and decking by placement of additional concrete.
4. Adjust embedded items to compensate for camber and deflection. Maintain locations within specified tolerances.

E. Consolidation:

1. Consolidate all concrete thoroughly during placement with high-speed mechanical vibrators and other suitable tools. Perform manual spading and tamping to work around reinforcement, embedded fixtures, and into corners of formwork as required to obtain thorough compaction.
   a. Provide vibrators with sufficient amplitude for adequate consolidation.
   b. Use mechanical vibrators at each point of concrete placement.

c. Keep additional spare vibrators, in addition to those required for use, at the site for standby service in case of equipment failure.

2. Consolidate each layer of concrete as placed.
   a. Insert vibrators vertically at points 18 to 30 inches apart; work into top area of previously placed layer to reconsolidate, slowly withdraw vibrator to surface.
   b. Avoid contact of vibrator heads with formwork surfaces.
   c. Systematically double back and reconsolidate wherever possible. Consolidate as required to provide concrete of maximum density with minimized honeycomb.

F. Unacceptable Materials:

1. Do not place concrete that has started to set or stiffen. Dispose of these materials.
2. Do not add water on site to concrete except as specified in the approved mix design, see PART 2 above.

G. Protection of installed work:

1. Do not introduce any foreign material into any specified drainage, piping or duct systems.
2. Contractor shall bear all costs of work required to repair or clean affected work as a result of failure to comply with this requirement.

3.05 CONCRETE JOINTS

A. Structural Joints (Construction/Cold Joints):

1. Locate joints only where shown, or as approved.
2. Review Required: Joints not indicated on the plans shall be located to meet the minimum requirements below, shall not impair the strength of the structure and shall be submitted to Architect/Engineer for review prior to placement of concrete.
   a. Indicate proposed location(s) of construction/cold/expansion joints on shop drawing submittals for review prior to placing concrete.
3. Clean and roughen all surfaces of previously placed concrete at construction joints by washing and sandblasting to expose aggregate to 1/4 inch amplitude.
4. Slabs-On-Grade: Maximum Length of continuous placement shall not exceed 60 feet without special review by the Architect/Engineer. Alternate or stagger placement sections.
5. Foundations, Beams, Elevated Slabs and Joists: Maximum Length of continuous placement shall not exceed 200 foot increments. Provide "keyed" shut-off locations made up with form boards. Extend reinforcing one lap length or more through shut-off.
   a. All reinforcement shall be continuous through construction/cold joint, lapping to adjacent reinforcing in future placement.
   b. Construction Joints in Elevated Slabs: Review all proposed locations with Architect/Engineer.
   c. Construction Joints in Slabs on Metal Decking: Review all proposed locations with Architect/Engineer. Do not locate closer than 24 inches to faces of girder or beam.
6. Horizontal Construction Joints: Place 2 inch slurry (specified concrete mix less coarse aggregate) at beginning of pour at the bottom of walls unless a prior review of a mock-up section demonstrates that segregation of aggregate will not occur.

B. Expansion/Construction Joints (Dowel Joints and Control Joints):

1. Interior and Exterior Floor Slabs-on-Grade:
   a. Expansion/Construction Joints: Provide dowel joints or control joints at a maximum dimension (in feet) of three times the slab thickness (in inches) in each direction unless noted otherwise (15'-0" maximum). Install joints to match slab level and in straight lines. Locate joints at all reentrant corners including blockouts.
   b. Proportions: Install joints to divide slab into rectangular areas with long dimensions less than 1.5 times short dimension.
2. Exterior Concrete Paving (walkways, patios) and other non-structural concrete flatwork at grade:
   a. Expansion/ construction joints: Provide a 2 inch deep troweled groove or asphalt impregnated joint material embedded 50 percent of the slab depth at 12 feet on center, maximum.
   b. Proportions: Place no section with a length larger than two times width. Additionally, place joints at all inside corners and at all intersections with other work.
3. Elevated Structural Slabs: Locate construction joints as specifically indicated on the drawings. All additional proposed locations shall be reviewed by the Architect/Engineer prior to placement.

C. Joint Types:

1. Dowel Joint: A keyed joint with smooth dowels passing through to allow unrestricted movement due to contraction and expansion. Joints are as specified on the drawings.
2. Control Joint(s): Shrinkage crack control joints may be of the following types when shown on the drawings. Install joints in a straight line between end points with edges finished appropriate to type. Depth shall be 25% of the slab thickness, unless noted otherwise. Fill joints with sealant as shown on the drawings or as required by related sections.
   a. 1/4 inch wide troweled joint.
   b. Keyed joint: Only at locations where concealed by other finishes.
   c. Masonite Strip, 1/8 inch: Only at locations where concealed by other finishes.
   d. Saw Cut, 1/8 inch: Must be performed within eight hours of completion of finishing. Do not make saw cuts if aggregate separates from cement paste during cutting operation. Prevent marring of surface finish. Fill with flexible sealant.

3.06 VAPOR RETARDER

A. Vapor Retarder Installation: Install as specified in Section 07 2500 "Weather Barriers", ASTM E1643, and per manufacturer's recommendations including taping and lapping of seams, sealing of penetrations, and repair of damage. Do not extend vapor retarder below footings.

3.07 FLATWORK

A. General Requirements for All Concrete Formed & Finished Flat:

1. Edge Forms and Screeds: Set accurately to produce indicated design elevations and contours in the finished surface, edge forms sufficiently strong to support screed type proposed.
2. Jointing: Located and detailed as indicated.
3. Consolidation: Concrete in slabs shall be thoroughly consolidated.

B. Flatwork Schedule:

1. Exterior Slabs-On-Grade: Place concrete directly over sub-base as indicated.
   a. Sub-Base: Clean free-draining, crushed base rock, 6 inch minimum thickness, thoroughly compacted.
2. Interior Slabs-On-Grade without floor covering:
   a. Sub-Base: Clean free-draining, crushed base rock, 6 inch minimum thickness, thoroughly compacted.
3. Concrete Slabs-On-Grade with floor coverings specified in related sections:
   a. Sub-Base: Clean free-draining, crushed base rock, 6 inch minimum thickness, thoroughly compacted.
   b. Vapor Retarder: Install over sub-base.

3.08 FORMED SURFACES

A. Form all concrete members level and plumb, except as specifically indicated. Comply with tolerances specified in ACI 318 Section 26.11, ACI 301 Section 2, and this specification, except that maximum permissible deviation is 1/4 inch end-to-end for any single member.

B. Cambers: Provide all cambers indicated in the formwork construction. Set screeds to produce specified cambers in the finished concrete.

3.09 CONCRETE FINISHES

A. Flatwork Finishing:

1. Perform with experienced operators.
2. Finish surfaces monolithically. Establish uniform slopes or level grades as indicated. Maintain full design thickness.
3. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on drawings.
4. Flatwork Finish Types:
   a. Wood Float Finish: Surfaces to receive quarry tile, ceramic tile, or cementitious terrazzo with full bed setting system, or wood frame for raised finished floors.
   b. Steel Trowel Finish: Surfaces to receive carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set tile or similar finishes specified in related sections. Trowel twice, minimum.
   c. Broom Texture Finish: Exterior surfaces as indicated or for which no other finish is indicated. Finish as for steel trowel finish, except immediately following first troweling, (depending on conditions of concrete and nature of finish required) provide uniform surfaces texture using a medium or coarse fiber broom.

B. Other Concrete: Provide as required to achieve appearance indicated on structural and architectural drawings and related sections.

1. Repair surface defects, including tie holes, immediately after removing formwork.
2. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
3. Exposed Form Finish: Finish concrete to match forms. Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

a. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
b. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
c. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

4. Intermediate joint and score marks and edges: Tool smooth and flush unless otherwise indicated or as directed by the Architect.
5. Use steel tools of standard patterns and as required to achieve details shown or specified. All exposed corners not specified to be chamfered shall have radiused edges.

3.10 TOLERANCES

A. Minimum Flatwork Tolerances: Measure flatness of slabs with in 48 hours after slab installation in accordance with ACI 302.1R and ASTM E1155 and to achieve the following FF and FL tolerances:

1. Exterior surfaces: 1/8 inch minimum per foot where sloped to drain. Level otherwise. FF20 and FL15.
2. Interior surfaces not otherwise shown or required: Level throughout. FF25 and FL20
3. Interior surfaces required to be sloped for drainage: 1/8 inch in 10 ft.
4. Finish concrete to achieve the following tolerances:
   a. Under Glazed Tile on Setting Bed: FF30 and FL20.
   b. Under Resilient Finishes: FF35 and FL25.
   c. Flooring manufactureer and pertainent section of Division 9.

B. Formed Surface Tolerances:

1. Permanently Exposed Joints and Surfaces: Provide maximum differential height within two feet of, and across construction joints of 1/16 inch.
2. Vertical Elevations: Elevation of surfaces shall be as shown or approved.

3.11 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

E. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels not to exceed 20 feet in either direction.

F. Screed toppings level, maintaining surface tolerances per above.

3.12 CONCRETE CURING

A. Curing - General: Cure in accordance with ACI 308. Maintain concrete water content for proper hydration and minimize temperature variations. Begin curing immediately following finishing.

B. Protection During Curing: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. The General Contractor is responsible for the protection of the finished slab from damage.

1. Avoid foot traffic on concrete for minimum of 24-hours after placement.
2. Protect concrete from sun and rain.
3. Maintain concrete temperature at or above 50 degrees F. during the first 7 days after placement. See Article ENVIRONMENTAL REQUIREMENTS.
4. Do not subject concrete to design loads until concrete is completely cured, and until concrete has attained its full specified 28-day compressive strength or until 21 days after placement, whichever is longer.
5. Protect concrete during and after curing from damage during subsequent building construction operations. See Article PROTECTION.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than 7 days.
2. High early strength concrete: Not less than 4 days.

D. Begin curing immediately following finishing.

E. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

F. Surfaces Not in Contact with Forms:

1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than 3 days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Begin final curing after initial curing but before surface is dry.
   a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
   b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

G. Flatwork on Grade: Cure by one of the following methods:

1. Water Cure (Ponding): Maintain 100 percent coverage of water over floor slab areas, continuously for minimum 7 calendar days.
2. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
3. Moisture-Retaining Film or Paper: Lap strips not less than 6 inches and seal with waterproof tape or adhesive; extend beyond slab or paving perimeters minimum 6 inches and secure at edges; maintain in place for minimum 7 days.

4. Absorptive Moisture-Retaining Covering: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides and extend beyond slab or paving perimeters 6 inches minimum; maintain in place for minimum 7 days.
5. Liquid Membrane-forming Curing Compound: Provide only when subsequent concrete treatments or finish flooring specified in related sections will not be affected by cure/sealer. Apply curing compound in accordance with manufacturer's instructions at the maximum recommended application rate in two coats, with second coat applied at right angles to first.

H. Elevated Flatwork: Cure by one of the following methods.

1. Moisture-Retaining Sheet: As specified for Flatwork on Grade above.
2. Water Cure: As specified above for minimum 14 days.
3. Apply Membrane Curing Compound as specified above after initial curing period.

I. Flatwork on Metal Decking: Moisture-Retaining Sheet method as specified above.

J. Formed Concrete Members: Cure by moist curing with forms in place for full curing period.

1. Protect free-standing elements from temperature extremes.
2. Maintain forms tight for minimum 7 days. Maintain exposed surfaces continuously damp and completely covered by sheet materials thereafter.
3. Maintain all shoring in place. Refer to related sections specifying formwork.
4. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

K. Foundations: Apply curing compound immediately after floating.

3.13 CONCRETE HARDENER

A. Apply hardener to all floor slabs not receiving other finishes after 30 days minimum curing. Clean slabs of non-compatible cure/sealers or other foreign material(s) and apply in strict accordance with the manufacturer's directions.

3.14 GROUTING AND DRY PACK

A. Set steel plates on concrete or masonry with high strength grout bed, completely fill all voids; thoroughly compact in place. See Section 05 1200 or 05 1100.

B. Bolts or inserts dry packed or grouted in place shall cure for minimum 7 days before tensioning.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspections by Independent Testing Agency: Provided verification and inspection of concrete per CBC Table 1705A.3. Provide written reports for to Engineer, Architect, Contractor and Building Official for the following tests and inspections:

B. Testing & Inspection: Provide periodic inspection of reinforcing steel. Provide continuous inspection during placement of structural class concrete, 3000 psi or more. Non-structural class concrete with a design strength of 2500 psi or less to have periodic inspection on a 150 cubic yard basis as required to assure conformance.

1. Provide periodic inspection of bolts in concrete prior to and during placement where so noted on the construction documents.
2. Structural Concrete Cylinder Tests: Perform in accordance with ASTM C31.
   a. Take four standard 6 inch x 12 inch (or five 4 inch x 8 inch) cylinder specimens on the site, of each class of concrete as specified in PART 2, not less than once a day or for each 50 cubic yards or 2000 sq ft or fraction thereof placed each day.
   b. Record the location of each concrete batch in the building in a log and also note on each specimen.
   c. Perform standard compression test of cylinders in accordance with ASTM C39, one at 7 days and two (three for 4x8 cylinders) at 28 days.
   d. Hold fourth (fifth) cylinder untested until specified concrete strengths are attained.
3. Structural Concrete Slump Test and Air Tests: Perform in accordance with ASTM D143 and C231 or C173 at the time of taking test cylinders, and/or at one-hour intervals during concrete placing.
4. Measure and record concrete temperature upon arrival of transit mixers and when taking specimens. Note weather conditions and temperature.
5. Propose adjustments to reviewed mix designs for Architect / Engineer review to account for variations in site or weather conditions, or other factors as appropriate.
6. Water Vapor Transmission Tests: Floors receiving floor finishes specified in related sections will be tested prior to installation of flooring systems. Refer to sections specifying floor finishes for related requirements.

C. Services by Contractor:

1. Rejection of Concrete Materials: Do not use the following without prior written approval of the Architect/Engineer;
   a. Materials without batch plant certificates.
   b. Materials not conforming to the requirements of these specifications.

3.16 ADJUSTING

A. Inspect all concrete surfaces immediately upon formwork removal. Notify Architect/Engineer of identified minor defects. Repair all minor defects as directed.

B. Surface and Finish Defects: Repair as directed by the Architect/Engineer, at no added expense to the Owner. Repairs include all necessary materials; reinforcement grouts, dry pack, admixtures, epoxy and aggregates to perform required repair.

1. Repair minor defective surface defects by use of drypack and surface grinding. Specific written approval of Architect/Engineer is required. Submit proposed patching mixture and methods for approval prior to commencing work.
2. Slabs-on-Grade, Elevated Slabs and on Slabs on Metal Deck: Review for "curled" slab edges and shrinkage cracks prior to installation of other floor finishes. Grind curled edges flush, fill cracks of 1/16 inch and greater with cementitious grout.

3. Grind high spots, fins or protrusions caused by formwork; Fill-in pour joints, voids, rock pockets, tie holes and other void not impairing structural strength. Provide surfaces flush with surrounding concrete.

3.17 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required compressive strength, lines, details, dimensions, tolerances, finishes or specified requirements; as determined by the Architect/Engineer.

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer who may order additional testing and inspection at his option. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Specific Defects:

1. "Low-Strength"; Concrete Not Meeting Specified Compressive Strength after 28 days:
   a. Concrete with less than 25% Fly Ash as cementitious material: Test remaining cylinder(s) at 56 days. If strength requirements are met, concrete strength is acceptable.
   b. Concrete with 25% or more Fly Ash as cementitious material: Test remaining cylinder(s) at 70 days. If strength requirements are met, concrete strength is acceptable.
2. Excessive Shrinkage, Cracking, Crazing or Curling; Defective Finish: Remove and replace if repair to acceptable condition is not feasible.
3. Lines, Details, Dimensions, Tolerances: Remove and replace if repair to acceptable condition is not feasible.
4. Slab sections not meeting specified tolerances for trueness/flatness or lines/levels: Remove and replace unless otherwise directed by the Architect/Engineer. Minimum area for removal: Fifteen square feet area unless directed otherwise by the Architect/Engineer.
5. Defective work affecting the strength of the structure or the appearance: Complete removal and replacement of defective concrete, as directed by the Architect/Engineer.

3.18 CLEANING

A. Maintain site free of debris and rubbish. Remove all materials and apparatus from the premises and streets at completion of work. Remove all drippings; leave the entire work clean and free of debris.
B. Slabs to Receive Floor Finishes Specified in other sections: Remove non-compatible cure/sealers or other foreign material(s) which may affect bonding of subsequent finishes. Leave in condition to receive work of related sections.

3.19 PROTECTION

A. Protect completed work from damage until project is complete and accepted by Owner.

B. Construction Loads: Submit engineering analysis for equipment loads (including all carried loads) specified in article submittals.

C. Keep finished areas free from all equipment traffic for a minimum of 4 additional days following attainment of design strength and completion of curing.

D. Protection of Drainage Systems:

1. Care shall be taken not to introduce any foreign material into any specified drainage, piping or duct system.
2. Cost of work to repair or clean drainage system as a result of failure to comply with this requirement will be back charged to the contractor.

E. Cover traffic areas with plywood sheets or other protective devices; maintain protection in place and in good repair for as long as necessary to protect against damage by subsequent construction operations.

END OF SECTION

SECTION 06 1000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: All labor, materials and equipment and all operations required to complete all rough carpentry and structural framing as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:

1. Structural floor, wall, and roof framing.
2. Floor, wall, and roof sheathing.
3. Rough hardware, framing connectors and fasteners.
4. Treatment of wood.
5. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, wood trim, and other work requiring supporting blocking.
6. Miscellaneous wood nailers and furring strips, including roof applications, other wood framing, furring, shims or blocking as required to complete the work.

B. Related Sections:

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
2. Pertinent sections of Division 01 specifying Structural Product Requirements: Structural Product Options, Substitution procedures and limitations, transportation, handling and storage.
3. Pertinent sections of Division 03 specifying wood formwork construction and/or setting anchors in concrete.
4. Pertinent section of Division 06 specifying wood construction and materials.
5. Pertinent sections of other divisions specifying steel or concrete construction.

1.02 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 23 Wood.

B. American National Standards Institute (ANSI) / American Wood Council (AWC) "NDS - National Design Specification for Wood Construction".

C. National Institute of Standards and Technology (NIST) / Engineered Wood Association (APA) "PS 1 - Voluntary Product Standard for Structural Plywood".

D. NIST / APA "PS 2 - Performance Standard for Wood-Based Structural-Use Panels".

E. NIST "PS 20 - American Softwood Lumber Standard".

F. Redwood Inspection Bureau (RIS) "Standard Specifications for Grades of California Redwood Lumber".

G. West Coast Lumber Inspection Bureau (WCLIB) "Standard Grading Rules for West Coast Lumber No. 17".

H. Western Wood Products Association (WWPA) "Western Lumber Grading Rules".

I. American Wood Preservers Association (AWPA) "Book of Standards".

1.03 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication. Submittals that do not meet these requirements will be returned for correction without review.

1. Substitutions for products specified require conformance to substitution requirements in Division 01.
2. Review of materials and hardware for substitution to products specified is at the additional expense of the Contractor.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.

C. Product Data:

1. Submit manufacturer's product data, specifications, and installation instructions for & location of framing connectors, wood preservative materials, application instructions, and fasteners. Include complete, accurate equivalence data when submitting alternate products to those specified. Provide samples of these items upon request.
2. Submit product data and current ICC-ES report for machine-driven nails, fasteners, and equipment, including dimensions of all fasteners, including head, shank diameter and length.
3. Submit samples of each and every type and size of proposed machine-driven nails and fasteners.

D. Shop drawings: For manufactured wood products, submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;

1. Indicate profiles, sizes, and spacing locations of structural members.
2. Cross-reference all shop drawing detail references to contract document detail references.
3. Secure all field measurements as necessary to complete this work.

E. Manufacturer's Certificate: Submit all certifications of physical and chemical properties of materials as specified below in Article titled QUALITY ASSURANCE.

1. Certify that wood products supplied for rough carpentry meet or exceed specified requirements, including specified moisture content.

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17A.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Inspection of fabricators is required per CBC 1704A.2 unless fabricator is registered and approved by the building official. Wood product quality standards:

1. All wood products to comply with article REFERENCES.
2. Factory-mark each piece of lumber and sheathing with type, grade, mill, and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
3. Sheathing panels to be marked by APA (The Engineered Wood Association).

D. End-Jointed lumber shall not be used.

E. Hardware and engineered wood products shall have current ICC ES Evaluation/research reports that are equivalent to products specified.

F. Employ competent workers experienced in work of the types specified and required.

1.05 MOCK-UP

A. Construct mock-ups of machine-driven nailed sheathing panels using submitted products and demonstrating conditions indicated. Locate where directed.

B. Mock-up shall be accepted and approved by the Inspector of Record (IOR) before commencement of machine-driven nailing activity.

C. Accepted mock-up shall remain exposed for reference for the duration of machine-driven nailing activity.

D. Remove all mock-ups at the completion of the work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent requirements of Division 01.

B. Delivery: Time delivery and installation of carpentry products to avoid delaying other trades whose work is dependent on or affected by this section and to comply with moisture content, protection and storage requirements.

C. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and sheathing panels to prevent deformation and provide air circulation within stacks.

1. Store materials for which a maximum moisture content is specified only in areas where relative humidity has been reduced to a level where specified moisture content can be maintained.
2. Handle and store materials above ground to prevent damage, contamination, or accumulation of dirt or foreign materials.
3. Provide special protection for horizontal sheathing panels. Deformation of panels due to moisture is not acceptable.

1.07 PROJECT/SITE CONDITIONS

A. Verify all conditions at project site affecting the work; work to field dimensions as required. Coordinate carpentry installation with size, location, and installation of service utilities.

B. Sequence rough carpentry installation activities to allow sufficient time for:

1. Review of all submittals, including machine-driven nail sample submittals.
2. Fabrication of mock-ups and required durations as specified.
3. Indicate submittal review, procurement, mock-up, and testing activities in the project schedule prior to the start of installation. Installation durations shall be based on hand-nailed installation methods specified.
4. Attainment of specified maximum lumber moisture content.

PART 2 PRODUCTS

2.01 DIMENSIONED LUMBER

A. General

1. Size per industry standards for nominal sizes shown; S4S (sanded four sides).
2. Warped/twisted and excessively checked members shall not be used regardless of grade marks.
3. At the Contractor's option, engineered lumber of equivalent size and material properties may be substituted for solid sawn lumber where material is difficult to source due to length, availability, etc. Submit proposed substitution to Engineer for review prior to purchasing materials.

B. Moisture content of framing:

1. All lumber to be maximum 19% at time of fastener installation, except 3x and 4x studs may be 25% at time of sheathing panel nailing. All lumber to be maximum 19% at time of close-in, unless noted otherwise.
2. The Owner's Testing Laboratory will test for moisture content prior to commencement of close-in.
3. The Contractor shall recognize that excessive shrinkage of lumber results from excess moisture content at the time of installation. The Contractor will compensate for use of such lumber by waiting for acceptable moisture content before close in and/or by replacing/repairing lumber that has sagged, twisted, or warped prior to close in.
4. Deviation from this specification would require structural redesign of connections and fasteners.

C. Sills on concrete or masonry: No. 2 pressure treated Douglas Fir and as called for on the drawings.

D. Interior structural framing shall be Douglas Fir (D.F.) with grades as noted below, unless otherwise specified on the drawings. All grades are per WCLIB standard grading rules.

1. All permanently exposed (interior or protected from weather) framing shall be select structural grade with no box heart.
2. Except per 1 above, unless noted otherwise, minimum grades are:
   a. Floor/roof joists/rafters (2x) and 2x8 & larger studs: D.F. No. 1
   b. 2x4 and 2x6 studs and plates: D.F. No. 2
   c. 4x and larger: D.F. No. 1
   d. Blocking: D.F. No. 2
   e. 6x8 and larger posts and beams may be SGL/CGL per below unless noted otherwise on the drawings.

E. Exterior structural framing (exposed to weather) shall be redwood select structural grade or pressure treated D.F. No. 1, unless noted otherwise.

F. Structural decking shall be D.F. select decking or White Pine select where not exposed to moisture. Where directly exposed to moisture or high humidity for prolonged periods of time, decking shall be Alaskan Yellow Cedar or Port Orford Cedar. Moisture content at time of installation to be less than 12%.

G. Framing not otherwise shown or specified: Douglas Fir construction grade per WCLIB paragraphs applicable to uses and sizes required.

2.02 MANUFACTURED LUMBER

A. Structural (Certified) Glued Lumber (SGL): SGL shall be manufactured following the American Lumber Standards Committee (ALSC) "Glued Lumber Policy" and meet the requirements of Voluntary Product Standard PS 20 "American Softwood Lumber Standard". Grading shall be per the West Coast Lumber Inspection Bureau (WCLIB) or Western Wood Products Association (WWPA). SGL shall be manufactured with waterproof adhesive. "Stud use only" SGL is not permitted.

1. Acceptable products:
   a. “RMT” by Rosboro.
   b. Approved equal.
2. Where specified for use on plan, SGL shall be entirely Douglas Fir lumber. SGL shall be grademarked to match the grade as would be specified for solid sawn lumber in the same location/use.
3. At the contractor's option, SGL may be substituted for solid sawn lumber. SGL species and grade shall match that for the solid sawn member. SGL shall not be substituted for glued-laminated (glulam) members.

B. Laminated Veneer Lumber (LVL): for use as joists, beams, blocking, or studs when so noted on the drawings. Conform to ICC AC 47. Minimum F_b = 2,600 PSI. Minimum E=1,900,000 PSI. Acceptable products:

1. "Microllam LVL" by Trus Joist, ICC ESR-1387
2. "Redlam LVL" by RedBuilt, ICC ESR-2993
3. Approved equal

C. Laminated Strand Lumber (LSL): for use as blocking (flat or vertical) or rim joist when used with I-joist or LVL, when so noted on the drawings. Conform to ICC AC 124. Minimum F_b = 1,700 PSI. Minimum E=1,300,000 PSI. Acceptable products:

1. "Timberstrand LSL" by Trus Joist, ICC ESR-1387
2. Approved equal

D. Parallel Strand Lumber (PSL): for use as beams and posts when so noted on the drawings. Conform to ICC AC 47. Minimum material properties for beams: E = 2,000,000 psi; F_b = 2,900 psi; F_c = 2,900 psi (parallel); F_v = 290 psi. Minimum material properties for posts: E = 1,800,000 psi; F_b = 2,400 psi; F_c = 2,500 psi (parallel); F_v = 190 psi. Acceptable products:

1. "Parallam PSL" by Trus Joist, ICC ESR-1387
2. Approved equal

2.03 MANUFACTURED STRUCTURAL PANELS

A. Plywood: Structural sheathing shall conform to product standard PS-1 or PS-2. All panels shall have an exterior exposure rating and bear the trademark of the Engineering Wood Association (APA) or other qualified agency. Grades shall be as required on the drawings.

B. Oriented Strand Board (OSB): All structural OSB shall be grade marked by a qualified agency for conformance with Product Standard PS-2 and shall be fabricated with exterior glue. Grades shall be as required on the drawings.

2.04 TREATED WOOD:

A. Treated Lumber and Plywood: Comply with requirements of AWPA Standard U1. See Standard U1 for "Use Category" designations. Do not provide higher Use Category lumber than that specified. Maximum moisture content shall be the same as required for "dimensioned lumber" as specified above.

B. Preservative Treated Lumber

1. General
   a. Preservatives shall be waterborne. Preservative retention rate shall be as required per AWPA Standards U1 & T1. Lumber shall be Douglas Fir No. 2 (or better). Cut faces of treated wood shall be brush treated (two complete applications) prior to installation.
   b. Lumber less than 8 inches above grade and lumber less than 6 inches above exterior hard-surface flatwork shall be treated.
   c. Each piece of wood shall be stamped by the wood preservative applicator to identify its treatment and preservative retention.
2. Lumber at interior, non-weather exposed locations installed adjacent to concrete or masonry shall be Use Category UC2. Examples include sill plates & ledgers and lumber in contact with roofing, flashing, or water proofing.

3. Lumber at exterior locations, not in contact with soil/ground, shall be Use Category UC3B. Examples include Douglas Fir decking and deck framing.
4. Lumber in contact with soil/ground shall be Use Category UC4A. Examples include timber retaining walls.
5. Poles, posts, and sheathing panels shall be treated as recommended by AWPA Standard U1 per use and exposure.
6. Maximum Volatile Organic Compound (VOC) content of field-applied preservative shall meet local air quality standards and the California Green Building Code. Provide either of the following:
   a. Copper Azole (CA-B) per ICC-ES AC143.
   b. Alkaline/Copper/Quaternary (ACQ).

C. Fire Retardant Treatment: Product and application process must be recommended by manufacturer of treatment as being suitable for painting. Application shall be by a California State Fire Marshal approved licensed contractor.

1. Exterior Type: Use Category UCFB, chemically treated, and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
   a. Treat exposed exterior rough carpentry items, including stairways, balconies, and covered walkways.
   b. Do not use treated wood in direct contact with the ground.
2. Interior Type: Use Category UCFA, low temperature (low hygroscopic) type, chemically treated, and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   a. Treat rough carpentry items as indicated.
   b. Do not use treated wood in applications exposed to weather or where the wood may become wet.

2.05 FASTENERS AND ACCESSORIES

A. General requirements for fasteners:

1. Fasteners shall be of adequate size, spacing, and number to resist design loads under intended use, and types shall be appropriate for the materials or conditions for which used.
2. Provide washers, pre-drilling, etc. as required for proper installation and to prevent damage to framing.
3. Fasteners shall be hot-dip galvanized (ASTM A153), mechanically galvanized (ASTM B695 class 55 minimum), stainless steel (type 303, 304, 305, or 316), silicon bronze, or copper by approved methods for the following applications:
   a. Exterior, exposed use.
   b. In contact with preservative or fire-retardant treated wood.
4. Fasteners in moist corrosive atmosphere to be of stainless steel (type 303, 304, 305, or 316).
5. Where the retention level of ACQ or MCQ preservative is greater than 0.40 pcf, CBA-A preservative is greater than 0.41 pcf, or CA-B preservative is greater than 0.21 pcf, provide stainless steel fasteners (type 303, 304, 305, or 316).

6. All fasteners specified by manufacturer shall be installed in framing hardware, unless noted otherwise.

B. Nails and nailing not otherwise shown or specified:

1. Comply with requirements of governing building code.
2. For securing materials to hardened concrete or masonry provide hardened steel masonry nails or Simpson Strong-Tie "Titen" screws.
3. For framing and general woodwork: Common bright wire nails (not box nails) per ASTM F1667. 16d cement coated sinker nails may be used in lieu of common nails for framing, where noted on the drawings.
4. Nails for sheathing panels shall be of common wire with full round heads and shall be of sufficient length to fully develop the nails.
5. Machine-driven nails of all types must comply with the requirements of this section. All proposed nails shall match diameter and penetration of specified nails.
6. Staples shall conform to length and gauges specified and shall be installed to match specified patterns and spacing.
7. Powder-Driven Pins (PDP): Use only as approved by the Architect/Engineer; operators shall be qualified.

C. Bolts: Malleable iron washers or steel plate washers, unless otherwise shown, shall be provided under all bolt heads and nuts.

1. Machine Bolts: ASTM A307 and ANSI/ASME B18.2.1, standard semi-finished machine bolts as shown or required. Nuts shall be standard size unless noted otherwise and shall be per ASTM A563.
2. Bolts in Concrete: Post-installed concrete anchors shall be Hilti "Kwik Bolt TZ", Simpson Strong-Tie "Strong Bolt 2", Hilti "Kwik HUS EZ", or Simpson Strong-Tie "Titen HD" except where shown to be cast-in-place machine bolts or anchor rods.
3. Anchor bolts or threaded rod anchors shall conform to ASTM F1554, ASTM A307, or ASTM A36. Anchor bolts shall be headed or end in two nuts tightened against one another, unless noted otherwise. Provide embedded plate washer as indicated on drawings. No upset threads allowed. No L or J bolts allowed.

D. Lag screws: Standard hex lag screws per ANSI/ASME B18.2.1.

E. Wood screws: Standard wood screws per ANSI/ASME B18.6.1.

F. Powder-Driven Pins (PDP): Hilti X-CP72, ICC ESR-2379; Simpson PDPWL-300 MG, ICC ESR-2138.

G. Framing hardware: Fabricated sheet metal timber framing connectors shall be manufactured from painted or galvanized G90 steel by Simpson Strong-Tie (connectors specified on drawings are per Simpson Strong Tie, USP Lumber Connectors, or approved equivalent. Connectors shall be at least 16 gauge material, (1/8 inch plate materials where welded), unless otherwise noted, punched for nailing. All heavy hardware to be fabricated from A36 steel per Division 05, Metals. All hardware intended for exterior exposed use shall be galvanized per G185 ASTM A653 or stainless steel.

1. For contact with preservative or fire-retardant treated wood, provide minimum G185 galvanizing per ASTM A653.
2. Nails and nailing shall conform to the manufacturer's instructions with a nail provided for each punched hole. Nails to be used with framing accessories are subject to the requirements specified in this Section for fasteners and anchors.

H. Subfloor Glue: Water proof, water base, air cure type, cartridge dispensed conforming to APA Standard AFG-01 or ASTM D3498. Maximum Volatile Organic Compound (VOC) shall meet local air quality standards and the California Green Building Code.

2.06 SOURCE QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform testing for moisture content of all lumber at time of fastener installation.

B. The Testing Agency will submit reports as specified in Division 01.

PART 3 EXECUTION

3.01 REQUIREMENTS FOR STRUCTURAL FRAMING

A. General

1. Refer to drawings for layouts, notes and details, provide framing as required; comply with governing building code requirements.
2. Provide framing to achieve true alignments as surfaces receiving finish materials.
3. It shall be the responsibility of the Contractor to provide and install all wood blocking, furring strips, or grounds detailed or required to provide anchorage for all finishes, accessories, fixtures, etc. as required to complete all work. All blocking and/or backing shall be securely bolted or otherwise anchored in place.
4. Contractor shall be responsible for layout of anchor bolts, and other hardware embedded in concrete when placed by other trades.
5. Provide and install all structural framing, blocking, fasteners, brackets, clips, etc. as required to complete work specified in the Construction Documents.

B. Framing

1. Sill Plates and Ledgers:
   a. Sill plates and ledgers on concrete shall be anchored with bolts, unless noted otherwise, shall have full bearing on concrete, and shall be placed for sheathing panel nailing as indicated. All bolt nuts shall be provided with a cut plate steel washer for bearing on wood.
   b. Provide a minimum of two sill anchor bolts per sill piece with a bolt no less than 4 ½" and no more than 12" from the end of the sill. Bolts to be 5/8" diameter x 12" (18" at curb) long at 48" on centers, unless otherwise shown or noted. Provide additional anchor bolts each side of a notch or hole, as per a typical plate splice, where notch or hole is in excess of 1/3 the plate width. At shear walls, provide a plate washer 3" x 3" x 0.229" minimum between the sill and nut at anchor bolts. Plate washer to extend within ½ inch of the structural wall sheathing. Offset and/or stagger anchor bolts, or provide larger plate washer as required.

c. Anchor bolt holes in sill plates or ledgers shall be 1/16" maximum larger than anchor bolt.

2. Stud Walls and Framing:
   a. Cut studs and posts with square ends, unless otherwise shown or noted. All posts and beams shall be "cut to bear" unless otherwise detailed.
   b. All studs in walls shall be placed with the shortest dimension parallel to the run of the wall. Bearing studs shall extend full height to be the supporting framing as shown; non-bearing studs shall extend to the supporting framing.
   c. Provide double studs on each side of all openings, unless shown or noted otherwise.
   d. All openings in stud walls and partitions shall be framed with headers across the top, as shown, with a minimum size (6" nominal depth x stud width) resting on short cripple studs, and as shown on the drawings.
   e. All stud partitions and walls shall have horizontal solid blocking not less than 2x and of the same width as the stud, fitted and nailed into the studs at mid-height of stud, for studs over 8 feet in height, except as otherwise shown or specified. This blocking shall be so spaced that there shall be no concealed air spaces greater than eight feet in any dimension.
   f. Stud partitions containing plumbing, heating or other pipes shall be so framed as to give proper clearance for piping. Plumbing, heating and vent pipes exceeding 1-1/2" in inside diameter shall not be placed in partitions used as bearing or shear walls unless completely furred clear of the wall. No notching shall be allowed. Pipes shall be placed in the center of the plate using a neat bored hole and the plates shall be strapped on each side with 3" x 36" x 14 gauge steel punched for 10d nails 3" on center, staggered, or as shown on the drawings.
3. Top Plates
   a. Top plates shall be double, set single. Corners where stud wall or partitions meet shall be framed with studs on all surfaces and blocking to form a "rigid" corner with nailing for all corners. Double top plates shall be lapped at corners. Lap splices and nailing per the drawings.
4. Floor, Roof and Ceiling Framing
   a. Joists and beams shall be accurately aligned and the position and spacing of all joists and beams shall be as shown and be coordinated with other framing and to other trades prior to actual construction.
   b. Place all joists and beams with crown up. Cantilevered joists and beams shall be placed with the crown down.
   c. Cutting of wood girders, beams or joists for electrical and mechanical lines shall be limited to cuts and bored holes not deeper than 1/5 of the beam depth from the top and located not farther from the support than three times the beam depth and not less than the beam depth. Cuts in excess of this, or single bored holes with a diameter of more than 1" are not permitted without special provisions for framing the beams. Location of all cuts in framing shall receive the prior review of the Architect/Engineer.
   d. Provide vent holes in rafters and/or blocking as shown and/or directed by the Architect.

3.02 STRUCTURAL SHEATHING

A. General

1. Sheathing nailing shall be as required on the drawings. Do not overdrive (Do not break skin of sheathing face sheet). Over driving will be cause for rejection.
2. Form sheathing may be re-used for concealed sheathing provided the lumber at the time of re-use is approved by the Architect, meets with the framing grade requirements specified herein, is in good condition, and is thoroughly cleaned with all nails removed.
3. Pneumatic nailing devices shall be adjustable so that nail heads do not penetrate skin of sheathing. Contractor shall submit equipment and nails for review prior to use. Refer to PART 2 for other nailing requirements.

B. Roof and Floor Sheathing: Except "Panelized Roofs", lay with face grain perpendicular to roof rafters, roof trusses or floor joists. Stagger sheets. Block all unsupported sheet edges with 2x material unless noted otherwise.

C. Wall Sheathing: Lay with face grain either parallel or perpendicular to studs. Exposed bottom edges shall be sealed as recommended by manufacturer. Block all unsupported sheet edges with 2x materials unless noted otherwise.

D. Panelized Roofs: Where sheathing is set @ 8'-0 1/8" spacing, cut every fourth sheet short by 1/2" to re-align structural framing that has been specified to be spaced at even units of 2, 4 or 8 feet.

3.03 ROUGH HARDWARE

A. General: Nails, spikes, screws, fabricated sheet metal anchors, ties, hangers and any other materials shown or required for the attachment of wood to concrete and wood to steel and wood to wood shall be furnished and installed as part of this work.

B. Framing Nailing: All framing nailing shall conform to minimum requirements of the Building Code, and with details shown on the drawing.

C. Bolts, Lag Screws and Washers:

1. Bolts in wood shall be machine bolts unless otherwise noted and shall be of such length that the bearing length of the treads does not exceed ¼ of the full bearing length in the member holding the treads. Bolt holes in wood shall be 1/32" oversized. Bolt holes for sill plates may be 1/16" maximum oversize. Holes in steel shall be 1/16" oversize. See Section 3.1 for anchor bolts at sill plates and ledgers.
2. Provide square plate or malleable iron washer and nut at head where bearing is against wood; cut washer under nut where it is against steel. Washer will not be required under head of carriage bolts. Provide malleable iron washers where exposed.
3. All nuts shall be tightened when placed and retightened at completion of the job or immediately before closing with final construction.
4. Lag screws shall be screwed (not driven) into place. Drill pilot hole to 70% of shank diameter. Drill clearance hole to full shank diameter and depth of unthreaded screw length.

D. Wood Screws: Minimum penetration is 10 diameters unless noted otherwise. Where fastening hardwood timber species or where wood tends to split, provide pilot hole 70% of screw shank diameter.

3.04 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

A. Coordinate installation of wood decking, metal-web wood joists, glued-laminated wood construction, shop-fabricated wood trusses, and wood I- joists.

B. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members. Fasten curbs corner-to-corner and to rafters with framing connectors configured for this application.

C. Blocking:

1. Provide fire blocking at locations and spacing's as required by CBC Chapter 7. Locate other blocking, supplementary framing, backing plates and bracing to facilitate installation of finish materials, fixtures, equipment, services, accessories, and trim requiring attachment and support.
2. Solid block joists and rafters over all supports with blocking of the same size and material as the joist or rafter.

D. Furring:

1. Nominal 1 inch x 3 inch minimum, continuous and spaced at 16 inches on center, maximum.
2. Install plumb, rigid, and level. Shim where necessary to provide a true, even plane suitable to receive the finish required.
3. Attach to concrete and masonry as shown in the contract drawings.

E. Bridging: Use 2 inch solid cross bridging. Nail bottom ends of bridging only after sheathing has been nailed.

F. Stair Framing: Provide with 3 stair stringers for each set of stairs, unless otherwise shown. Cut notches to receive exact size of treads and risers (if any) shown, with no change in dimensions between landings. Provide stringers of size shown, or if not shown, of a size to allow not less than 3-1/2 inch of effective depth, measured perpendicular to the rake of the stringer, after notching.

G. Install miscellaneous metal angles, bolts, and other items; secure into formwork where embedded in concrete.

H. Install accessory items not otherwise set under other sections; after completion of painting and other finishing work; in locations shown or directed by the Architect. Set items plumb, level, and secure using appropriate fastening as applicable.

3.05 FIELD APPLIED WOOD TREATMENT

A. Field treat all end cuts and holes in preservative treated materials per PART 2.

B. Apply two brush coats; or full-immersion dip not less than 15 minutes; or as required to thoroughly saturate all surfaces after cutting.

C. Air dry 2-hours minimum before installation.

3.06 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum. Provide framed substrates meeting requirements for application of finishes specified in other sections.

D. Exposed surfaces shall be free from dents and tool marks, unsanded rough or torn faces and corners, and other defects.

3.07 FIELD QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following tests and submit reports as specified in Division 01:

1. Moisture content of all lumber at time of close-in.
2. Periodic special inspection of nailing, bolting, and other fastening within the seismic-force-resisting system including shear walls, wood diaphragms, etc. per CBC Section 1705A.12.2.
3. Special inspection of high load diaphragms per CBC Section 1705A.5.1 where designated on documents.

3.08 ADJUSTING

A. Replace all defective work at Contractor's expense.

B. Replace defective or damaged work with conforming work.

C. Correct defects using means that will not injure the materials.

D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.

E. Repair or replace framing lumber sagged, twisted or warped due to shrinkage from excessive moisture content at time of installation, or from other causes.

F. Adjust to meet specified tolerances.

G. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.

H. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work.

I. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work.

3.09 CLEANING AND PROTECTION

A. Clean all surfaces upon completion of erection, leave free of grime and dirt. Remove unused materials, tools, equipment, and debris from the premises and leave surfaces broomed clean.

B. Waste Disposal: Comply with the requirements of pertinent sections of Division 01 specifying cleaning and disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.

C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

D. Prevent sawdust and wood shavings from entering the storm drainage system.

E. Protect work from damage by subsequent operations.

END OF SECTION

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SECTION 06 1733

WOOD I-JOISTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Include: The furnishing and installation of all wood I-joists as shown on the drawings, herein specified and necessary to complete the work.

B. Related Sections

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency Services.
2. Pertinent sections of Division 06 specifying Rough Carpentry.

1.02 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 23 Wood.

B. American National Standards Institute (ANSI) / American Wood Council (AWC) "National Design Standard (NDS) for Wood Construction".

C. International Code Council Evaluation Service (ICC-ES) "Acceptance Criteria (AC) 14 Prefabricated Wood I-Joists".

D. American Society for Testing and Materials (ASTM) D5055 "Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists".

1.03 SUBMITTALS

A. Submit shop drawings, furnished by the Manufacturer, showing all critical dimensions for determining fit and placement in the building and erection instructions.

1.04 QUALITY ASSURANCE

A. All wood I joists shall be manufactured in a shop approved for fabrication by the Authority Having Jurisdiction (AHJ).

B. Wood I-joists are not required to be continuously inspected during fabrication, but must carry a stamp indicating the plant of manufacture, date of manufacture, and logo of the third party independent inspection agency, conforming to AC14, and ASTM D5055.

C. Fabricators must have a minimum of three years experience in manufacturing comparable systems and shall have a valid evaluation report issued by a qualified evaluation agency prescribed in DSA IR A-5.

D. Wood I-joists delivered shall be free from any defects in materials, and the members shall be adequate to carry the design loads for the life of the building.

PART 2 PRODUCTS

2.01 MATERIALS

A. Joists shall be manufactured from materials in the evaluation report and shall be of sizes and shapes shown on the contract documents.

B. Blocking construction shall be the same as I-joists, unless noted otherwise.

2.02 FABRICATION

A. Camber – None, unless noted otherwise.

B. Tolerances:

1. Length (between outside bearing edges): +/- 1/2 inch
2. Depth: +/- 3/8 inch
3. Camber: +/- 1/4 inch

PART 3 EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Wood I-joists shall be stored in a vertical position and protected from the weather. They shall be handled with care so they are not damaged. Provide bearing supports and bracings to avoid bending or overturning of I-joists, and protect I-joists from construction operations.

3.02 ERECTION AND INSTALLATION

A. Use all means necessary to coordinate the work of this section with the work of other sections to ensure proper and adequate erection of the work of this section.

B. Wood I-joists shall be installed in accordance with the approved shop drawings and installation instructions therein.

C. Temporary construction loads, which will cause member stresses beyond design limits, are not permitted.

D. Erection bracing in addition to specified bridging is to be provided to keep the I-joists straight and plumb as required to assure adequate lateral support for the individual I-joist and entire system until the sheathing material has been applied. Bridging as shown on the drawings and per Manufacturer's recommendations shall be installed as erection of I-joists progresses and before any construction loads are placed on the I-joists.

E. Round holes may be cut in the I-joist web as indicated on the drawings. Square or rectangular holes may be cut when the diagonal dimension of the square or rectangular hole does not exceed the diameter of the maximum allowable round holes shown on the drawing. Overcut square or rectangular holes shall be treated as a hole matching the overcut. Holes exceeding maximum holes shown on the drawings are cause for rejection of the I-joist.

F. The Contractor shall give notification prior to enclosing the I-joists to provide opportunity for inspection of the installation.

END OF SECTION

SECTION 06 1800

GLUED LAMINATED CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: All labor, materials and equipment for glued laminated timber necessary to complete work shown, implied, specified and required.

B. Related Sections:

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
2. 06 1000 Rough Carpentry

1.02 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 23 Wood.

B. American National Standards Institute (ANSI) A190.1 "Standard for Wood Products - Structural Glued Laminated Timber".

C. ANSI 117 "Standard Specification for Structural Glued Laminated Timber of Softwood Species".

D. American Society for Testing and Materials (ASTM) D3737 "Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)".

1.03 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Shop Drawings: Submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following:

1. Indicate profiles, sizes, lengths, appearance grade, and locations of structural members.
2. Cross-reference all shop drawing detail references to contract document detail references.
3. Secure all field measurements as necessary to complete this work, prior to submittal.

D. Certifications:

1. ANSI/AITC Certificate of Conformance.
2. Special Inspection Certification.

E. Warranty:

1. Two copies of a five-year warranty, signed by an officer of the manufacturer, shall be submitted to the Architect/Engineer stating that the workmanship shall be corrected to the satisfaction of the Architect/Engineer at no cost to the Owner.

1.04 QUALITY ASSURANCE

A. Each glued laminated member shall bear the ANSI/AITC Quality Mark to indicate conformance to ANSI A190.1.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Certification and Identification of Materials and Uses: Provide Testing Agency with access to fabrication plant to facilitate inspection of fabrication. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification.

D. Testing and Inspection: Tests and Inspections performed by Independent Testing Agency are specified below in Article SOURCE QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs, and test reports to be in conformance with pertinent sections of Division 01.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber

1. Conform to ANSI/AITC 117.
2. Laminations shall be 2 inch nominal thickness unless otherwise noted.
3. 16% maximum moisture content (MC) at time of manufacture (12% for mechanically reinforced members).
4. All laminations to be greater than 90% heartwood, unless noted otherwise.

B. Adhesive: Shall be exterior grade for wet surface condition above 16% and shall meet requirements of ANSI 405.

C. Interior use glue laminated members shall be manufactured entirely from Douglas Fir.

1. Simple span beams shall be combination 24F-V4-1.8E.
2. Beams with intermediate supports and/or cantilevers shall be combination 24F-V8-1.8E.
3. Posts and truss members shall be combination 3-1.9E.

D. Glue laminated members that are protected from weather by a roof, eave, or similar covering may be Douglas Fir. The ends shall be flashed and treated with approved wood preservative to prevent decay.

E. Glue laminated members with exterior exposure shall be fabricated entirely from Alaskan

Yellow Cedar (AYC). No sap wood permitted.

1. Simple span beams shall be combination 20F-V12-1.5E.
2. Beams with intermediate supports and/or cantilevers shall be combination 20F-V13-1.5E.
3. Posts and truss members shall be combination 20F-V13-1.5E.

F. Radial Tension Reinforcement: ANSI/AITC 404.

2.02 CAMBER

A. All beams shall be cambered as noted on the drawing. Where no camber is noted, provide 5,000 ft radius camber at simple span beams.

B. Cambers specified shall be provided within tolerances per ANSI A190.1. The Contractor shall verify all beam cambers prior to the erection and report his findings in writing to the engineer for review and comment.

2.03 APPEARANCE

A. Glued laminated members shall be Industrial Appearance Grade when not exposed to permanent view and Architectural Appearance Grade otherwise. Appearance to meet the requirements of ANSI A190.1.

2.04 PROTECTION

A. Protection during shipping and field handling to meet requirements of AITC 111, including protective wrapping and proper storage of members to prevent increased moisture content and damage. Individually wrap members with Architectural Appearance Grade.

B. Ends shall be sealed after end trimming and entire surface of members shall be factory sealed with a penetrating sealer that has been approved by the Architect. Field cuts, notches, and daps shall receive one coat of the same sealer prior to erection.

2.05 SOURCE QUALITY CONTROL

A. Special Inspection is not required for non-custom members with maximum 6 inch nominal width, maximum 18 inch depth, and maximum 32 feet clear span per CBC section 1705A.5.4. Provide an ANSI/AITC certificate for each member.

B. Members not meeting the above criteria shall be continuously inspected during fabrication by a glue fabrication inspector specifically approved for that purpose. The Inspection shall conform to CBC requirements. An ANSI/AITC Certificate will not meet this requirement.

1. An independent Testing Agency will perform source quality control tests and submit reports, as specified in pertinent sections of Division 01 and CBC Chapter 17A.
2. The inspector shall issue four copies of certificates to the Architect/Engineer certifying that materials, manufacture and fabrication are in accordance with these Specifications and the Drawings and shall specify the following:
   a. Species, grade and slope of grain of lumber. Lumber grading inspection shall be done by lumber graders authorized under the provisions of the American Lumber Standards Committee and verified by the special independent inspector.

b. Glue quality specified.
c. Glue bond over entire surface.
d. Continuous inspection of gluing operation.
e. Moisture content of laminations during manufacture.
f. Finger joint locations.
g. All requirements of ANSI A190.1 are met.

3. Each inspected member shall be stamped by the special inspector with an identification mark.

PART 3 EXECUTION

3.01 ERECTION

A. Members shall be seat cut to bear, dapped, etc. as detailed on the drawings prior to erection.

B. Members shall be erected with suitable equipment and secured in place as detailed on the drawings.

C. Glued laminated members shall be aligned and braced until all secondary members or other framing is secured. Contractor shall verify all beam cambers in the field prior to erection.

3.02 CLEANING

A. All debris resulting from this portion of the work shall be removed from the site upon completion.

B. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 22 0000

PLUMBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Bidding Requirements and Contract Forms, including General Conditions and Supplemental General Conditions, and Division 01 Sections apply to all work herein.

1.02 DESCRIPTION

A. This Specification establishes the required standards for all labor, materials, equipment, and workmanship in connection with the furnishing, fabrication, and installation of "Plumbing". Plumbing work includes, but is not necessarily limited to, the following items of work:
   1. A complete system of soil, waste, vent and sanitary sewer piping and structures, including provisions for mechanical equipment drainage; and connection of same to public sanitary sewers, located as indicated on the Drawings.
   2. Cold water distribution system, complete, from points of contact with site domestic water systems, located approximately as indicated on the Drawings, to all plumbing fixtures, mechanical equipment, building specialties, and Owner supplied equipment scheduled for service on the Drawings.
   3. Hot water distribution system, complete, from serving water heaters and/or points of contact with site domestic hot water, to all plumbing fixtures, mechanical equipment, building specialties, and Owner supplied equipment scheduled for service on the Drawings.
   4. Cold water distribution system, complete, from points of contact with site domestic water systems, located approximately as indicated on the Drawings, to all plumbing fixtures, mechanical equipment, building specialties, and Owner supplied equipment scheduled for service on the Drawings.
   5. Gas piping system, complete from point of connection with site gas piping (located approximately as indicated on the Drawings) and terminating in stopcocks adjacent to all gas-fired equipment, as noted on the Drawings. Gas pressure regulator and shut-off valve shall be provided at building entrance, located as shown on the Drawing.
   6. All plumbing fixtures and trim as scheduled on the Drawings, inclusive of setting of fixtures and connections to drainage and water supply systems.
   7. Flashing of all plumbing pipe penetrations through exterior walls, roofs, and foundations.
   8. Excavation and backfill as required for the work of this Section in conformity with Division 31 of these Specifications.
   9. Final connection of water and natural gas to equipment furnished under other Sections.
   10. Condensate drainage piping and connections from points of attachment to equipment to indirect waste locations, as noted on the Drawings.
   11. Protection of all piping specified herein and/or shown on the Drawings, from freezing. Buried piping shall be a minimum of 12" below the local frost line. If ambient design temperature is 30°F or less, all pipes in unconditioned spaces shall be insulated.
   12. Testing and adjusting of all piping systems and equipment herein specified.
   13. Sterilization of domestic water systems.
   14. Pipe wrapping and insulation.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Sealants and Firestopping: See applicable Section(s) of Division 07.

B. Line voltage wiring: Division 26 - Electrical.

C. Final connection of water and gas to equipment furnished under other Sections of the Specifications.

D. Finish painting: See Division 09 for painting requirements.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Conform to all applicable codes and standards as stated herein and as described in Division 01 of the Specifications, including the following:

1. American Gas Association (AGA)
2. American National Standards Institute (ANSI)
3. Adhesive and Sealant Council (ASC)
4. American Society of Mechanical Engineers (ASME)
5. American Society for Testing and Materials (ASTM)
6. American Society of Civil Engineers (ASCE)
7. California Building Code (CBC)
8. California Plumbing Code (CPC)
9. California Fire Code (CFC)
10. California Energy Conservation Code, Title 24
11. State of California Administrative Code (CAC) Titles 8, 17, and 24
12. California Electric Code (CEC)
13. National Electrical Manufacturers Association (NEMA)
14. National Fire Protection Agency (NFPA)
15. Underwriters' Laboratories (UL)
16. Comply with all ADA and California Title 24 requirements for disabled access.
17. City Fire Marshal requirements
18. Comply with the latest edition of all applicable standards, including AWWA, PDI, and OSHA
19. NSF/ANSI 61 Standard, Drinking Water System Components - Health Effects for fixture materials that will be in contact with potable water.
20. AB 1953, Amendments to Section 116875 of the Health and Safety Code relating to lead plumbing.

B. Minimum requirements: The requirements of these are the minimum that will be allowed unless such requirements are exceeded by applicable codes or regulations, in which the regulatory codes or regulation requirements shall govern.

1.05 SUBMITTALS

A. All submittals shall be submitted under the provisions of Division 01 and the following.

1. Product Data: For each type of product.
   a. Submit cut sheets for each plumbing fixture. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow control rates for each fixture indicated.
   b. Submit manufacturer's product data for all plumbing piping, fittings, materials, and equipment.
2. Shop Drawings:
   a. Prepare complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Shop drawings shall be prepared

using AutoCAD 2012 or newer and shall be drawn at a minimum ¼" = 1' - 0" scale. Sections, details, and diagrams shall be to required scales for specified areas. Include diagrams for all piping, and power, signal and control wiring.

b. Complete and detailed shop drawings shall be maintained throughout the coordination and construction phase, indicating all equipment and trades' work clearly. All equipment including piping, etc. shall clearly identify both top and bottom elevations as well as distances from equipment to established building lines. Coordinate with other trades and field conditions and show dimensions and details including building construction and access for servicing.
c. Use of contract documents for shop drawings is not acceptable.
d. Submit shop drawings to Architect for approval, prior to fabrication or installation of any work. Do not install equipment or piping until layout drawings have been approved.
e. Any work installed without prior shop drawing approval shall be removed at the Contractor's expense.

1.06 AS-BUILT DRAWINGS

A. Comply with the requirements of Division 01 and the following:

1. A complete set of Contract Drawings shall be maintained at the work site, and all changes in the work shall be recorded on this set on a daily basis. In addition to changes made during course of work, show the following:
   a. Exact location, type and function of concealed valves and controllers.
   b. Exact size, elevations and location of underground and under floor piping.
2. Submit to Architect for final approval.

1.07 LICENSING

A. All plumbing systems shall be installed by a C-36 Plumbing Contractor. Plumbing systems include: waste removal and connection of on-site waste disposal systems; piping, storage tanks, and venting for supply of gases and liquids for any purpose; all gas appliances, flues, and gas connections; water and gas piping from the owner's side of utility meter to the structure or fixed works; installation of any type of equipment to heat water or fluids to a suitable temperature; and maintenance and replacement of the items described above, including health and safety devices.

1.08 OPERATION & MAINTENANCE DATA (Closeout)

A. Comply with the requirements of Division 01 Sections relating to Operation and Maintenance data and the following.

1. The data shall include a table of contents identifying items therein, and index tabs for each system. Neatly obscure or cross out inapplicable data from manufacturer's literature.
2. Contractor shall provide all operating and maintenance instructions provided by the manufacturer, describing proper operation and maintenance of any equipment and devices installed. Operating and maintenance instructions shall cover maintenance, adjustment, and operation of each piece of apparatus. Include description of start-up procedures for each system, including controls diagrams and description of operating sequences.
3. Contractor shall provide a parts list of all equipment and component parts for all equipment under this Section. The equipment list shall include manufacturer's name, model number, and local representative, service facilities and normal channel of supply for each item. Include manufacturer's brochures, ratings, certified shop drawings, lubrication charts and data, if available
4. Mark each sheet with equipment identification number and actual installed condition or system and location of installation. Specifically identify which options are provided.

5. Recommend preventative maintenance schedule and procedures.

B. Submit data to the Architect for approval. Final acceptance of the work will not be made until a satisfactory submission of this material is received and approved by the Architect.

1.09 COORDINATION

A. All work shall be coordinated with water, gas, sanitary sewer, and other services on the site. The locations of points of connection to the site services shall be confirmed prior to commencement of work.

B. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.01 PRODUCTS CRITERIA

A. Only specified materials shall be utilized in the work of this Section unless substitutions have been approved in accordance with the General Conditions and Division 01 Sections of the Specifications.

B. All materials, appliances, and equipment shall be new and best of their respective kinds, free from defects, and of the make, brand or quality specified or as accepted by the Architect.

C. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

D. Apply and install all items in accordance with the manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Architect for resolution.

E. All fixtures, materials, and equipment equal in quality and utility to these herein mentioned will be accepted. When specific names are used in describing fixtures, materials, and equipment they are mentioned as standards only, but this implies no right on the part of the Contractor to use other fixtures, materials and equipment, or methods, unless approved as equal in quality and utility by the Architect. The decision of the Architect shall govern as to what fixtures, materials, and equipment are equals to those mentioned, but the burden of proof as to the quality of any proposed fixtures, materials, or equipment shall be upon the Contractor. If any tests are necessary to determine the quality of proposed fixtures, materials, or equipment, an unbiased laboratory shall make such tests at the expense of the Contractor satisfactory to the Architect.

2.02 PIPE, FITTINGS

A. General

1. Tracer wire shall be installed with all non-metallic piping below grade. Tracer wire shall be solid core copper, 14 gauge minimum, laid continuously along pipes. Wire shall be "ty-wrapped" to pipe at eight feet on center. Tracer wire shall terminate in concrete access boxes at the beginning and terminal ends of the buried pipe.
2. All accessible pipe 2" and smaller shall be threaded. Fittings for threaded pipe shall be 150-lb. malleable iron, screwed and banded.
3. Vent piping shall have vandal resistant mushroom vent caps.

B. Below Ground Soil, Waste, Vent, and Storm Drainage Piping:

1. Lines 2" and larger shall be standard weight, no-hub cast iron soil pipe and fittings manufactured from gray cast iron with a tensile strength of not less than 21,000 psi,

bituminous coated interior and exterior, conforming to the requirements of ASTM A888 and CISPI Standard 301. Each length of pipe shall be hydrostatically (water) tested by the manufacturer to verify compliance. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF international. All pipe and fittings shall be of the same manufacturer. Approved manufacturers: AB&I, Charlotte, or Tyler.

2. Joints: No hub couplings shall conform to CISPI 310 Standard, current edition.
   a. Super-duty no-hub couplings shall have a shield constructed of type 304 stainless steel with a minimum thickness of 0.016" (28 gauge). The worm gear drive clamps shall have a hexagon head to accept a 3/8" socketed torque wrench. The clamps shall be tightened to a minimum of 80 in pounds. The gaskets shall be manufactured using neoprene rubber meeting the requirements of ASTM C-564. Couplings shall meet FM 1680 class 1. Smooth shielded couplings shall have a 304 stainless steel shield with a minimum thickness of 0.025" (24 gauge). Couplings 1-1/2" through 4" shall have four bands and 5" through 10" shall have six bands. Approved manufacturers: Husky SD4000, Clamp-All High Torq 125, or MG Couplings.
   b. Couplings shall be installed in accordance with manufacturer's installation instructions, local code requirements, and shall be tightened using a calibrated torque wrench. The clamps shall be tightened between 115 and 125 inch pounds.

C. Above Ground Soil, Waste, Drain, and Vent Pipe:

1. Lines 2 inches and larger shall be of standard weight no-hub cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301 and ASTM A88. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International. All pipe and fittings shall be produced by a single manufacturer. AB&I, Charlotte, or Tyler.
2. Lines under 2 inches shall be galvanized steel, with threaded cast iron drainage fittings.
3. Joints: Hubless Couplings shall conform to CISPI Standard 310 and local code requirements. Couplings shall be manufactured in the United States and be certified by NSF® International. Heavy Duty and Medium Duty couplings shall conform to ASTM C 1540. Hubless coupling gaskets shall conform to ASTM C-564. Couplings 1-1/2" through 4" shall have four bands and 5" through 10" shall have six bands.
   a. Piping 2" and smaller: Medium duty no-hub couplings, Husky 2000, Tyler Wide Body, Clamp-All 80.
   b. Piping 2½" and larger: Heavy duty no-hub couplings, Husky 4000, Mission, or Clamp-All 12.
   c. Couplings shall be installed in accordance with the manufacturer's band tightening sequence and torque recommendations. Tighten bands with a properly calibrated torque limiting device.
4. At the option of this Contractor, all soil, waste, and vent piping above ground may be DWV copper, with wrought copper fittings, with "Stay-Safe 50" lead free solder and a suitable non-corrosive flux.

D. Natural gas Pipe:

1. Above ground piping shall be Schedule 40, black steel. ASTM A-53-84A, electric resistance welded or seamless, Grade B
   a. All concealed pipe and all pipe 2½" and larger shall be welded. Fittings for welded pipe shall be seamless steel, weld neck.
   b. All accessible pipe 2" and smaller shall be threaded. Fittings for threaded pipe shall be 150-lb. malleable iron, screwed and banded.
2. Piping exposed to weather: Schedule 40 galvanized steel pipe and fittings. All exposed threads shall be primed with one coat of rust inhibiting paint.

3. Pipes below grade inside buildings shall be Ric-wil "Safe-T-Gard". Carrier pipes shall be Schedule 40 black steel, welded per ANSI B31.3. Containment casings shall be Schedule 40 PVC. All carrier piping shall be spaced, guided and supported within the containment casing.

E. Below Grade Natural Gas Pipe:

1. Below Grade Gas Pipe: Performance Pipe, "DriscoPlex 6500" PE2406 polyethylene pipe and fittings for underground gas distribution. The polyethylene plastic pipe and heat fusion fittings shall meet the requirements of ASTM D 2513.
2. The pipe and fitting manufacturer shall be ISO Certified in accordance with the current edition of ISO 9001 and a documented quality management system that defines product specifications and manufacturing and quality assurance procedures that assure conformance with customer and applicable regulatory requirements.
3. A licensed and bonded Contractor shall perform all underground gas distribution piping construction work. The Contractor shall secure all necessary permits before commencing construction.
4. Materials used for the manufacture of polyethylene pipe and fittings shall be PE 2708 (PE2406) medium density polyethylene meeting cell classification 234373E per ASTM D 3350; and shall be Listed in Plastic Pipe Institute TR-r with standard grade HDB ratings of 1250 psi at 73°F, and 1000 psi at 140°F. All pipe and fittings materials shall be opaque yellow in color. Materials shall be stabilized against ultraviolet deterioration and suitable for outdoor storage for at least 4 years.
5. Heat Fusion Joining:
   a. Butt, socket, and saddle fusion joints in polyethylene gas piping shall be made using procedures that have been qualified and approved by the Operator in accordance with Title 49, CFR, and Part 192.283.
   b. In accordance with CFR 49, part 192, Section 192.85, the Operator shall ensure that all persons making heat fusion joints have been qualified to make joints in accordance with the Operator's Approved Qualified Fusion Procedures. The Operator shall maintain records of qualified personnel, and shall certify that qualification training was received not more than 12 months before commencing construction. The Contractor shall ensure that all persons making heat fusion joints are qualified in accordance with these requirements.
   c. Butt fusion of unlike wall thickness shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple or by mechanical means or electrofusion.
6. Joining by Other Means: All transitions from PE to steel pipe shall be made with pre-manufactured transition fittings, Central Plastics "Victaulic Double 'O' Seal", or equal.

F. Hot & Cold Water Piping:

1. All domestic hot and cold water piping 3" and smaller shall be Type L, hard temper, copper pipe with wrought copper or cast brass solder joint fittings or ProPress fittings. Pipe shall be NSF 61 Certified and bear the NSF Certification mark. All joints shall be made up with lead free solder. A suitable non-corrosive flux shall be used at all joints.
   a. Viega Copper Press fittings: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path).
2. Pipes below grade inside buildings shall be soft drawn, Type L or K copper with no joints below slabs. Pipes shall be sleeved with 20-mil plastic sheathing.

G. Condensate Drainage Pipe:

1. Condensate drainage piping shall be Anvil, Mueller, Watts, or approved equal.
   a. 1 ¼ inch and larger shall be type DWV copper tube, ASTM B306.
   b. 1 inch and smaller shall be type M, hard temper copper, standard copper fittings.
2. Drainage fittings shall be ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings. 1 ¼ inches & smaller, standard pressure fittings.
3. Solder shall be ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.03 VALVES, SPECIALTIES

A. General Requirements:

1. All valves, except pressure reducing and control valves, shall be the same size as the pipe to which they are installed.
2. All valves of a particular type and size range shall be the product of one manufacturer.
3. Valve body materials shall be compatible with piping system materials.
4. Provide a union immediately downstream from each valve, unless the valve is flanged.
5. All valves shall be installed with the stem 45 degrees above horizontal, if possible. In no case shall the stem be installed below horizontal.
6. Where insulation is indicated, install extended stem valves arranged in proper manner to receive insulation.

B. Ball Valves (threaded): Valves shall be rated 600 PSI non-shock CWP and have 2-pc. Lead-free dezincification-resistant body, end piece, stem and ball, TFE seats, full port, separate pack nut with adjustable stem packing and anti-blowout stems. Valves ends shall have full depth ANSI threads. Valves shall be 3rd party certified to Annex G of NSF/ANSI 61. Nibco T-685-80-LF, Watts LFB-6080, or KITZ 858.

C. Ball Valves (solder): Nibco S-685-80-LF, Watts LFB-6081, or KITZ 859; two piece, full port, lead free, lever handle, 600 psi CWP

D. Gate Valves:

1. 3" and smaller shall be Nibco T134, Stockham B-120, KITZ 42T; bronze body, union bonnet, rising stem, solid wedge, 150 lb. with wheel handle.
2. Larger than 3" shall be Nibco F-617-0 or KITZ 72; iron body, bolted bonnet, outside screw and yoke, solid wedge, 125 lb. with wheel handle.

E. Lift Check Valves (vertical): Nibco T-480-Y-LFor KITZ 836; bronze body, inline lift type, Teflon seat, and discs, spring actuated, 125 lb.

F. Swing Check Valves (horizontal): Nibco T-413-Y-LF, Stockham B-345, or KITZ 822T; bronze body, Y-pattern swing-type, rated 200 PSI non-shock CWP. Body, bonnet, and disc hanger shall be of lead-free dezincification-resistant material and TFE seat disc. Valve ends shall be threaded type. Valves shall be 3rd party certified to Annex G of NSF/ANSI 61.

G. Gas Shut-off Valves:

1. At Building Service: Homestead Fig. 601, pressure Class 125 lubricated plug valve, cast iron, lever handle, 200 lb., leak and hydro tested. Install California Series 300 seismic actuated shut off valve at meter (or entrance to building if not new construction). Brace per manufacturer's instructions.
2. At Connection to Equipment: Jomar T-203 gas ball valves, 2-piece design, threaded connection; 2 "Viton" o-rings; 1/8-inch side tap; leakproof stem. Provide with AGA/CSA certified stainless steel flex connection 12" max.

H. Gas Pressure Regulators: American Meter, Series 1813B. Regulators shall be sized for full gas capacity of equipment as scheduled on the Drawings. Inlet pressure shall be 3 psig. Outlet

pressure shall be 7" water column. Regulators installed indoors shall have relief opening piped to outdoors. Size relief pipe in accordance with ANSI Z223.1 "National Fuel Gas Code".

I. Water Pressure Regulating Valves: Wilkins 500 YSBR series. Install where pressure to building exceeds 70 psi.

J. Backflow Preventers (Where shown on the Drawings or required by local code):

1. Atmospheric type: Wilkins #35 series
2. Pressure type: Wilkins #720A series
3. Reduced pressure type:
   a. ¼" to 2" - Wilkins #975-XLMS series
   b. 2½" to 10" - Wilkins #375 series

K. Hose Bibbs

1. HB-1: Interior Hose Bibbs: Chicago No. 293-E27CP with vacuum breaker, polished chrome plated, tee handle, adjustable threaded flange inlet, hose thread outlet. Provide a Chicago No. 1771ABCP loose key stop at each hose bibb.
2. HB-2 (Hose station) Strahman CEC-1000 stainless steel cabinet; M-159-TM mixing unit; hose assembly "B" and M-70 series spray nozzle

2.04 UNIONS

A. Steel pipe unions shall be malleable iron, 150 lb., ground joint, Anvil Fig. 463 or equal.

B. Copper pipe unions shall be soldered joint, Nibco series 633 or 733, Mueller, or equal.

C. Dielectric unions shall be Epco, Watts, Zurn Wilkins, or equal.

2.05 DIELECTRIC FITTINGS

A. Precision Plumbing Products, "Clear Flow" series, threaded dielectric fittings, sizes 19100P thru 19195P.

B. Dielectric fittings shall have zinc electroplated steel casing, and NSF/FDA listed lining. Fittings shall meet the requirements of ASTM standard F1545 for continuous use at temperatures up to 225°F (- +5°F) and for pressures up to 300 psi, and shall achieve a dielectric waterway in all potable water and appropriate HVAC applications

2.06 PIPE INSULATION

A. Insulate all hot water supply piping, all hot water return piping, all tempered water supply piping and all tempered water return piping with Johns Manville "Micro-Lok HP", or equal, rigid fiberglass one-piece pipe insulation or Knauf Insulation "Earthwool 1000°" or "Earthwool Redi-Klad 1000° rigid glass mineral wool one-piece pipe insulation, or approved equal.

B. Pipe covering shall have factory applied All Service Jackets (ASJ). Jackets shall be constructed of high density, white kraft bonded to aluminum foil with fiber glass yarn, with a pressure sensitive closure system, or of aluminum foil reinforced with a glass scrim bonded to a kraft paper interleaving with an outer film layer leaving no exposed paper. Adhesives or staples shall not be required to seal the jacket and butt strips.

C. All insulation shall have composite (insulation, jacket, tape seal, and adhesive used to adhere the jacket to the insulation) Fire and Smoke Hazard ratings as tested under Procedure ASTM E 84 and NFPA 255, not exceeding: Flame Spread - 25, Smoke Developed - 50. PVC fitting covers, jacketing and accessories such as adhesives, mastics, cements and cloth for fittings should have the same component ratings.

D. Insulation thickness shall conform to Title 24, Part 6 requirements as indicated in the following table:

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)				
			1 and less	1 to <1.5	1.5 to < 4	4 to < 8	8 and lrgr
			INSULATION THICKNESS REQUIRED (in inches)				
Space heating, Hot Water systems (steam, steam condensate and hot water) and Service Water Heating Systems							
Above 350	0.32-0.34	250	4.5	5.0	5.0	5.0	5.0
251-350	0.29-0.31	200	3.0	4.0	4.5	4.5	4.5
201-250	0.27-0.30	150	2.5	2.5	2.5	3.0	3.0
141-200	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
105-140	0.22-0.28	100	1.0	1.5	1.5	1.5	1.5

E. Fittings, valves and flanges shall be covered with Manville "Zeston 2000" insulated PVC fitting covers and Hi-Lo Temp insulation inserts or Knauf "Proto LoSmoke". Insulation for all exposed piping and all piping in crawl spaces shall be covered with Zeston PVC jacketing. PVC jackets shall be 20 mils thick and shall be bonded with Zeston Perma-Weld adhesive. In crawl spaces, Knauf Earthwool RediKlad 1000° pipe covering shall serve as an acceptable alternate to standard pipe covering and PVC.

F. All piping exposed to the weather shall be finished with aluminum jacketing with a laminated moisture retarder or Earthwool RediKlad 1000° with Venture Clad embossed jacket. Aluminum jacketing shall be overlapped 2 to 3 inches and held in place with stainless steel bands to form a weather tight system. Elbows and tees shall be fitted with matching aluminum fitting covers. Other fittings in metal-jacketed systems shall be finished with conventional weather-resistant insulating materials with painted aluminum finish.

G. All domestic water piping below grade shall be insulated with Dow Trymer-2000. Pipes shall be sleeved with 30 mil PVC jacket, with glued joints.

2.07 FLOOR DRAINS

A. Floor Drains: Drains in membrane dampproofed floors shall have flashing flange and membrane clamp.

B. Drains in membrane dampproofed floors shall have flashing flange and membrane clamp.

C. Drains in sheet vinyl floors shall have a 14" square latex flange.

1. FD-1: Zurn ZN-4156S-P or equal Jay R Smith. Dura-Coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with seepage holes, primer connections and "Type S" polished, nickel bronze, square heel-proof, light-duty strainer. 2" pipe size. 6" x 6" square top grate.

2.08 FLOOR SINKS

A. Where shown on Drawings, floor sinks shall be as follows:

1. FS-1: Zurn Z-1901-P-2, or equal Jay R Smith. 12" x 12" x 8" deep, white acid resisting interior, aluminum anti-splash interior dome strainer, ½ grate, 2" size. Set rim flush with finished floor.

2.09 CLEANOUTS

A. Cleanouts in membrane dampproofed floors shall have flashing flange and membrane clamps. Plugs shall be bronze, with cast iron body ferrule for cast iron pipe.

B. Floor Cleanouts (FCO): Zurn ZN1400-HD, "Level-trol" adjustable floor cleanouts, dura-coated cast iron with gas and water-tight ABS tapered thread plug, and round scoriated top, adjustable to finished floor.

C. Grade (COTG): Zurn Z1474-N or equal Jay R Smith. Housing to be dura-coated cast iron body with integral anchor flange and scoriated cover with lifting device. Cleanouts in un-paved areas shall be set in 18" x 18" x 4" concrete pads.

D. Accessible:

1. Cast iron pipe: Zurn Z-1440, dura-coated with gas and water-tight, bronze, taper thread plug
2. Steel pipe: Zurn Z-1470-A bronze, raised head, cleanout plug.
3. Copper tubing: Nibco figure 816 or 817.

E. Wall Cleanouts (WCO):

1. Copper tubing: Nibco figure 816 or 817, with Zurn Z-1462, 6" x 6" polished chrome-plated bronze wall plate and frame.
2. Cast iron pipe: Zurn Z-1441, dura-coated with gas and water-tight bronze, taper thread plug and round smooth stainless steel access cover with securing screw
3. Steel pipe: Zurn Z-1468, round stainless steel wall access cover, complete with securing screw and bronze raised hex head plug for steel pipe.

2.10 SLEEVES, WALL PLATES

A. Service pipe through exterior walls, roofs; interior walls, ceilings: Sioux Chief or equal, wall and ceiling plates; chrome plated at finished rooms.

B. Pipes through, under footings: 18 gauge iron sleeves two diameters larger than pipe, cast in concrete, annular space filled with mastic or plastic bituminous cement.

C. Pipes through fire rated walls and through 1-hour walls shall be protected with fire retardant mastic as detailed on the drawings. Installation shall be in full accordance with the requirements of the UL system number. Hilti or approved equal.

D. Pipes through floors, interior concrete walls, and through fire rated walls and smoke stop partitions: 18 gauge iron sleeves, two diameters larger than pipe, annular space filled with 3M Brand Fire Barrier CP-25 caulk.

2.11 SHOCK ABSORBERS

A. Zurn Z1700 "Shoktrol" series, or equal Jay R Smith, stainless steel bellows. Install with gate valve shut-off and access door at all flush valves or other automatic valves. A single unit sized in accordance with the manufacturer's recommendations may serve batteries of valves.

2.12 TRAP PRIMERS

A. Precision Plumbing Products model P-2, adjustable to line pressure, automatic trap primer with all bronze body, integral vacuum breaker, non-liming internal operating assembly with gasketed

bronze cover. Install with shut off valve and access doors in Janitor's closets, Mechanical Rooms and other areas not served by, or in close proximity to, flushometer valve operated water closets.

2.13 ACCESS PANELS:

A. Where construction is not inherently accessible, provide adequately sized and conveniently located access doors in ceilings, walls, and furring for access to controls and for servicing valves, equipment, etc.

1. Fire Rated walls and ceilings: Milcor, Style UFR, U.L. Class B, 1½ hour rating, insulated, self closing, self latching, flush key operated cylinder lock, interior latch release. Minimum size shall be 12" x 12". Provide larger sizes where required.
2. Drywall ceilings or walls: Milcor, Style DW, prime coated steel, flush screwdriver-operated cam lock. Minimum size shall be 12" x 12". Provide larger sizes where required.
3. Masonry and tiled walls: Milcor, Style M, prime coated steel, flush screwdriver-operated cam lock. Tiled walls shall have satin finish stainless steel. Minimum size shall be 12" x 12". Provide larger sizes where required.
4. Plastered walls and ceilings: Milcor, Style K, prime coated steel, flush screwdriver-operated cam lock. Minimum size shall be 12" x 12". Provide larger sizes where required.

B. Doors shall be delivered to the General Contractor for installation.

2.14 VALVE BOXES

A. Christy #F-08, complete with concrete cover and required extensions. Index all covers "GAS" or "WATER" as required for service use.

2.15 STRAINERS

A. For pipes 1 ½" – 2": NIBCO T/S 221/222-A or Wilkins S or YB series strainer, 20 mesh type 304 stainless steel screen, bronze construction 200 psi CWP or approved equal. Provide with hose bibb drain.

B. For pipes 2 ½" & larger: NIBCO F-721A or Wilkins F series, flanged, 125 lb., tapped bolted bonnet with plug and stainless steel screen.

2.16 THERMOMETERS

A. Weksler "Adjust-Angle", or equivalent Weiss, with separable sockets and 6" minimum scale reading 30-240°F.

2.17 VIBRATION AND SOUND CONTROL

A. Make all necessary provisions to prevent the transmission of vibration to the building structure and the passage of noise from the equipment rooms to other rooms. Provisions shall include: vibration isolators for motor driven equipment; flexible pipe connections to motor driven equipment; resilient mounting for piping; sealing off pipe and duct penetrations of walls, floors and ceilings of equipment rooms.

B. Provide pipe and sound isolation for all piping through walls, Acoustoplumb by LSP Products, Holdrite Silencer by Hubbard Enterprises, or equal.

2.18 FIXTURES:

A. The quantity and location of fixtures shall be taken from the Architectural and Plumbing drawings. Provide adequate supports and all standard trim normally furnished for fixtures. All enamel shall

be acid resisting. Traps, unless otherwise noted shall be 17 gage brass tubing, chrome plated when exposed.

B. Submit catalog cut-sheets on all fixtures.

C. Except as otherwise shown, provide ¼" steel backing plates, 36" wide by 12" high minimum size, secured to a minimum of three studs by welding, or with ¼" x 2½" lag screws for all wall hung fixtures for which no other means of support is specified.

D. Stops and supplies: Provide stops for all fixtures. Unless otherwise specified, stops exposed at lavatories and similar fixtures shall be Chicago #1016ABCP chrome plated, loose key. Concealed stops shall be Chicago #1771ABCP.

E. All vitreous china fixtures shall be Zurn, Kohler, or American Standard, except where specifically noted otherwise. All fixtures shall be standard white color, except as noted.

F. All fixtures shall meet or exceed the requirements of the California Administrative Code, Title 24, Part 5.

G. All plumbing fixtures providing domestic water shall comply with AB 1953, lead free. This includes, but is not limited to, lavatory faucets, sink faucets, shower valves, emergency showers, hose bibbs, and drinking fountains.

1. P-1 - WATER CLOSET

a. Fixture: Zurn Z5615-BWL; wall mounted; vitreous china; elongated bowl; 1.28 gpf

b. Flush Valve: Sloan "Royal" #111-1.28 or Zurn Z6000, exposed diaphragm-type, chrome plated; synthetic rubber diaphragm with dual filtered bybass; 1.28 gpf

c. Seat: Olsonite #95SSCT or Zurn Z5955SS-EL; extra heavy duty; elongated; open front; less cover; integral bumpers; self-sustaining check hinge; white.

d. Carrier: Zurn Z1201/Z1202 EZ Carry; 500 lb. capacity

2. P-1A - WATER CLOSET (ADA)

a. Fixture: Zurn Z5615-BWL; wall mounted; vitreous china; elongated bowl; ADAS compliant; 1.28 gpf

b. Flush Valve: Sloan "Royal" #111-1.28 or Zurn Z6000, ADA compliant; exposed diaphragm-type, chrome plated; synthetic rubber diaphragm with dual filtered bybass; Install flush valve on wide side of ADA water closet enclosures; 1.28 gpf

c. Seat: Olsonite #95SSCT or Zurn Z5955SS-EL; extra heavy duty; elongated; open front; less cover; integral bumpers; self-sustaining check hinge; white.

d. Carrier: Zurn Z1201/Z1202 EZ Carry; 500 lb. capacity

3. P-2 – LAVATORY

a. Fixture: Zurn Z5344; 20" x 18", vitreous china, wall hung, punched for 4" centers. See Architectural Drawings for mounting height.

b. Faucet: Chicago 802-VE2805-665ABCP; deck mounted, 4" fixed centers; metering (HW/CW)

c. Drain: McGuire #155A; open grid P.O. plug.

d. P-Trap: McGuire #8902 adjustable trap with cleanout.

e. Carrier: Zurn Z1251

4. P-2A – LAVATORY (ADA)

b. Fixture: Zurn Z5344; 20" x 18", vitreous china, wall hung, punched for 4" centers. See Architectural Drawings for ADA mounting height.

b. Faucet: Chicago 802-VE2805-665ABCP; deck mounted, 4" fixed centers; metering (HW/CW)

c. Drain: McGuire #155WC; offset tailpiece; open grid P.O. plug.

d. P-Trap: McGuire #2150; insulated adjustable trap with cleanout; includes covers for riser, angle stop, and tailpiece

e. Carrier: Zurn Z1251

5. P-3 – URINAL

a. Fixture: Zurn Z5738-U; vitreous china, high efficiency; ¾" top spud; 0.125 gpf.

b. Flush Valve: Sloan "Royal" 186-0.125DBP or Zurn Z6003"; exposed; double bypass 0.125 gpf.

c. Carrier: Zurn Z-1222

6. P-3 – URINAL

a. Fixture: Zurn Z5738-U; vitreous china, high efficiency; ¾" top spud; 0.125 gpf.

b. Flush Valve: Sloan "Royal" 186-0.125DBP or Zurn Z6003"; exposed; double bypass 0.125 gpf.

c. Carrier: Zurn Z-1222

7. P-4 - MOP SINK

c. Fixture: Florestone "Model 96"; neo angle; drop front mop receptor; 24" x 24" x 12"; terrazzo; stainless steel cap.

d. Faucet: Chicago 897-RCF; vacuum breaker; pail hook; rough chrome plated; adjustable centers.

8. P-5 – SINK

a. Fixture: Just SLF-1921-ADA-GR, single compartment; 19 " x 21" x 6½" deep self-rimming; 18 gauge; Type 304 stainless steel; 3 hole punched; integral overflow

b. Faucet: Chicago #786-E35XKABCP; 8" centers; 5 ¼" rigid/swing gooseneck spout; wristblade handles; 1.5 gpm (HW/CW)

c. Drain: Just J-35-FS strainer.

d. P-Trap: McGuire 8903

7. P-6 - DRINKING FOUNTAIN & BOTTLE FILLER (ADA)

a. Fixture: Elkay "EZH2O", #VRCTLDDWSK, ADA compliant; vandal-resistant bottle filling station, green ticker, electronic bottle filler button with mechanical front bubbler button activation, 1.5 gpm fill rate; non-filtered, non-refrigerated bi-level drinking fountain, stainless steel vandal resistant bubblers, "real drain" system; indoor/outdoor use

8. P-7 SHOWER (ADA)

a. Fixture: Tile shower area. See Architectural Drawings for mounting heights of valves and head, 1C/EF/SB built in showers with concealed supplies

b. Shower Head: Bradley model B24, 60" flexible hose; 24" metal slide bar with hand shower; chrome plated brass supply arm, vacuum breaker, 1.5 gpm flow control

c. Valve: Bradley Equa-Flo C5 Pressure Balancing Thermostatic Mixing Valve

9. P-8 – EMERGENCY EYEWASH & SHOWER:

a. Fixture: Guardian Equipment, model G1942, combination eyewash and shower safety station; freeze and scald protection valves; 10" diameter orange ABS plastic shower head; 2 spray heads with flip top dust cover, internal flow control & filter; 11" stainless steel bowl; ANSI compliant identification sign

2.19 GAS-FIRED WATER HEATERS

A. Water heater shall be A.O. Smith, "BTH" series or equal Bradford White, EF series.

1. Water heater shall be of the seamless glass lined steel tank construction in which the glass coating is applied to the waterside surfaces of the tank after the tank has been assembled and welded.
2. The water heater shall have foam insulation, a CSA Certified and ASME rated T&P relief valve, and a down-fired power burner designed for precise mixing of air and gas, requiring no special calibration on start-up.
3. The water heater shall be approved for 0" clearance to combustibles.

B. Heater shall be supplied with maintenance-free powered anode.

C. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display and shall have digital temperature reset.

D. The water heater shall be design-certified by Underwriter's Laboratories, Inc. according to ANSI Z21.10.3-CSA 4.3 standards governing storage type water heaters; and shall meet the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE90.1. It shall comply with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

E. Water heater should incorporate the iCOMM™ system for remote monitoring, leak detection and fault alert.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. This Contractor shall be held to have examined the site and compared it with the Contract Documents, and to have satisfied himself as to the conditions under which the work is to be performed. In the event of discrepancy, he shall notify the Architect and proceed as he directs. He

shall be held responsible for all existing conditions, whether or not accurately described, and no allowance shall subsequently be made on his behalf for any error, omission, or extra expense to which he may be put due to failure or neglect on his part to make such examination and notification.

B. Prior to commencing the work of this Section, this Contractor shall inspect the installed work of other trades and verify that their work is sufficiently complete to permit the start of work under this Section and that the completed work will be in complete accordance with the original design. In the event of discrepancy immediately notify the Architect and proceed as he directs.

3.02 ACCESSIBILITY

A. Equipment shall be placed and piping connections made in such a manner that all routine adjustments and maintenance operations may be carried out without inconvenience and so that all code requirements for clearances are maintained.

3.03 VIBRATION AND SOUND CONTROL

A. Make all necessary provisions to prevent the transmission of vibration to the building structure and the passage of noise from the equipment rooms to other rooms. Provisions shall include: vibration isolators for motor driven equipment; flexible pipe connections to motor driven equipment; resilient mounting for piping; sealing off pipe and duct penetrations of walls, floors and ceilings of equipment rooms.

3.04 INSTALLATION, GENERAL

A. Provide all necessary cutting in connection with the work of this Section. No structural members shall be drilled, bored, or notched in a manner that will impair their structural capacity; all penetrations of concrete or masonry shall be made with core drills. No cutting shall be done without the approval of the Architect.

3.05 INSULATION

A. Insulation shall be applied in complete accordance with the manufacturer's published installation instructions. All insulation shall be applied on clean, dry surfaces and shall be continuous through wall and ceiling openings and sleeves. All joints shall be firmly butted together and longitudinal jacket laps and butt strips shall be smoothly secured. Specified adhesives, mastics, and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.

3.06 INSTALLATION, PIPING

A. Soil, Waste, Vent, Drain Piping:
   1. Soil, waste, and vent piping occurring within the building shall be installed to a uniform minimum grade of ¼" per foot unless otherwise noted. Vent piping shall be graded so that all condensation shall flow directly to a soil or waste line.
   2. Exterior soil and waste lines shall be installed to inverts or grades indicated on the drawings.
   3. Bell and Spigot pipe shall be installed with the bell up grade.
   4. Changes in direction of drainage piping shall be accomplished by the use of appropriate drainage and sanitary fittings.
   5. Drilling and tapping of drains, soil, waste, or vent pipes and the use of saddle hubs and bands are prohibited.

6. Protection against breakage of piping passing under or through walls shall be provided using specified sleeves and caulking.
7. Adapters shall be installed between threaded iron and soil pipe.
8. Test tees shall be installed at the foot of all soil, waste, and storm water stacks.
9. Cleanouts shall be located where indicated on the Drawings; at all horizontal offsets; at ends of waste or sewer branches more than 5' in length; at intervals of 100' in straight runs of piping, or at closer intervals if directed or required by local code. Location of cleanouts in finished spaces shall be approved by the Architect prior to installation.

B. Hot, Cold Water Systems:
1. Di-electric unions shall be installed where copper pipe is connected to galvanized steel piping or stub outs.
2. Connections from copper pipe to fixture supply fittings shall be made with copper or brass nipples.
3. Provide 18" high vertical air chambers at all domestic water connections to fixtures and/or equipment that are not specified to have shock absorbers.
4. All domestic water piping shall be kept clear of the building structure. Where it is within 1" of the building structure it shall be wrapped with felt (3/16" minimum thickness).
5. To the greatest extent possible, domestic cold water piping shall be kept separated from hot piping and where there is a choice shall be run in the coolest portion of the available space.

C. Natural Gas Piping Systems:
1. Natural gas piping shall slope back to meter where possible; bottom of vertical natural gas lines shall be fitted with 6" long capped drip legs.
2. In addition to main shut-off valve, a natural gas stopcock shall be installed at each natural gas fired piece of equipment.

D. Plumbing Fixtures:
1. Space between wall mounted fixtures and wall surface shall be neatly pointed up with G.E. silicone rubber compound of color matching fixture.
2. All exposed bolt heads and nuts used to secure fixtures shall be concealed with vitreous china caps.

E. Flashing:
1. All roof and wall penetrations shall be flashed and counterflashed water tight with 26 gauge sheet metal, except as noted.
2. Vents through roof shall be flashed with Semco #1100-4 lead flashing assemblies. Flashing shall be extended over top of pipe and shall be turned down inside top of pipe.

F. Excavation, Backfill:
1. Provide all excavation, trenching, and backfill in connection with the work of this Section.
2. Excavation shall be carried to 4" below the bottom of pipes. Provide a sand bedding for all sloped drainage piping, and provide smooth uniformly graded bedding of firm but yielding material for all other piping, catch basins, and similar structures.
3. Backfill material shall be non-corrosive and free from all foreign material that could damage pipes. Installation shall be in accordance with "Earthwork" Section.

G. Indirect Waste Piping:
1. Indirect waste piping shall be installed to a uniform minimum grade of ¼" per foot unless otherwise noted.
2. Changes in direction of indirect waste piping shall be accomplished by the use of appropriate drainage fittings.
3. Drilling and tapping of indirect waste pipes and the use of saddle hubs and bands are prohibited.

4. Protection against breakage of piping passing under or through walls shall be provided using specified sleeves and caulking.

3.07 CONNECTION, OWNER FURNISHED EQUIPMENT

A. All electrical wiring and connections for equipment furnished under this Section shall be furnished and installed under the Electrical Sections.

3.08 TESTING, INSPECTIONS

A. General:

1. This Contractor shall not allow or cause any work of this Section to be covered or enclosed until it has been inspected, tested, and approved by the Architect and the authorities having jurisdiction over the Work. Should any of this work be enclosed or covered up before such inspection, testing, and approval, this Contractor shall uncover the work, have the necessary inspections, tests, and approvals made and, at NO expense to the Owner, make all repairs necessary to restore both his work and that of other contractors which may have been damaged to be in conformity with the Contract Documents.

B. Tests:

1. This Contractor shall make all tests required by all local, state, and federal laws, codes, ordinances, and regulations having jurisdiction over this work.
2. Furnish all necessary labor, materials, and equipment for conducting tests, and pay all expenses in connection therewith. Should leaks develop while testing, repairs shall be made, and tests shall be repeated until a satisfactory test is obtained.
3. Water Piping: Shall be hydrostatically tested for six (6) hours at 150 psi. All equipment shall be tested water tight at utility pressure.
4. Drainage and Vent Piping: Shall be tested for (1) hour by plugging all outlets and filling the pipes with water to the top of vertical sections of pipes. No loss of water shall be permitted.
5. Natural Gas Piping: Shall be tested for twenty-four (24) hours at a pressure of 50 psig with nitrogen or compressed air. NO pressure drop shall be allowed during the last four (4) hours of the test. Tests joints of natural gas piping with Leak-Tek or Nupro-Snoop solution while maintaining ten (10) psig minimum internal pressure.
6. Compressed Air Piping Systems: Shall be tested with compressed air at 150 psig for six (6) hours. No pressure drop shall be allowed during the last four (4) hours of the test. Check for leaks with a soap solution.

3.09 CLEANING

A. Flush all water piping systems. Remove, clean and replace all strainer baskets prior to final inspection.

B. Blow out all compressible fluid piping with compressed air before connecting with regulators or equipment.

3.10 DOMESTIC WATER SYSTEM STERILIZATION

A. Upon completion of this work, the new domestic water system shall be thoroughly flushed, sterilized and reflushed. Sterilization and reflushing shall be performed using the procedure below. All work shall be performed in the presence of the inspector.

B. All domestic water outlets shall have signs posted at their location stating that the water has not been sterilized and shall not be used for human consumption. The signs shall remain until the sterilization process is complete.

C. Procedure

1. Introduce chlorine or a solution of sodium hypochlorite, filling the lines slowly and supplying the sterilization agent at a rate of 200 parts of chlorine per million. The entire system shall be completely filled with the solution. All valves shall be operated and ends of all branches tested for residual chlorine. Continue to inject the solution until at least 200 ppm of free chlorine is indicated.
2. After the sterilizing agent has been applied, the system shall be isolated with the solution retained for at least 3 hours. Test for residual chlorine after retention. If less than 200 ppm is indicated, repeat the sterilization procedure.
3. After satisfactory sterilization, flush the system until all traces of the chemical are removed or until the chlorine content is no greater than that in the existing supply.

D. After a period of 48 hours minimum, bacteriological tests, using samples from at least 3 representative points, shall be made by recognized testing agency, who shall certify to the Architect that the system is bacteriologically safe and at least equal in safety to that of the principal water supply. The laboratory report and certification shall be transmitted to the Architect.

3.11 ADJUSTING

A. Properly adjust all stops, and controls, and demonstrate safe and satisfactory operation of all equipment.

3.12 CLEANUP

A. Upon completion of the work of this Section, remove all surplus material, debris, and equipment associated with or used in the performance of this work.

END OF SECTION

SECTION 23 0000

HEATING, VENTILATING, AIR CONDITIONING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The requirements of the General Conditions, Supplemental General Conditions, Division 01 Sections and Section 23 0500 - General Mechanical apply to all work herein.

1.02 DESCRIPTION

A. This Specification establishes the required standards for all labor, materials, equipment and workmanship in connection with the furnishing, fabrication and installation of complete "Heating, Ventilating, Air Conditioning" systems.

B. The HVAC Contractor shall furnish all materials and labor under the scope of the Contract, unless otherwise noted. Anything accepted as standard trade practice reasonably incidental to the completion of the system shall be furnished without additional cost to the Owner. The Contractor shall understand that the work herein described shall be complete in every detail, notwithstanding every item necessarily involved is not particularly mentioned, and the Contractor shall be held to provide all labor and material necessary for the entire completion of the work to be intended to be described.

C. Heating, ventilating, air conditioning work includes but is not necessarily limited to the following:
1. Variable Refrigerant Volume heat pumps with heat recovery;
2. Gas fired unit heaters;
3. Gravity relief ventilators;
4. General exhaust ventilation systems;
5. Garage ventilation system;
6. Flues, inclusive of all appurtenances, for equipment supplied under this section;
7. Thermal and sound insulation for all piping and ductwork supplied under this Section;
8. Refrigerant piping and appurtenances;
9. Ductwork, inclusive of all air turns, dampers, grilles, diffusers, fire dampers, sound traps, supports, bracing and fresh air/combustion air ducts;
10. Flashings, curbs and caps in connection with all equipment, piping and ductwork supplied under this Section;
11. Temperature control wiring and control devices;
12. Start up, adjusting, and balancing.

1.03 RELATED WORK

A. Sheet metal flashing and trim: Division 07.

B. Domestic water piping: Section 22 0000 - "Plumbing".

C. Line voltage wiring, disconnect switches, conduit for temperature control wiring, and final connection of electrical equipment: Division 26.

D. Finish painting: Division 09.

E. Condensate drainage piping to points adjacent to equipment: Section 23 0000 - Plumbing.

F. Natural gas piping to points adjacent to equipment: Section 23 0000 - Plumbing.

G. HVAC Controls: Section 23 0923 - Direct Digital Controls for HVAC.

H. Air Balancing: Section 23 0593, Testing, Adjusting and Balancing of HVAC

PART 2 PRODUCTS

2.01 GENERAL

A. Only specified materials shall be utilized in the work of this Section unless substitutions have been approved by the Architect and in accordance with Division 01 Sections for Substitutions and Product Options.

B. Provide guards to enclose exposed moving equipment components in accordance with Title 8, California Code of Regulations. Fabricate belt guards with rigid angle iron frame, expanded metal screen, pivoted 4" diameter tachometer opening covers, and in two pieces to permit lubrication or sheave and belt adjustment without removing guard. Provide removable sheet metal guards at shafts and couplings and removable framed wire mesh guards at openings in mechanical systems.

2.02 REFRIGERANT PIPING AND APPURTENANCES:

A. Refrigerant piping shall be Type "ACR" drawn temper, seamless copper tube, ASTM B 280. .

B. Mechanical joints on refrigerant piping systems are prohibited. All refrigerant piping joints shall be brazed. Use lead-free, silver solder, minimum 15% silver content.

C. Pipe fittings shall be wrought-copper with soldered joints; ASME B16.22.

D. Flexible connections shall be bronze, double braided, sweat solder ends.

E. Moisture/liquid indicators (sight glasses) shall be color change moisture indication type, replaceable element, filter screen and pad, sweat solder ends; Sporlan "See-All", Henry, or equal.

F. Charging and purge valves shall be forged brass, diaphragm packless, globe type, angle or straight through, one end solder, one end flare; Henry 623 and 643 series, Sporlan, or equal.

G. Solenoid valves shall be forged brass, extended end connections, solder ends, molded coil; Sporlan "E" series or equal. Comply with ARI 760 & UL 429.

H. Filter driers shall be replaceable media, angle type; Henry "Dri-Cor" or equal; ARI 730.

I. Electronic thermostatic expansion valves shall have stainless steel body and connections, ceramic slide and port, linear flow capacity, continuous modulation, and direct coupling of motor and valve. Emerson "EX" series or equal.

J. Pipe hangers: All refrigerant piping shall be supported 8' on center.

K. Split system fan-coil units and heat pump units shall have brazed sweat-fitting connections on the refrigerant piping between the units with a flexible piping section at the outdoor unit.

2.03 FILTERS FOR A/C AND AIR HANDLING EQUIPMENT

A. Unless otherwise specified, air filters shall be Model Pre-Pleat M13 panel filters, as manufactured by Flanders.

B. Each filter shall consist of synthetic only media, with corrosion-resistant expanded metal backing and moisture resistant enclosing frame. The filter shall be 2" nominal depth. The grid shall be 100% bonded to the media on the air exiting side to eliminate media vibration and pull-away.

C. The grid shall be formed to provide a uniform V-wedge shaped pleat with the open area on the air exiting side for maximum utilization of the media and low airflow resistance. The filter shall be classified for flammability by Underwriters Laboratories, Standard 900 as Class 2.

D. The filter shall have a Minimum Efficiency Reporting Value (MERV) of 13 by ASHRAE Standard

52.2.

2.04 LOUVERS

A. Louvers shall be Ruskin model ELF375D, or approved alternate, extruded aluminum louver with stationary 4" aluminum drainable blades, extruded aluminum frame with downspouts, ¾" mesh expanded aluminum bird screen and intermediate stiffening mullions as required.

2.05 UNIT HEATERS

A. Reznor UDAS series, or approved equal, as scheduled on the Drawings. The units shall be high-efficiency, power vented, natural gas-fired unit heaters as scheduled on the Drawings. Gas connection shall be external to the cabinet.

B. Heat Exchanger. The heater shall be equipped with a multicell, 4-pass serpentine style steel heat exchanger. Heat exchanger tubes shall be press fabricated of titanium stabilized, corrosion resistant aluminized steel. All heat exchangers shall be fabricated with no welding or brazing, only tool pressed mechanical joints. All heat exchanger cells shall be designed with an aerodynamic cross section to provide maximum airflow.

C. Burner. The units shall incorporate a single, one piece burner assembly with a single orifice. The burner shall have a continuous wound close pressed stainless steel ribbon separating the flame from the burner interior. All units shall have a single venturi tube and orifice supplying fuel to a one-piece burner housing. Each heat exchanger cell shall use balanced draft induction to maintain optimum flame control.

D. Controls.
   1. Controls shall include a two-stage gas valve; direct spark multi-try ignition with electronic flame supervision, with 100% lockout integrally controlled via a printed circuit control board. The control board shall also incorporate diagnostic lights, DIP switches for fan overrun settings, and a relay for fan only operation. All units shall be equipped with a safety limit switch.
   2. All controls shall be enclosed in the unit housing to protect them from accidental damage that could be caused by factors in the building that would adversely affect external controls.

E. Combustion Air and Venting.
   1. The unit shall have a factory-installed power venter device to draw combustion air through an inlet in the rear of the cabinet.
   2. The combustion air/venting system shall include a vibration isolated power venter motor and wheel assembly and a combustion air pressure switch and a flame rollout switch.

F. Electrical
   1. Operation shall be controlled by an integrated circuit board that includes LED diagnostic indicator lights. Supply voltage connections are made at the circuit board. 24-volt control connections shall be made on an externally mounted terminal strip with connections (W1, W2, R, and G). All internal wiring, both line and control voltages, shall be terminated by insulated terminal connectors to minimize shock hazard during service.
   2. Each unit shall be equipped for use with 115/1 volt power supply.

G. Cabinet.
   1. The cabinet shall be low profile with a pre-coat or powdercoat RAL 1001 white paint finish. Finish shall be a minimum 80 gloss on G30 galvanized steel. The cabinet shall be constructed so that screws are not visible from the bottom, front, or sides, except for service panel and accessories. Unit construction shall incorporate a beveled front corner on control side. All units shall be manufactured with a tooled drawn supply air orifice on the rear panel to reduce fan inlet noise.

2. The unit shall be designed for ceiling suspension featuring 3/8”-16 female threads at both 2-point and 4-point locations, with no additional adapter kits.
3. The cabinet shall be equipped with RAL 3005 burgundy painted, roll-formed horizontal louvers. Louvers shall be spring held and adjustable for directing airflow. Downturn nozzles with vertical louvers shall be available.
4. The cabinet shall be equipped with a full safety fan guard. The open drip-proof motor and fan assembly shall be resiliently mounted to the cabinet to reduce vibration and noise.

H. The unit shall be designed with a full opening service access panel complete with screw closure attachment and lifting handle for removal. All components in the gas train, all standard electrical controls, and the power venter shall be within the service compartment.

I. Certifications: Units shall be manufactured in an ISO 9002 certified facility.

2.06 FLUES

A. All flue-gas carrying parts of the vent system shall be Metalbestos Type “B”, or approved equal, double-wall gas vent piping, and such piping shall be continuous from the appliances outlets into the Metalbestos vent top of housing.

B. Provide complete with: adjustable roof flashing; storm collar; pipe collar at ceiling penetration; and “bird-proof” top. Horizontal flues 5’ or longer and all vertical flues shall be supported as detailed in the Metalbestos RV and QC Installation Instructions, or as detailed in the manufacturers installation instructions.

2.07 EXHAUST FANS (GREENHECK)

A. Submittals
1. General: Submit in accordance with Section 01 33 00 Submittal Procedures
2. Provide dimensional drawings and product data on each fan.
3. Provide fan curves for each fan at the specified operation point, with the flow, static pressure and horsepower clearly plotted.
4. Provide outlet velocity and fan's inlet sound power readings for the eight octave bands, decibels, and sones.
5. Provide manufacturer's certification that exhaust fans are licensed to bear Air Movement and Control Association (AMCA), Certified Rating Seal for sound and air performance
6. Installation, Operation, and Maintenance Manual (IOM): Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, pulley adjustment, receiving, handling, storage, safety information and cleaning. A troubleshooting guide, parts list, warranty and electrical wiring diagrams

B. Quality Assurance
1. Performance ratings: Conform to AMCA standard 211 and 311. Fans must be tested in accordance with ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall be certified to bear the AMCA label for air and sound performance seal
2. Classification for Spark Resistant Construction, levels A, B, and C conform to AMCA 99
3. Each fan shall be given a balancing analysis which is applied to wheels at the outside radius. The maximum allowable static and dynamic imbalance is 0.05 ounces (Balance grade of G6.3).
4. Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.
5. Each fan shall bear a permanently affixed manufacture's nameplate containing the model number and individual serial number

C. Warranty
   1. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
      a. The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at the Manufacturers option when returned to Manufacturer, transportation prepaid.
      b. Motor Warranty is warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station.

2.08 DUCT MOUNTED IN-LINE EXHAUST FANS

A. Greenheck "BSQ" series exhaust fans, as scheduled on the Drawings. or approved equal. The fans shall be of the duct mounted supply, exhaust, or return fans of the centrifugal, belt driven in-line type The fans shall be duct mounted, and of the centrifugal, belt driven in-line type.

B. The fan housing shall be of the square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction. The drive frame shall be of welded steel. The motor plate shall pivot with adjusting screws for belt tensionig.

C. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access all interior components.

D. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be dynamically and statically balanced.

E. Motors shall be permanently lubricated, heavy-duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase. Motor enclosures shall be open driproof.

F. Precision grounded and polished fan shafts shall be mounted in permanently sealed bearings or pillow block ball bearings. Bearings shall be selected for a minimum L10 life in excess of 100,000 hours, at maximum cataloged operating speed.

G. Drives shall be sized for a minimum of 150% of driven horsepower. The belts shall be static free and oil resistant. Pulleys shall be cast type, keyed and securely attached to wheel and motor shafts. Pulleys shall be adjustable for final system balancing. The drive assembly shall be readily accessible for maintenance with two-sided access panels mounted perpendicular to the motor mounting panel.

H. A NEMA 1 disconnect switch with positive electric shut-off shall be provided, factory wired from motor to the junction box installed within motor compartment.

2.09 CEILING MOUNTED EXHAUST FANS

A. Greenheck “CSP-A” series, or approved equal, direct drive, premium inline cabinet centrifugal exhaust fans, as scheduled on the Drawings. Each fan shall bear the AMCA seal for both sound and air performance, shall be UL Listed 507 – Electric Fans, and shall bear a permanently affixed manufacturer’s nameplate containing the model number and individual serial number.

B. The fan wheel shall be forward curved, centrifugal, and constructed of galvanized steel or calcium carbonate filled polypropylene. The fan wheel shall be dynamically balanced in accordance to

AMCA Standard 204-05.

C. The motor enclosures shall be open drip-proof (ODP), opening in the frame body and or end brackets. Motors shall be permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase. Motors shall be mounted on vibration isolators and be accessible for maintenance. Motors shall be compatible for use with speed controls and have thermal overload protection.

D. The fan housing shall be constructed of heavy gauge galvanized steel. The interior shall be lined with 0.5 inches of acoustical insulation.

E. The outlet shall be field rotatable from horizontal to vertical discharge and the duct collar shall include a spring loaded aluminum backdraft damper. The access for wiring shall be external.

F. Each fan shall be complete with all options and accessories as scheduled on the Drawings.

2.10 GRAVITY VENTILATORS

A. Greenheck, model GRSI, intake gravity ventilators and model GRSR relief gravity ventilators where indicated.

B. Hood shall be constructed of aluminum. Internal structure shall be constructed of galvanized steel. Birdscreen shall be constructed of ½ inch galvanized mesh, and mounted horizontally across the intake area of the hood.

C. Housing shall be constructed of aluminum, including windband and curb cap. Windband to be one piece spun aluminum construction and maintain original material thickness throughout the housing. Windband to include an integral rolled bead. Curb cap shall have integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to roof.

D. Provide with roof curb, and gravity type backdraft damper for intake or relief as indicated on Drawings.

E. Options / Accessories
   1. Insulated roof curb, to be mounted onto roof with fan.
   2. Gravity type backdraft damper, with galvanized frames with pre-punched mounting holes. Damper shall be balanced for minimal resistance to flow.
   3. Insect screen constructed of fine mesh aluminum and fitted to the top of the throat to prevent entry of insects.

2.11 CIRCULATION FANS

A. Big Ass Fans, "Isis" series lightweight commercial fan with anodized aluminum airfoils and black winglets. The motor shall be gearless direct-drive type. The fan(s) shall have 1 ft extension tube and a wall mounted controller.

2.12 AIR COMPRESSOR

A. Ingersoll Rand model 2340L5-V, or equal, with 60 gallon stationary vertical tank. The air compressor shall be electric driven two-stage, with a 100% cast iron pump, ODP electric motor, automatic start stop control with a NEMA 1 pressure switch mounted and an ASME coded air receiver tank.

2.13 SPLIT SYSTEM VRF UNITS

A. The variable capacity, heat pump heat recovery air conditioning systems shall be a Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning systems. The systems shall consist of an S-series "PUMY" outdoor unit and a R2-series "PURY" outdoor unit, "PEFY", "PLFY" and

"PKFY" series CITY MULTI indoor units, and M-NET DDC (Direct Digital Controls). Each CITY MULTI indoor unit or group of CITY MULTI indoor units shall be independently controlled.

B. Quality Assurance
1. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
3. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
4. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.
5. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

C. Warranty
1. The units shall be covered by the manufacturer's limited warranty for a period of one (1) year from date of installation.
   c. If the systems are:
      1) designed by a certified CITY MULTI Diamond Designer,
      2) installed by a contractor that has successfully completed the Mitsubishi Electric 3-day service course, AND
      3) verified with a completed commissioning report submitted to and approved by the Mitsubishi Electric Service Department,
   d. then the units shall be covered by an extended manufacturer's limited warranty for a period of five (5) years from date of installation.
2. In addition the compressor shall have a manufacturer's limited warranty for a period of seven (7) years from date of installation.
3. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.
4. This warranty shall not include labor.

D. General:
1. Manufacturer shall have a minimum of twenty-nine years of HVAC experience in the U.S. market.
2. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.
3. The CITY MULTI VRF system shall be installed by a contractor with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

E. Controls
1. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
2. System controls and control components shall be installed in accordance with the

manufacturer's written installation instructions.

3. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.
4. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.
5. Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.
6. System shall be capable of email generation for remote alarm annunciation.
7. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in Mitsubishi controls system configuration and operation. The representative shall provide proof of certification for Mitsubishi CMCN Essentials Training and/or CMCN Hands-On Training indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

2.14 R2-SERIES OUTDOOR UNIT (PURY)

A. General:

1. The R2-Series PURY outdoor unit shall be used specifically with CITY MULTI VRF components. The PURY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
2. The model nomenclature and unit requirements are shown below. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.

Outdoor Unit Model Nomenclature		
208/230 Volt		Twinning Kit
Model Number	Units	
PURY-P192TSKMU	(2) PURY-P96TKMU	CMY-R100CBK2

3. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
4. Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller (Single or Main) shall be insulated.
5. There shall be no more than 3 branch circuit controllers connected to any one outdoor unit.
6. Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.
7. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
8. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
9. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet and have total refrigerant tubing length of 1804-2625 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.
10. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperatures or cooling mode down to 23°F ambient temperatures, without additional low

ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

11. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
12. Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend "no or reduced heating" periods shall not be allowed.

B. Unit Cabinet:
   1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (–BS models)

C. Fan:
   1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.
   2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
   3. All fan motors shall be mounted for quiet operation.
   4. All fans shall be provided with a raised guard to prevent contact with moving parts.
   5. The outdoor unit shall have vertical discharge airflow.

D. Refrigerant
   1. R410A refrigerant shall be required for PURY-P-T/Y(S)KMU-A outdoor unit systems.
   2. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

E. Coil:
   1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
   2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
   3. The coil shall be protected with an integral metal guard.
   4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
   5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

F. Compressor:
   1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.
   2. A crankcase heater(s) shall be factory mounted on the compressor(s).
   3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.
   4. The compressor will be equipped with an internal thermal overload.
   5. The compressor shall be mounted to avoid the transmission of vibration.
   6. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

G. Controls:
1. The outdoor unit shall have the capability of up to 8 levels of demand control for each refrigerant system

H. Electrical:
1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz.
2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz).
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.15 BRANCH CIRCUIT (BC) CONTROLLERS FOR R2-SERIES SYSTEMS

A. General
1. The BC (Branch Circuit) Controllers shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices with no subcooling risk bubbles in liquid supplied to LEV and are not allowed.
2. The BC (Branch Circuit) Controllers shall be specifically used with R410A R2-Series systems. These units shall be equipped with a circuit board that interfaces to the M-NET controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

B. BC Unit Cabinet:
1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant
1. R410A refrigerant shall be required.

D. Refrigerant valves:
1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and up to three indoor units. Branches may be twinned to allow more than 54,000 BTUH.
2. Each branch shall have multiple two-position valves to control refrigerant flow.
3. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.
4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

E. Integral Drain Pan:
1. An Integral drain pan and drain shall be provided

F. Electrical:
1. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).
3. The BC Controller shall be controlled by integral microprocessors

4. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.16 S-SERIES (PUMY) OUTDOOR UNIT

A. The PUMY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.
   1. The sum of connected capacity of all CITY MULTI indoor units shall range from 50% to 130% of outdoor rated capacity.
   2. Outdoor unit shall have a sound rating no higher than 59 dB(A).
   3. Both refrigerant lines from the outdoor unit to indoor units shall be individually insulated.
   4. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
   5. The outdoor unit shall have a high-pressure safety switch, low pressure safety switch and over-current protection and DC bus protection.
   6. The outdoor unit shall have the ability to operate with a maximum height difference of 98 feet for the PUMY-P36NHMU and have a total refrigerant tubing length of 393 feet for the PUMY-P36NHMU. The greatest length is not to exceed 262 feet between the outdoor unit and the CITY MULTI indoor units and shall not require line size changes nor traps.
   7. The outdoor unit shall have rated performance for heat operation at 0°F for the PUMY-P36NHMU (-BS) & PUMY-P48NHMU (-BS) and -4°F for the PUMY-P60NKMU (-BS) ambient temperature without additional low ambient controls.
   8. The outdoor unit shall be capable of cooling operation down to 23°F outdoor ambient without additional low ambient controls.
   9. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

B. Unit Cabinet:
   1. The casing shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

C. Fan:
   1. The unit shall be furnished with two direct drive, variable speed motors.
   2. The fans will be forward curved type blades for quiet operation.
   3. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
   4. The fan motor shall be mounted for quiet operation.
   5. The fan shall be provided with a raised guard to prevent contact with moving parts.
   6. The outdoor unit shall have horizontal discharge airflow.

D. Refrigerant
   1. R410A refrigerant shall be required for all S-Series outdoor unit systems.

E. Coil:
   1. The outdoor coil shall be of nonferrous construction with lanced or corrugated fins on copper tubing.
   2. The coil fins will have a factory applied corrosion resistant blue-fin finish.
   3. The coil shall be protected with an integral metal guard.
   4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

F. Compressor:
   1. The compressor shall be a single high performance, inverter driven, modulating capacity scroll compressor.
   2. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity

shall be completely variable down to 41% of rated capacity for the PUMY-P36NHMU (-BS), 33% for the PUMY-P48NHMU (-BS), and 29% for the PUMY-P60NKMU (-BS).

3. The compressor shall be equipped with an internal thermal overload.
4. The compressor shall be mounted to avoid the transmission of vibration.

G. Electrical:
1. The outdoor unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair, non-polar shielded cable to provide total integration of the system.

H. BS Coating:
1. The outdoor unit shall be coated with the Seacoast Protection Coating (Bermuda Special – BS coating) if the installation site falls within the following criteria:

	Distance from the Sea		
	984' (300m)	1,640' (500m)	3,281' (1km)
Direct Exposure to Sea Breezes			
Facing Inland	Seacoast Protection (-BS) Models		Standard Models
Facing Sea	Seacoast Protection (-BS) Models		
On an Island	Seacoast Protection (-BS) Models		
Indirect Exposure to Sea Breezes			
Facing Inland	Seacoast Protection (-BS) Models		Standard Models
Facing Sea	Seacoast Protection (-BS) Models		
On an Island	Seacoast Protection (-BS) Models		

I.
1. The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.
2. The outdoor unit must not be installed in a location that is subject to direct sea winds.
3. The outdoor unit shall be open to the elements such that rain will wash away salt residue.
4. The outdoor unit shall be installed in such a way as to achieve optimal drainage.
5. The outdoor unit shall be washed periodically to remove salt residue.
6. The panels on the outdoor unit should be scratch free. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately.
7. The outdoor unit shall be inspected regularly and parts shall be painted or replaced as necessary.
8. The salt spray coating shall adhere to the following specifications:

9.

Component	Base Material	Standard Models	Seacoast Protection Models (-BS)	Surface Treatment	Coating Thickness	
					External Surface	Internal Surface
External Panel Base	Alloyed Galvanized Steel Sheet	●	●	Thermoset Polyester-resin Powder Coating	≥70μm	≥70μm
External Front Panel	Alloyed Galvanized Steel Sheet	●		Polyester-resin Coating	≥15μm	≥5μm
			●	Thermoset Polyester-resin Powder Coating	≥85μm	≥75μm
Pillar	Alloyed Galvanized Steel Sheet	●		Polyester-resin Coating	≥30μm	
			●	Thermoset Polyester-resin Powder Coating	≥70μm	≥70μm
Compressor Cover	Galvanized Steel Sheet	●		No Treatment		
	Galvanized Aluminum Sheet		●	Thermoset Polyester-resin Powder Coating	≥70μm	≥70μm
Fin Guard	Steel Wires	●	●	Weather-resistant Polypropylene-resin Coating	≥300μm	≥300μm
Fan Guard and Drum	Weather-resistant Polypropylene Plastic	●	●	No Treatment		
Fan	Weather-resistant Acrylic Nitrile Styrene Plastic	●	●	No Treatment		
Fan Motor Frame	Galvanized Steel Sheet	●	●	No Treatment		
Fan Motor Shaft	High-carbon S35C Steel	●	●	Rust-prevention Coating		
Fan Motor Support	Galvanized Steel Sheet	●		No Treatment		
			●	Thermoset Polyester-resin Powder Coating	≥70μm	≥70μm
Heat Exchanger (Fin Only)	Aluminum Plate	●		Cellulose- and Polyurethane-resin Coating *(Blue Fin)* (no unusual rust development to 480 hours)	≥1μm	
			●	Cellulose- and Polyurethane-resin Coating *(Blue Fin)* (no unusual rust development to 960 hours)	≥1 - 1.5μm	
Electrical Parts Box	Galvanized Steel Sheet	●		No Treatment		
	Galvanized Aluminum Sheet		●	Thermoset Polyester-resin Powder Coating	≥70μm	
Printed Circuit Board	Epoxy Resin	●		No Treatment		
			●	Polyurethane Coating	≥10μm	
Screws	Steel	●	●	Zinc-nickel Alloy Plating with a Chromate Film	≥5μm	

2.17 PKFY (Wall Mounted) INDOOR UNIT

A. Indoor unit:
   1. The PKFY shall be a wall-mounted indoor unit section and shall have a modulating linear expansion device and a flat front. The PKFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PKFY shall support individual control using M-NET DDC controllers.
   2. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:
   1. All casings, regardless of model size, shall have the same white finish
   2. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
   3. There shall be a separate back plate which secures the unit firmly to the wall.

C. Fan:
   1. The indoor fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor.
   2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

3. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
4. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

D. Filter:
1. Return air shall be filtered by means of an easily removable, washable filter.

E. Coil:
1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. Both refrigerant lines to the PKFY indoor units shall be insulated.

F. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)

G. Controls:
1. This unit shall use controls provided by Mitsubishi Electric Cooling & Heating to perform functions necessary to operate the system. Please refer to Part 4 of this guide specification for details on controllers and other control options.
2. The unit shall be able to control external backup heat.
3. The unit shall have a factory built in receiver for wireless remote control
4. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
5. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
6. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
7. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

2.18 PLFY-P**NCMU (4-WAY CEILING-RECESSED CASSETTE WITH GRILLE) INDOOR UNIT

A. General:
1. The PLFY-P**NCMU-ER4 shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:
1. The cabinet shall be a compact 22-7/16" wide x 22-7/16" deep so it will fit within a standard 24" square suspended ceiling grid.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
3. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.

C. Fan:
1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
4. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
5. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

D. Filter:
1. Return air shall be filtered by means of a long-life washable filter.

E. Coil:
1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4" inches above the condensate pan.
7. Both refrigerant lines to the PLFY indoor units shall be insulated.

F. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

G. Controls:
1. This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

2.19 PEFY-NMAU (CEILING-CONCEALED DUCTED) INDOOR UNIT

A. Indoor Unit
1. The PEFY shall be a ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device. The PEFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PEFY shall support individual control using M-NET DDC controllers.
2. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall

be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:
1. The unit shall be, ceiling-concealed, ducted.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

C. Fan:
1. PEFY-NMAU models shall feature external static pressure settings from 0.14 to 0.60 in. WG.
2. The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
3. The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
4. The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function
5. The indoor unit shall have a ducted air outlet system and ducted return air system.

D. Filter:
1. Return air shall be filtered by means of a standard factory installed return air filter.
2. Optional return filter box (rear or bottom placement) with high-efficiency filter shall be available for all PEFY indoor units.

E. Coil:
1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The condensate shall be gravity drained from the fan coil.
7. Both refrigerant lines to the PEFY indoor units shall be insulated.

F. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

2.20 GARAGE VENTILATION SYSTEM

A. Products by National System of Garage Ventilation or approved equal.
1. Hose Reel: “SHR” series spring operated hose reel. The hose reel body shall be supported by two side plate mounting supports constructed of 11 gauge formed steel drawn securely together by two 11 gauge “J” channel steel support braces. The hose reel housing shall be equipped with a 1/8” x 7 x 19 galvanized stranded aircraft cable and a 4” pull-ring that hangs down to operator height.
2. Vertical stack adapter: The adapter shall be use in conjunction with an existing undercarriage exhaust system, and shall include a 10’ long rigid duct, 45° elbow, 48 series adapter, two adjustable handles, and chain with “S” hook assembly. The vertical stack adapter shall easily slide inside the existing exhaust system. Construction material shall be 24-gauge galvanized steel. The inlet edge of the adapter shall have a hemmed edge design.
3. Clamping tailpipe adapter: The adapter shall be constructed of minimum 24-gauge steel. The tailpipe adapter must have an external sleeve constructed of a minimum ¼” EPDM rubber sleeve as well as a hemmed edge on any exposed edges. A screen constructed of minimum 16-gauge steel mesh shall be incorporated into the adapter.
4. Flexible tube: “XT-65” series tubing shall be constructed of a two-ply, triple overlap thermostatic polyester fabric. The material shall be .028 mil thickness and be reinforced with a 12-gauge spring steel wire helix enclosed in the tubing.

2.21 REGISTERS, GRILLES AND DIFFUSERS

A. Air terminals shall be Titus, Price, or approved equal, as scheduled on the Drawings.

B. All terminals shall be steel and shall be factory painted "off-white", unless otherwise noted. Air terminals for installation in gypsum board shall have a 1" border for surface mounting. All air terminals for installation in lay-in ceilings shall have a lay-in frame to match the specified grid system.

2.22 ACCESS PANELS

A. Where construction is not inherently accessible, provide adequately sized and conveniently located access doors in ceilings, walls, and furring for access to controls and for servicing valves, equipment, etc.
   1. Fire Rated walls and ceilings: Milcor, Style UFR, U.L. Class B, 1½ hour rating, insulated, self closing, self latching, flush key operated cylinder lock, interior latch release. Minimum size shall be 12" x 12". Provide larger sizes where required.
   2. Drywall ceilings or walls: Milcor, Style DW, prime coated steel, flush screwdriver-operated cam lock. Minimum size shall be 12" x 12". Provide larger sizes where required.
   3. Masonry walls: Milcor, Style M, prime coated steel, flush screwdriver-operated cam lock. Minimum size shall be 12" x 12". Provide larger sizes where required.
   4. Tiled walls: Milcor, Style MS, satin finish stainless steel, flush screwdriver-operated cam lock.
   5. Plastered walls and ceilings: Milcor, Style K, prime coated steel, flush screwdriver-operated cam lock. Minimum size shall be 12" x 12". Provide larger sizes where required.

B. Doors shall be delivered to the General Contractor for installation.

2.23 VIBRATION ISOLATORS

A. Unless otherwise noted on the equipment schedule, all mechanical equipment shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. All isolators shall be Mason Industries, Kinetics, or approved equal. Rated deflections and model numbers shall be as scheduled on the drawings.

B. Spring equipment mounts, earthquake motioned restrained:
   1. Mounts shall incorporate a single spring vibration isolator built into a welded steel mount assembly, designed and engineered to limit movement of supported equipment during an earthquake without degrading the vibration isolation of the spring during normal equipment operating conditions.
   2. Mounts shall incorporate a welded steel plate and motion limit assembly, and steel spring isolator, engineered as a system to accept a force of 1.3 times the rated load capacity of the spring isolator without yield or failure, and shall limit movement of the point of level bolt connection to supported equipment to 0.75 inches in any direction, relative to any fixed point on the mount assembly, while subjected to the minimum force specified.
   3. The motion limit assembly shall be welded to a steel base plate having a ¼" thick ribbed neoprene noise stop pad, and drilled holes for bolting to supporting structures.
   4. Springs shall be wound steel, using high strength, heat treated spring alloy steel and shall have a horizontal spring stiffness equal to or greater than 1.3 times the rated vertical spring stiffness. The outside diameter of each spring shall be a minimum of 0.8 times the rated vertical spring height.
   5. Springs shall be selected to provide the tabulated minimum operating static deflections and shall provide a 50% overload capacity before reaching solid state. Springs shall be designed to reach solid state before exceeding the spring steel fatigue point.

2.24 DUCTWORK

A. Sheet Metal Ductwork:

1. Ducts and plenums shall be fabricated and installed in conformance with the latest editions of: NFPA Pamphlet No. 90A; California Building Code; California Mechanical Code and the SMACNA HVAC Duct Construction Standards (Metal & Flexible). Ducts and plenums shall be constructed of G-60 coated galvanized steel of lockforming grade conforming to ASTM A653 and A924 standards. Seals shall be airtight Class "B" seals at all transverse joints and longitudinal seams. Tables and figures hereinafter referenced are from the 2005 edition of the SMACNA HVAC Duct Construction Standards (Metal and Flexible).
2. Rectangular duct construction shall conform to Table 2-3. All transverse joints shall be flanged per Table 2-32, with corner closures or "Duct Mate" flanged connections with corner closures per Figure 2-16 or 2-17. Elbows shall be standard radius (Type RE 1) or square throat with vanes (Type RE 2) per Figure 4-2, with double thickness turning vanes per Figures 4-3 and 4-4. Offsets and transitions shall be per Figure 4-7. Supply, return, and exhaust branch connections shall be per Figure 4-5 or 4-6. Splitters SHALL NOT be used.
3. Round ducts shall be spiral, United McGill or equal. All transverse joints and longitudinal seams shall have Class "B" seals. All branches in round duct systems shall be made with factory fabricated reducing wye branches. Duct turns shall be made with standard, factory fabricated, three-piece elbows.
4. Lined ducts shall be fabricated such that the net inside dimensions equals the duct sizes shown on the Drawings.
5. Flexible ducts shall be acoustical type, Flexmaster "6M", Casco "Silent Flex – SF-18M", or approved equal. Flexible ducts shall be used only where shown on the Drawings, and maximum length of any given flexible duct shall not exceed 7 feet. Galvanized sheet metal elbows shall be used for turns greater than 45 degrees on flexible ducts 10 inches and larger. Connections to rectangular ducts shall be made with "spin-in" fittings with air scoops. The installation of flexible ducts shall conform to Figure 3-10, with the exceptions noted herein.
6. Supports for horizontal ducts and plenums shall be fabricated per Figures 5-5 and 5-6 and Tables 5-1, 5-2 and 5-3. The maximum distance between hangers shall be 8 feet for rectangular ducts and 12 feet for round ducts. Attachments to the structure shall be made with adequately sized lag bolts for strap hangers and adequately sized machine bolts and side beam brackets for rod hangers. Supports for vertical ducts shall be band iron strap or angle bracket type per Figures 5-8 and 5-9.
7. All roof-mounted ductwork shall be water tight and sloped to shed water. All transverse joints shall be T-25 flanged Ductmate "25", or approved equal.
8. Outside air intakes shall be type 316 stainless steel.
9.
10. Ducts and plenums shall be fabricated and installed in conformance with the latest editions of: NFPA Pamphlet No. 90A; California Building Code; California Mechanical Code and the SMACNA HVAC Duct Construction Standards (Metal & Flexible). Ducts and plenums shall be constructed of hot dipped galvanized mild steel and shall have airtight Class "B" seals at all transverse joints and longitudinal seams. Tables and figures hereinafter referenced are from the 2005 edition of the SMACNA HVAC Duct Construction Standards (Metal and Flexible).
11. Rectangular duct construction shall conform to Table 2-3. All transverse joints shall be flanged per Table 2-32, with corner closures or "Duct Mate" flanged connections with corner closures per Figure 2-17. Elbows shall be standard radius (Type RE 1) or square throat with vanes (Type RE 2) per Figure 4-2, with double thickness turning vanes per Figures 4-3 and 4-4. Offsets and transitions shall be per Figure 4-7. Supply, return, and exhaust branch connections shall be per Figure 4-5 or 4-6. Splitters SHALL NOT be used.
12. Round ducts shall be spiral, United McGill or equal. All transverse joints and longitudinal

seams shall have Class "B" seals. All branches in round duct systems shall be made with factory fabricated reducing wye branches. Duct turns shall be made with standard, factory fabricated, three-piece elbows.

13. Lined ducts shall be fabricated such that the net inside dimensions equals the duct sizes shown on the Drawings.
14. Flexible ducts shall be Flexmaster "8M" or approved equal. Flexible ducts shall be used only where shown on the Drawings, and maximum length of any given flexible duct shall not exceed 7'. Galvanized sheet metal elbows shall be used for turns greater than 45° on flexible ducts 10" and larger. Connections to rectangular ducts shall be made with "spin-in" fittings with air scoops. The installation of flexible ducts shall conform to Figure 3-10, with the exceptions noted herein.
15. Supports for horizontal ducts and plenums shall be fabricated per Figures 5-5 and 5-6 and Tables 5-1, 5-2 and 5-3. The maximum distance between hangers shall be eight feet for rectangular ducts and twelve feet for round ducts. Attachments to the structure shall be made with adequately sized lag bolts for straphangers and adequately sized machine bolts and side beam brackets for rod hangers. Supports for vertical ducts shall be band iron strap or angle bracket type per Figure 5-8 and 5-9.
16. All roof-mounted ductwork shall be water tight and sloped to shed water. All transverse joints shall be T-25 flanged, Ductmate "25", or approved equal.
17. Outside air intakes shall be type 316 stainless steel.

B. Fiberglass Ductwork:
   1. Fiberglass ductwork is unacceptable and may not be used on this project.

C. Specialties:
   1. Duct Mounted Access Doors
      e. Including those for removing filters, duct access doors shall be fabricated as detailed in Figure 7-2, with sash locks, piano hinges, and cam latches. Round duct shall be fabricated as detailed in Figure 7-3.
      f. Access doors shall be double wall, rectangular, insulated or uninsulated same as duct. Insulation fill and thickness shall be as indicated for pressure class.
      g. Access doors shall have a vision panel and an unobstructed full swing.
      h. Fabricate doors airtight and suitable for duct pressure class.
   2. Dampers:
      i. Provide butterfly or multiple blade dampers where indicated on the Drawings or as required for balancing air quantities, to values shown without generating excessive noise. Provide Duro-Dyne " KS-385", or approved equal, locking quadrants on each manual damper. Locate dampers in furred ceilings near access panels where possible.
      j. Butterfly dampers shall be constructed as per Figure 7-4, Figures A, B, and C.
      k. Multi-blade dampers shall conform to Figure 7-5.
      l. Motorized dampers - See Temperature Controls.
   3. Remote Actuators: Young Regulator Company, Round Cable Controlled Dampers Model 5020-CC or 830A-CC (rectangular) and Remote Cable Control System Kit Model 270-301EZ. All dampers in inaccessible ceilings shall have remote actuators.
   4. Air Extractors: Duct mounted volume extractors made of galvanized steel with 1-inch blade spacing, Titus model "AG-45", or equal.
   5. Flexible Duct Connections: Duro-Dyne "Metal-Fab" with Durolon, Ventfabrics "Ventglas", or approved equal. Install at each point where a blower unit is connected to a duct. A minimum clearance of 3" between the duct and the source of vibration shall be maintained. Install per Figure 7-8.
   6. Screens: Install removable bird screens at ALL outside air intakes and exhaust air discharges. Screens shall be fabricated from ½" x 14 gauge mesh secured in full frames.

Screens and frames shall be constructed of the same material as the duct, hood, or equipment to which attached.

7. Access Panels: Milcor, Style M, prime coated steel, or approved equal. Minimum size shall be 10" x 10". Provide larger sizes where required. Locks shall be flush, screwdriver operated. Provide as required for concealed ducts at all fire dampers, electric duct heaters, and automatic dampers except at suspended acoustical ceilings.
8. Joints: Tape all joints airtight using Hardcast - Carlisle, type "DT" pressure-less tape and "RTA 50" sealant, or McGill AirSeal, "Uni-Flex" duct sealer. Install per manufacturer's directions.

2.25 INSULATION

B. General
   1. All duct insulation materials including jackets, tapes, adhesives and coatings shall meet ASTM E84 25/50 Flame Spread/Smoke Development requirements.

C. Exterior of Ductwork: (Flexible Duct Wrap)
   1. Unless specified to be lined, all ductwork shall be wrapped with formaldehyde-free, flexible glass-fiber or mineral-wool, blanket type insulation with factory applied FSK aluminum foil facing. Thickness shall be 2 inches unless noted otherwise.
      a. Johns Manville "Microlite EQ", Knauf Insulation "Friendly Feel", Owens Corning "SoftR Duct Wrap", or approved equal.

D. Interior of Ductwork: (Duct Liner)
   1. All ducts exposed to the weather shall be internally insulated. All other ductwork within 10 feet of a fan (supply and return) shall be internally insulated. Duct liner shall be installed in supply and return ducts and plenums where noted on the Drawings. Exhaust ductwork need not be insulated.
   2. Duct liner shall meet the requirements of ASTM C 1071, NFPA 90A or NFPA 90B Type I and Type II. Operating temperature shall meet ASTM C411. Microbial growth shall meet ASTM C1338, G21 and G22.
      a. Type I - Plenum Liner Board: Johns Manville "Permacote Linacoustic R-300" or Knauf "Rigid Plenum Liner", or approved equal. Thickness shall be 1 ½ inches, unless otherwise noted.
      b. Type II - Flexible Duct Liner: Johns Manville "Linacoustic RC" or Knauf "Sonic XP Duct Liner", with fire resistant facing; or approved equal. Thickness shall be 1 ½ inches, unless otherwise noted.

E. Supply & Return Piping
   1. Insulate all supply and return piping with Johns Manville "Micro-Lok HP" rigid fiberglass one-piece pipe insulation, Knauf Insulation "Earthwool 1000 Degree", "Earthwool Redi-Klad 1000 Degree, Owens Corning "Fiberglas" rigid glass mineral wool one-piece pipe insulation with an all purpose vapor retarder jacket, or approved equal.
   2. ASJ+ jackets shall be constructed of high density, white kraft bonded to aluminum foil with fiberglass yarn, with a pressure sensitive closure system or aluminum foil reinforced with a glass scrim bonded to a kraft paper interleaving with an outer film layer leaving no exposed paper. Adhesives or staples will not be required to seal the jacket and butt strips.
   3. Fittings, valves and flanges shall be covered with Manville "Zeston 2000" insulated PVC fitting covers and Hi-Lo Temp insulation inserts or Knauf "Proto LoSmoke".
   4. Insulation for all exposed piping and all piping in mechanical rooms and similar spaces shall be covered with Zeston PVC jacketing. PVC jackets shall be 20 mils thick and shall be bonded with Zeston Perma-Weld adhesive. In crawl spaces, Knauf Earthwool RediKlad

1000° pipe covering shall serve as an acceptable alternate to standard pipe covering and PVC.

5. All piping exposed to the weather shall be finished with aluminum jacketing with a laminated moisture retarder or Earthwool RediKlad 1000° with Venture Clad embossed jacket. Aluminum jacketing shall be overlapped 2 to 3 inches and held in place with stainless steel bands to form a weather tight system. Elbows and tees shall be fitted with matching aluminum fitting covers. Other fittings in metal-jacketed systems shall be finished with conventional weather-resistant insulating materials with painted aluminum finish.

F. Refrigerant Piping:
1. Insulate all refrigerant suction lines, fittings, and valves with flexible elastomeric thermal insulation, Resolco Insul-Phen rigid closed cell phenolic foam, or equal, according to manufacturer's suggested installation procedures, UV protected.
2. Liquid, suction, and hot gas (where applicable) lines shall be insulated individually.
3. Oil equalization lines between multiple condensing units shall be insulated.

G. Piping insulation thickness shall be as follows:

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)				
			1 and less	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
			INSULATION THICKNESS REQUIRED (in inches)				
Space heating, Hot Water systems (steam, steam condensate and hot water) and Service Water Heating Systems							
Above 350	0.32-0.34	250	4.5	5.0	5.0	5.0	5.0
251-350	0.29-0.31	200	3.0	4.0	4.5	4.5	4.5
201-250	0.27-0.30	150	2.5	2.5	2.5	3.0	3.0
141-200	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
105-140	0.22-0.28	100	1.0	1.5	1.5	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)							
40-60	0.21-0.27	75	0.5	0.5	1.0	1.0	1.0
Below 40	0.20-0.26	50	1.0	1.5	1.5	1.5	1.5

H. All tanks, expansion tank, pumps, volutes, valves and strainers shall be completely insulated with ½" Armaflex glued and sealed, vapor tight, in place with Armstrong #520 adhesive.

2.26 COMBINATION FIRE SMOKE DAMPERS

A. Furnish and install Ruskin FSD 60 low leakage combination fire smoke dampers (for sizes up to 36 x 14 use FSD-60LP low profile) , or equal at locations shown on Drawings or as described in schedules.

B. Dampers shall meet the requirements of NFPA90A, 92A and 92B. Dampers shall have a fire rating of 1-1/2 hours in accordance with the latest edition of UL555 and shall be classified as Leakage Class I Smoke Dampers in accordance with the latest version of UL555S. Dampers shall be FM approved and labeled as Specification Tested Products and shall be warranted to be free from defects in material and workmanship for a period of 5 years after date of shipment.

C. Each fire smoke damper shall be AMCA licensed and shall bear the AMCA Certified Ratings Seal for Air Performance. AMCA certified testing shall verify pressure drop does not exceed .03" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper.

D. In addition the dampers and their actuators shall have a UL555S elevated temperature rating of 250°F or 350°F depending upon the actuator. Appropriate electric or pneumatic actuators shall be installed by the damper manufacturer at time of damper fabrication. Electric actuators shall have been energized hold open tested for a period of at least 1 year with no spring return failures.

E. Each fire smoke damper shall be equipped with a "controlled closure" quick detect heat-actuated release device to prevent duct and HVAC component damage. Instantaneous damper closure through the use of fusible links is unacceptable.

F. Damper frame (when size permits) shall be constructed using the UniFrame Design Concept (UDC) and shall be a roll-formed structural hat channel, reinforced at the corners, formed from a single piece of minimum 16 gauge galvanized steel. Damper blades shall be airfoil shaped with 13 gauge equivalent thickness formed from a single piece of galvanized steel. Bearings shall be stainless steel turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable).

G. Each damper shall be supplied with a factory-mounted sleeve of 17" minimum length. Each sleeve shall include a factory mounted access door.

H. Provide factory-mounted smoke detector for each Fire/Smoke Damper. Smoke detector shall be mounted on the outside of the damper sleeve, with sensing tubes extended into the air stream. Smoke detectors shall be model "DSDF photoelectric type, requiring a 120 volt "single point" field electrical connection.

2.27 THERMOSTATS

A. Each heating, ventilating, and air conditioning system shall be controlled by an individual electronic night setback thermostat, mounted 48" above finished floor.
   1. Single stage units: White Rodgers 1F97-371 with clear plastic locking cover.
   2. Multiple stage units: White Rodgers 1F95-371 with F29 series metal guard.

2.28 HANGERS, SUPPORTS

A. Pipe supports shall be manufactured by Thomas & Betts, "Superstrut" or equivalent Cooper B-Line, Nibco (Tolco), or Anvil International.

B. All hangers shall be electro-chromate finished. Hanger rods shall have electro-galvanized finish.

C. Copper tubing:
   1. C-711 copper tube hanger, complete with C-716 isolator.
   2. Copper pipe shall be attached to channels with A-716 "Cush-A-Clamp".

D. Insulated pipe:
   1. C-711 pipe hanger fitted to outside of insulation with C-790 galvanized shields.

E. Trapeze hangers:
   1. Grouped pipes may be supported by A-1200 channel bolted to rods.

F. Point of support connectors:
   1. Wood construction:
      a. Stationary pipes: 540 side beam hanger
      b. Pipes subject to movement: S541
   2. New concrete construction: 452 inserts.
   3. Existing concrete construction: Phillips "Red-Head" 3-piece concrete anchors or Hilti "Quik-Bolt", drilled-in, concrete anchors.
   4. Steel beams: Series 500 beam brackets.

5. Plywood decks: machine bolts, nuts and washers.

G. Vertical pipe risers:
   1. Vertical pipe risers shall be securely supported with C-720 pipe clamps anchored to construction.
   2. C-720P for bare cold-water pipe, anchored to construction.

H. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

I. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

J. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

K. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

L. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

M. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

N. Insulated pipe supports: K.B. Enterprises “Snapp Itz”.

O. Pipes through studs or joists shall be isolated from structure with properly sized Hubbard "Hold-Rite" suspension clamps or LSP “Acousto-Plumb” system.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Prior to commencing the work of this Section, the Contractor shall inspect the installed work of other trades and verify that their work is sufficiently complete to permit the start of work under this Section, and that the completed work will be in complete accordance with the original design. In the event of discrepancy, immediately notify the Architect and proceed as directed.

3.02 GENERAL INSTALLATION

A. Provide all necessary cutting in connection with the work of this Section. No structural members shall be drilled, bored, or notched in a manner which will impair their structural capacity. All penetrations of concrete or masonry shall be made with core drills. No cutting shall be done without the approval of the Architect.

3.03 HEATING & AIR CONDITIONING EQUIPMENT INSTALLATION

A. All units shall be set with curbs plumb, level, and securely attached through framed opening with bolts and/or lag screws as noted on the Drawings. Connections to ductwork shall be secured, filter racks shall be aligned, enclosures and ductwork connections shall be fully waterproofed, and all utility and control connections shall be complete.

3.04 INSULATION

A. Exterior Ductwork:
   1. Duct wrap shall be cut in a manner to meet the manufacturers’ stretch-out guideline to

provide a 2" staple lap and have minimum compression at the corners. All joints shall be lapped 2" and stapled with outward clinching staples 2" on center. The insulation shall be mechanically fastened to the underside of all ducts 24" wide or more using cup-head pins, weld pins, or stick pins with speed clips 18" on center. Insulation shall not be compressed to comply with required installed R-value. All joints and penetrations of the vapor barrier jacket shall be sealed with a minimum 3" wide matching pressure sensitive tape. Pressure-sensitive tape shall be firmly rubbed in place immediately after application using a "squeegee" type tool.

2. When a vapor seal is required, two coats of vapor retarder mastic reinforced with one layer of 4" wide, open weave glass fabric may be used in lieu of pressure-sensitive tape. Mastic shall be brushed onto joint and glass fabric imbedded in it. A second coat of mastic shall be brushed over the glass fabric until the fabric is filled. Mastics shall be applied in accordance with application instructions on the container.

B. Interior Duct Liner
1. Apply to the inside face of ducts, coated side facing air stream. Fasten using fire retardant adhesive and secure with mechanical fasteners at 12" maximum o.c., both directions, for velocities up to 2,500 fpm .Velocities over 2,500 fpm shall have fastener spacing of 6" o.c.
2. Exposed edges must be factory or field coated with adhesive. Metal nosing shall be installed in all liner leading edges facing the airstream at fan discharge, at access doors, and at any interval of lined duct preceded by unlined duct.
3. Insulation with torn or broken coatings shall be removed and replaced. Loose corners, edges, and butt joints will not be accepted.
4. Maximum velocity: 5,000 ft/min.

C. Refrigerant Piping:
1. The insulation shall be installed in accordance with the manufacturer's instructions. All joints and seams shall be sealed with waterproof vapor retarder adhesive. All pipes exposed to the weather shall be coated to protect the insulation from ultra-violet radiation in accordance with the manufacturer's published instructions.

3.05 FILTERS

A. During construction, protect all filters upstream of air handling units with blankets of 2" fiberglass filter media or 2" disposable panel filters. UL Class 2 listed.

B. Systems shall not be operated without properly installed filters. Filters used during construction shall be removed and replaced with new filters after construction is completed and the systems are ready for final acceptance by the owner.

3.06 VRF SPLIT SYSTEM INSTALLATION

A. Contractor's Qualifications
1. The mechanical contractor shall show having successfully installed a minimum of two Mitsubishi City Multi projects within the past 5 years. Provide for approval prior to construction, a written statement indicating the project names, dates completed, owners name and contact information.

B. Installer Qualifications
1. Installers for the Mitsubishi systems shall have at least one person factory trained and certified for installation and service of the systems by Mitsubishi Electric. This person shall at all times supervise the installation of all other installers and assure that all work is done in accordance with Mitsubishi requirements. All other installers shall be trained and certified in HVAC installation (included but not limited to refrigerant piping and controls)

by a national or regionally recognized organization. Provide for approval, prior to construction, copies of installers certificates or other proof of qualifications.

C. All units shall be set with curbs plumb, level, and securely attached through framed opening with bolts and/or lag screws as noted on the Drawings. Connections to ductwork shall be secured, filter racks shall be aligned, enclosures and ductwork connections shall be fully waterproofed, and all utility and control connections shall be complete.

D. General:
1. Rig and install in full accordance with manufacturer's requirements, project drawings, and contract documents. Refer to the manufacturer's installation manual for full requirements.

E. Location:
1. Locate indoor and outdoor units as indicated on drawings. Provide service clearance per manufacturer's installation manual. Adjust and level outdoor units on support structure.

F. Components / Piping:
1. Installing contractor shall provide and install all accessories and piping for a fully operational system. Refer to manufacturer's installation manual for full instructions.
2. Traps, filter driers, and sight glasses are NOT to be installed on the refrigerant piping or condensate lines.
3. Standard ACR fittings rated for use with R410A are to be used for all connections. Proprietary manufacturer-specific appurtenances are not allowed.
4. Refrigerant pipe for CITY MULTI shall be made of phosphorus deoxidized copper, and has two types.
   c. ACR Type-L "Annealed Temper": Soft copper pipe, can be easily bent with human's hand.
   d. ACR Type L "Drawn Temper": Hard copper pipe (Straight pipe), being stronger than Type-O pipe of the same radical thickness.
5. The maximum operation pressure of R410A air conditioner is 4.30 MPa [623psi] . The refrigerant piping should ensure the safety under the maximum operation pressure. Refer to recommend piping specifications in Mitsubishi Electric's engineering manual. Pipes of radical thickness 0.7mm or less shall not be used.
6. Flare connection should follow dimensions provided in manufacturer's installation manuals.

G. Insulation:
1. Refrigerant lines, as well as any valves, shall be insulated end to end with ½" closed-cell pipe insulation. If state or local codes require insulation other than that specified above, the greater insulation shall be used.

H. Electrical:
1. Installing contractor shall coordinate electrical requirements and connections for all power feeds with electrical contractor. Refer to Division 26 for additional information.

I. Third Party Controls:
1. Installing contractor shall coordinate all BAS/BMS control requirements and connections with controls contractor.

3.07 DUCTWORK

A. All ductwork shall be installed within spaces provided, where possible. Ducts shall be installed true to line and grade, fully secured to structural framing with specified hangers and supports, insulated, and vibration isolated.

B. Each section of supply air ductwork shall be cleaned, dust and oil free, at the shop using a degreasing agent and detergent and sealed airtight at both ends with visqueen and tape. Supply ducts shall be additionally cleaned with a disinfecting solution. Ends of all supply and internally insulated exhaust ducts shall be kept sealed until the time they are joined. When duct sections are joined, wipe down all interior surfaces with a clean tack cloth. If tack cloth shows any dust, then re-clean duct as described above. The intent is that no foreign matter be allowed to enter the ductwork at any time after factory cleaning and during construction.
   1. Submit detailed shop and field duct handling procedures for review.
   2. Unlined exhaust ducts shall be vacuum cleaned when installed, but shall otherwise be exempt from shop cleaning and sealing.

3.08 GRAVITY VENTILATORS INSTALLATION

A. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance

B. Ensure duct is plumb, sized correctly, and to proper elevation above roof deck.

3.09 FIRE/SMOKE DAMPERS

A. Inspect areas to receive dampers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the dampers. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Install dampers at locations indicated on the Drawings and in accordance with manufacturer's UL approved installation instructions. Install dampers square and free from racking with blades running horizontally. Do not compress or stretch damper frame into duct or opening. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jackshaft.

C. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.10 INSTALLATION, HANGERS AND SUPPORTS

A. Pipe supports shall be spaced sufficiently close to support pipes properly without formation of pockets. Hangers shall be installed at ends of mains and branches. Maximum horizontal support spacing shall be as follows:

Nominal Diameter Pipe (inches)	Maximum Space Between Hangers (feet)			Minimum Recommended Rod Size (inches)	
	Standard Steel Pipe		Copper Tube		
	Water	Steam	Water	Copper	Steel
1/2	7	8	5	3/8	3/8
3/4	7	9	5	3/8	3/8
1	7	9	5	3/8	3/8
1 1/4	7	9	7	3/8	3/8
1 1/2	9	12	8	3/8	3/8
2	10	13	8	3/8	3/8
2 1/2	11	14	9	½	½

3	12	15	10	½	½
3 1/2	13	16	11	½	½
4	14	17	12	1/2	5/8

B. No valve or piece of equipment shall be used to support piping.

C. Pipes through studs or joists shall be isolated from structure with properly sized Hubbard "Hold-Rite" suspension clamps.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Installation of piping shall be such that damage cannot result through loading, expansion or contraction of piping. Anchors shall be installed to obtain uniformity of pipe movement.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-½ inches and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

3.11 TESTS, INSPECTIONS

A. Make all necessary control adjustments and balancing of air and water flows. Operate the entire system for a period of time not less than three (3) working days for the purpose of proving satisfactory performance. During this period, instruct such persons as the Owner and/or Architect may designate in the proper operation of the systems. Should further adjustment prove necessary, operating tests shall be repeated until a satisfactory test is obtained.

B. This Contractor shall not allow or cause any work of this Section to be covered or enclosed until it has been inspected, tested, and approved by the Architect and the authorities having jurisdiction over the Work. Should any of this work be enclosed or covered up before such inspection, testing, and approval, this Contractor shall uncover the work, have the necessary inspections, tests, and approvals made and, at NO expense to the Owner, make all repairs necessary to restore both his work and that of other contractors which may have been damaged to be in conformity with the Contract Documents.

C. Furnish all necessary labor, materials, and equipment for conducting tests, and pay all expenses in connection therewith. Should leaks develop while testing, repairs shall be made, and tests shall be repeated until a satisfactory test is obtained.
   1. Condenser water piping shall be hydrostatically tested at 125-psi pressure and proved tight before covering. Tests may be made in sections provided connection to service previously tested is included in each succeeding test. Systems shall be tight for eight hours.
   2. Pressure tests on refrigeration piping and equipment shall be done in accordance with the American Standard Safety Code for Mechanical Refrigeration USAS B9.1.

3.12 INSTALLATION, REFRIGERANT PIPING

A. Piping installation shall comply with all federal, state, and local regulations and industry guidelines. In addition, the following practices shall be followed.
   1. All piping shall be stored with ends sealed to prevent entry of moisture and debris.

2. A pipe cutter specific to the piping material applied shall be used.
3. All factory and field cut tube ends shall be de-burred and cleaned.
4. Flared fittings shall be formed using tools recommended by the equipment manufacturer.
5. Flare nuts shall be tightened with torque wrench furnished by the equipment manufacturer.
6. Piping shall be continuously purged with dry nitrogen while soldering. Care shall be taken when soldering near valves or other equipment that may be damaged by extreme heat.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

C. Install refrigerant piping according to ASHRAE 15.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping adjacent to machines to allow service and maintenance.

H. Install piping free of sags and bends. Install fittings for changes in direction and branch connections. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

I. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

J. Install refrigerant piping in protective conduit where installed belowground. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

K. Slope refrigerant piping as follows:
1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Use double-suction riser for maximum compressor efficiencies if load variation is expected.
4. Install traps and double risers to entrain oil in vertical runs.
5. Liquid lines may be installed level.

L. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

N. All refrigerant piping and valves shall be identified.

3.13 REFRIGERANT PIPING TESTING

A. Prior to charging with refrigerant, piping shall be tested for leaks under 550 psi pressure using a mixture of 95% nitrogen and 5% hydrogen gas. (WARNING! OXYGEN OR ACETYLENE SHALL NOT BE USED IN PLACE OF DRY NITROGEN. A VIOLENT EXPLOSION MAY RESULT!).

B. All joints shall be tested for leaks using an electronic hydrogen leak detector. Pressure and leak tests on refrigeration piping and equipment shall be done in accordance with local code requirements and the American Standard Safety Code for Mechanical Refrigeration (ANSI B9.1).

C. Piping shall be continuously purged with dry nitrogen while brazing. Care shall be taken when soldering near valves or other equipment that may be damaged by extreme heat.

D. Be sure that all controls, relief valves or rupture discs that could be damaged by test pressure are removed before beginning pressure test.

E. Precautions shall be taken to keep moisture out of the system, and a drier shall be used.

F. After successful completion of pressure tests, the entire system shall be purged with dry nitrogen and then evacuated with a standard vacuum pump to remove all moisture and non-condensibles. Three evacuations shall be required, and shall be down to 500 microns absolute pressure. Break the first two vacuums with dry nitrogen. Charge with refrigerant after third evacuation.

G. The contractor shall notify the Architect 48 hours prior to the time and date of the evacuation.

H. The refrigerant charge shall be calculated and weighed into the system.

I. Service technicians shall be certified in the use of CFC and HCFC refrigerant recovery and recycling equipment and shall use UL listed and labeled recovery equipment when discharging refrigerant.

3.14 CLEANUP

A. Upon completion of the work of this Section, remove all material, debris, and equipment associated with or used in the performance of this Work.

END OF SECTION

SECTION 23 0500

GENERAL MECHANICAL

PART 1 GENERAL

1.01 SUMMARY

A. The requirements of this Section shall apply to all work of Division 23.

1.02 QUALITY ASSURANCE

A. Regulatory compliance: All work performed under Division 23 shall comply with the latest currently adopted editions of all codes and regulations and all requirements of all Authorities having Jurisdiction. The following references and standards are hereby made a part of these sections and work shall conform to applicable requirements herein, except as otherwise specified herein or shown on the Drawings.

B. Codes, Standards: Conform to all applicable codes and standards as stated herein and as described in Division 01 of the Specifications, including the following:
   1. American Gas Association (AGA)
   2. American National Standards Institute (ANSI)
   3. American Society of Mechanical Engineers (ASME)
   4. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standards 55 and 62.1
   5. American Society for Testing and Materials (ASTM)
   6. California Building Code (CBC)
   7. California Code of Regulations Titles 8, 17, 19, 20, 21 & 22
   8. California Electric Code (CEC)
   9. California Energy Conservation Code (Title 24)
   10. California Fire Code (CFC)
   11. California Mechanical Code (CMC)
   12. California Plumbing Code (CPC)
   13. CAL Green Building Standards
   14. City Fire Marshal requirements
   15. National Electrical Manufacturers Association (NEMA)
   16. National Fire Protection Association (NFPA)
   17. NSF/ANSI 61 Standard, Drinking Water System Components – Health Effects for fixture materials that will be in contact with potable water
   18. Office of Statewide Health Planning and Development (OSHPD)
   19. Sheet Metal and Air Conditioning Contractors Nation Association (SMACNA) Standards
   20. Underwriters Laboratories (UL)

C. Comply with all ADA requirements for disabled access.

D. Minimum requirements: The requirements of these are the minimum that will be allowed unless such requirements are exceeded by applicable codes or regulations, in which the regulatory codes or regulation requirements shall govern.

E. When the Contract Documents call for materials or construction of a higher standard than is required by the above, the Contract Document requirements shall take precedence over the requirements of the said laws, rules, and/or regulations, accepting that nothing in the Contract Documents shall be interpreted as permitting work in violation of said laws, rules, and/or

regulations. The Contractor for this work shall furnish any additional materials and/or labor as may be required for compliance with these laws, rules, and/or regulations though such materials and/or labor are not specifically set forth in the Contract Documents, with no additional charges to Owner.

F. Seismic construction and restraints shall be in accordance with the requirements of Title 17 and Title 24 of the California Code of Regulations. All equipment mounts, isolators, and hanging systems must meet local authority approval requirements.

G. Comply with the Safety Orders issued by Cal-OSHA and any other regulations of the State of California and any districts having jurisdictional authority.

1.03 LICENSES, PERMITS, FEES

A. The Contractors for this Section of work shall provide, procure and pay for all licenses, permits, fees, etc. as required to carry on and complete their work.

1.04 LICENSING REQUIREMENTS

A. All work of Divisions 23 shall be performed by an appropriately licensed contractor. The licenses shall be current, valid through the term of the contract and in the name of the contractor.
   1. All HVAC work, which includes warm air heating systems and water heating pumps, ventilating systems, air conditioning systems, and ductwork, registers, flues, humidity, and thermostatic controls in connection with these systems, shall be performed by a C-20 - Warm-Air Heating, Ventilating and Air-Conditioning Contractor.

1.05 CONTRACT DRAWINGS

A. The Contract Drawings indicate diagrammatically the general layout of the mechanical systems and other related work. Field verification of scaled dimensions taken from the Drawings is required. The Contractors for this Section of the work shall review and compare the Architectural, Structural, Plumbing, Mechanical and Electrical Drawings and all Owner supplied equipment Drawings, and adjust their work to be in conformity with the conditions indicated thereon. Discrepancies between different Drawings, between Drawings and actual field conditions, or between Drawings and Specifications, shall be brought to the attention of the Architect promptly for a determination of the modifications to be affected.

1.06 SUBMITTALS

A. General:
   1. Before any fixtures, materials, or equipment are purchased, the Contractor shall submit to the Architect for approval, a complete list of materials, fixtures, and equipment, giving the manufacturers' names, catalog number, capacity, size, power requirements, and other pertinent data. Submittal lists and drawings shall be specifically applicable to this project, shall include identifying marks assigned by Specifications and Drawings, and shall not contain extraneous material or optional choices.
   2. The Contractor shall submit for the approval of the Architect, shop drawings of proposed material and equipment that differ from the specified materials and equipment, and of any specified materials and equipment with special conditions and/or arrangements. These drawings shall show necessary modifications of Owner, plumbing, electrical and mechanical work required by the proposed materials and equipment.
   3. Submittal of substitutions shall be limited to one proposal for each type or kind of item.

If the first proposed product submittal is rejected, the Contractor shall then submit the first named or scheduled product.

4. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements. Review of drawings and other material submitted shall not be construed as a complete check or constitute a waiver of the requirements of the Drawings and Specifications, but will indicate that the material submitted is acceptable in quality and utility. This review shall not relieve the Contractor of the responsibility to fit the proposed materials to the spaces provided, and to effect necessary rearrangement or construction of other work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall be responsible for delivery, storage, protection and placing of all equipment and materials.

B. Contractor shall protect the work and materials from damage during construction. Equipment stored at the jobsite shall be protected from dust, water or other damage, and be covered if equipment is exposed to weather. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

C. Any items damaged shall be repaired or replaced, at no additional cost to the Owner.

D. Cleanliness of Piping and Equipment Systems:
   1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
   2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
   3. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.08 COOPERATION WITH OTHER TRADES

A. Cooperate fully with other trades doing work on the project as may be necessary for the proper completion of the project. Refer to the Structural, Plumbing, and Electrical Drawings for details of the building structure and equipment installation that will tend to overlap, conflict with, or require coordination with the work of this Section, and schedule this work accordingly.

B. Priority of right of way in space shall be as follows, in decreasing order of authority:
   1. Electrical lights, electrical panels and drain piping.
   2. Ductwork.
   3. Fire protection piping, domestic hot water, domestic cold water and condenser water piping.

C. Any work done without regard for other trades shall be moved, replaced, or redone as required, without extra charges to Owner.

1.09 VERIFICATION OF EXISTING CONDITIONS AND DEMOLITION

A. Before installation of any new work, verify the location, size and other conditions at all points of connection to services or other existing piping, and at all locations where new work will cross or pass near existing piping, electrical, or other facilities.

B. Information shown relative to existing services is based upon available records and data during preparation of the Drawings, but shall be verified. Make reasonable deviations found necessary to conform with actual locations and conditions, without extra charge.

C. Remove piping, controls, fixtures, and equipment that is not to remain in service as shown on the Drawings or as required. This includes the removal of associated appurtenances and supports.

D. Patch, cap, or repair existing works affected by this demolition in concealed spaces within 6" of a live main or branch.

E. Deliver removed material to the Owner as directed by the Architect. Dispose of all other removed material offsite.

1.10 ACCURACY OF DATA

A. The data given herein and on the Drawings is as exact as could be reasonably secured, but absolute accuracy is not guaranteed. Exact locations, distances, elevations, etc. will be governed by shop drawings, the building itself, and actual field conditions.

1.11 UTILITY CONNECTIONS

A. Arrange for all utility connections, determine their exact requirements, and pay all costs incurred.

B. Send proper notices, make necessary arrangements, and perform other services required for care and maintenance of all utilities and assume all responsibility concerning same. Observe all rules and regulations of the respective utilities in executing the work.

1.12 DAMAGED WORK

A. Each Contractor shall be held responsible for all damage that is caused by their work, including leaks in any temporary or permanent piping systems due to pipe rupture, disconnected pipes or fittings, or by overflow of equipment.

B. Patching and replacing of damaged work shall be done by the Contractor who installed the work, as directed by the Architect, but the cost of same shall be paid by the Contractor who is responsible for the damage.

PART 2 PRODUCTS

2.01 PRODUCTS CRITERIA

A. All materials, appliances, and equipment shall be new and best of their respective kinds, free from defects, and of the make, brand or quality specified or as accepted by the Architect.

B. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

C. Apply and install all items in accordance with the manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Architect for resolution.

D. All fixtures, materials, and equipment equal in quality and utility to these herein mentioned will be accepted. When specific names are used in describing fixtures, materials, and equipment they are mentioned as standards only, but this implies no right on the part of the Contractor to use other fixtures, materials and equipment, or methods, unless approved as equal in quality and utility by the Architect. The decision of the Architect shall govern as to what fixtures, materials, and equipment are equals to those mentioned, but the burden of proof as to the quality of any proposed fixtures, materials, or equipment shall be upon the Contractor.

If any tests are necessary to determine the quality of proposed fixtures, materials, or equipment, an unbiased laboratory shall make such tests at the expense of the Contractor satisfactory to the Architect.

2.02 SEISMIC FORCE RESISTANCE: MECHANICAL

A. Equipment:
   1. Each piece of equipment installed under this Section shall be constructed and anchored to structural supports to resist a seismic force and displacement in accordance with CBC Section 1616A1.17 through 1616A.1.26 and ASCE 7-10 Chapter 13, 26 and 30.
   2. Equipment manufacturers shall have equipment certified to satisfy that it is compliant with these special minimum seismic resistance requirements. Compliance shall be certified by an approved, independent agency and proof of such compliance from the agency shall be provided

B. Piping:
   1. Flexibility of piping systems must be maintained by the use of flexible devices at critical points at junctions of separate building structures. Braces or anchors shall be designed to damp oscillations or check excessive movement. Flexible devices for piping of gas shall be loops or offsets. Flexible devices for other piping may be loops, Victaulic grooved, or roustabout couplings.
   2. Piping at tops and bottoms of risers are critical points where flexibility is required, as well as at changes in direction on long runs of piping 4" and larger.
   3. Tops of risers shall be restrained from motion in horizontal direction, and midpoints shall be anchored in all directions.
   4. All piping and ductwork bracing shall be designed to resist a seismic force and displacement in accordance with ASCE 7-10, Section 13.3 as defined in Section 13.6.7 and 13.6.8 and 2016 CBC Section 1616A.1.25 and 1616A.1.26.
   5. The following table shows maximum lengths of shapes used for sway bracing:

TYPE/SIZE Angle	MAX. LENGTH (l/r=200)	TYPE/SIZE Flat Bar	MAX. LENGTH (l/r=200)
1½ x 1½ x ¼"	4'-10"	1½ x ¼"	1'-2"
2 x 2 x ¼"	6'-6"	2 x ¼"	1'-2"
2½ x 2½ x ¼"	8'-2"	2 x ⅜"	1'-9"
3 x 3 x ¼"	9'-10"		
Threaded Rod		Pipe (Schedule 40)	
⅜"	1'-7"	1"	7'-0"
½"	2'-1"	1¼"	9'-0"
⅝"	2'-7"	1½"	10'-4"
¾"	3'-1"	2"	13'-1"
1"	4'-2"		

2.03 PIPE LABELS

A. Brady, Seton or approved equal pipe labels. Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or

abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

D. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

E. Label Sizes (per ANSI A13.1 / ASME A13.1-2007 Standards):
   1. For pipes or covering with outside diameter ¾ to 1¼ inches, minimum length of label: 8 inches, minimum height of letters: ½ inch.
   2. For pipes or covering with outside diameter 1½ to 2 inches, minimum length of label: 8 inches, minimum height of letters: ¾ inch.
   3. For pipes or covering with outside diameter 2 ½ to 6 inches , minimum length of label: 12 inches, minimum height of letters: 1¼ inch.
   4. For pipes or covering with outside diameter 8 to 10 inches, minimum length of label: 24 inches, minimum height of letters: 2½ inches.

2.04 ELECTRICAL MOTORS

A. With exception of motors in UL labeled equipment, motors for HVAC blowers and fans, pumps, and other general purpose applications using an adjustable speed drive shall be Baldor Premium Efficient Super-E®, three phase, foot mounted, Class H insulated motor with AEGIS shaft grounding ring installed internally, re-greasable ball bearings, dynamically balanced rotors.

B. Motors shall be certified for quiet operation and shall bear a label so stating. Motors shall be drip-proof frame, 1.15 minimum service factor in 40°C, ambient windings specially impregnated and epoxy coated for outdoor service.

C. Torque characteristics of motors shall be as required to accelerate machine to 100% full load speed within 10 seconds. Motors shall be dynamically balanced to maximum deflection as follows:
   1. 15 HP and larger: 0.0003 inches.
   2. 10 HP and smaller: 0.0002 inches.

D. Motors shall be Inverter duty, meet NEMA MG-1 and part 30 and 31, and shall be guaranteed to satisfactorily operate at ± 10% voltage shown on Drawings. Transformers of adequate capacity shall be provided if necessary to satisfy this requirement.

E. All 3-phase motors shall be provided with phase and brown-out protection to shut down all motors in the unit if the phases are more than 10% out of balance on voltage or the voltage is more than 10% under design voltage.

F. Fractional horsepower fan motors (¼ hp, ½ hp, ¾ hp) shall be Greenheck "Vari-Green" series motors, DC electronic commutation type, specifically designed for fan applications. Motors shall be permanently lubricated with heavy duty ball bearings to match the fan load and pre-wired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

G. Provide fan drives rated at 150% of motor horsepower. Drives shall be adjustable sheave type unless specified otherwise. Listed fan speeds are only approximate; select and/or change drives to operate at approximately midpoint of adjustable range after final balancing.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Provide all necessary sleeving, core drilling, carpentry, cutting and patching required for proper installation of material and equipment specified.

B. No structural members shall be drilled, bored, or notched in a manner that will impair their structural capacity. No structural cutting or drilling shall be done without the approval of the Architect.

C. All penetrations of concrete or masonry shall be made with core drills. Verify location of all core drills with structural engineer prior to execution.

3.02 EQUIPMENT

A. Equipment shall operate quietly and without objectionable vibration. Such problems, other than from equipment operating at optimum conditions, shall be the Contractor's responsibility and shall be eliminated at the direction of the Architect.

B. Install equipment to provide good appearance, easy access, and adequate space to allow replacement and maintenance. Provide bases, supports, anchor bolts, and other items required to achieve this. Installation shall be level, above moisture level, and adequately braced.

C. Extend ¼" schedule 40 black steel lubrication pipes from hard-to-reach locations to front of equipment or to access doors. Terminate with proper lubrication fittings.

D. Move equipment into building through available openings. Dismantle equipment where necessary to accomplish this. After reassembly, test equipment to verify its satisfactory operating condition.

E. Thoroughly lubricate equipment before operating. Repair of damage resulting from failure to comply with this requirement shall be the Contractor's responsibility.

F. Connections to piping shall be secured and properly aligned and all utility and control connections shall be properly isolated from the building structure by means of vibration isolators and flexible connections. Any equipment not meeting this requirement will be modified and properly reinstalled at no expense to the Owner.

3.03 ACCESS

A. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract Drawings to Architect for resolution.

3.04 CONCRETE EQUIPMENT BASES

A. Concrete work that is part of the mechanical installations, as such is shown and/or detailed on the Drawings, shall conform to the requirements of the Concrete Section of these Specifications.

B. Concrete bases: Anchor equipment to concrete base according to equipment details on mechanical and structural Drawings.

C. Bases shall be neatly finished, have rounded corners and smooth trowel finish.

3.05 ELECTRICAL REQUIREMENTS

A. Electrical work in this Section shall conform to the requirements of Division 26. Equipment shall conform to the standards of the National Electric Manufacturer's Association. Electrical equipment shall bear the label of Underwriters' Laboratories, Inc., where examination and listing service is available for such materials. Motors and motor control equipment shall be as specified below.
   1. The work shall include the furnishing of:
      a. Motor controls mounted as integral part of equipment assemblies.
      b. Pre-wired control panels as described and shown.
      c. Electronic control panels and their components.
      d. Wiring for low voltage controls and "interlock work" except where specifically shown otherwise.
   2. Installing of:
      a. All motors.
      b. All control panels and their components.
      c. Low voltage wiring, line voltage "interlock" wiring, control wiring for safety devices, alarms, and refrigeration.

B. Wiring includes all connections to devices, and all wiring shall be installed in conduit.
   1. Conduit fittings and devices shall be as specified in the basic electrical materials section of Division 26 - Electrical.
   2. Line voltage work (in equipment assemblies) shall be as specified in Division 26 - Electrical.
   3. Devices shall be installed in NEMA enclosures of type required for location.
      a. Flush enclosures: Keystone "Telephone Cabinets" type PF with pull box knockouts.
      b. Surface enclosures: Keystone LJC.

C. Electrical Controls:
   1. Submit shop-wiring diagrams of temperature controls and air conditioning unit controls for approval. Furnish approved wiring diagrams and assistance to Electrician.
   2. Refer to Electrical, Fire Protection, Plumbing and Mechanical documents for work and devices required. All wiring required by plumbing and heating, ventilating and air conditioning work shall be performed by the Controls Contractor.

D. The following work will be furnished and installed under Division 26.
   1. Disconnect switches, remote switches, motor starters, relays and test switches not mounted as integral part of equipment assemblies or in temperature control panels.
   2. All line voltage controls and interlocks, all other controls, circuits from electric panel board to disconnect switches, starters, motors, switches and/or other motor controls, to temperature controls and safety devices.

3.06 PAINTING

A. Properly prepare work to be painted per the requirements of Division 09, except preservative and special painting as described herein. Priming shall conform to Division 09 requirements and be of a material compatible with paint for finish painting.

B. All equipment and materials shall be cleaned of grease, wax, oil, rust or dirt in preparation for finish painting. Any prime coated surfaces showing signs of rust before being finish painted shall be thoroughly cleaned and a new prime coat applied.

C. Prime paint both sides of flashings prior to installation.

D. Furnish can of touch-up paint with each factory finished piece of equipment.

E. Paint all piping in mechanical rooms. Color as selected by the Architect.

F. Black steel piping exposed to the environment shall be painted with rust-inhibiting paint. Color as selected by Architect.

3.07 IDENTIFICATION OF SYSTEMS

A. Nameplates
   1. Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

B. Piping
   1. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
      a. Adjacent to all valves and flanges
      b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
      c. At both sides of wall or floor penetrations.
      d. Before and after all wall, floor and ceiling penetrations and inaccessible enclosures.
      e. Adjacent to changes in direction.
      f. At access doors, manholes, and similar access points that permit view of concealed piping.
      g. Near major equipment items and other points of origination and termination.
      h. Spaced at maximum intervals of 25 feet along each run. Reduce intervals in areas of congested piping and equipment.
      i. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
   2. All piping shall be identified.
   3. Pipe Label Color Schedule: (per ANSI A13.1 / ASME A13.1)
      a. Potable, Cooling, Boiler Feed and other Water Piping:
         1) Background Color: Green.
         2) Letter Color: White.
      b. Fire Quenching Fluids:
         1) Background Color: Red.
         2) Letter Color: White.
      c. Toxic and Corrosive Fluids
         1) Background Color: Orange.
         2) Letter Color: Black
      d. Flammable Fluids:
         1) Background Color: Yellow.
         2) Letter Color: Black.
      e. Combustible Fluids:
         1) Background Color: Brown.
         2) Letter Color: White
      f. Compressed Air:
         1) Background Color: Blue.
         2) Letter Color: White.

C. Valves

1. For identification and Owner's maintenance records, all valves shall be numbered and identified with clearly stamped 1¼" diameter brass tags, in accordance with drawings and service performed.
2. Control valves shall be also marked whether normally open (N.O.) or normally closed (N.S.).
3. Affix Underwriter's standard porcelain enameled identification signs to all fire protection sprinkler control valves, drain valves, and flow switches.

D. Equipment
1. All equipment shall be labeled with 1" high stencils showing identifying mark noted on drawings, and usage.
2. Warning signs shall be placed on machines driven by electrical motors that are controlled by fully automatic starters, per California Code of Regulations, Title 8, Subchapter 7 - General Industry Safety Orders, Article 7, Section 3320.
3. A typewritten schedule of all stencils and valve tags used, with identification, shall be framed and posted in mechanical rooms, at locations as directed.

3.08 INSTALLATION, PIPING

A. Installation of piping shall be such that damage cannot result through thermal expansion or contraction, to piping, building, or pipe hangers and supports. Anchors shall be installed at midpoints of all runs in main piping for the purpose of localizing pipe expansion or prevention of creepage.

B. Rough in shall proceed as rapidly as general construction will permit. All rough-in shall be complete, at locations verified by Architect and Owner, and tested and inspected prior to installation of concrete, lath, plaster, gypsum wallboard, or other finishes.

C. All piping shall be concealed in finished rooms, installed in furred walls and partitions. Where furred or suspended ceilings occur, piping shall be installed in the concealed space at points adjacent to beams and/or other structural members, and coordinated with ductwork and equipment. Where exposed piping occurs, it shall be installed parallel to or at right angles to building walls, unless specifically shown otherwise on the Drawings.

D. All pipe lines shall be installed free from traps and air pockets, true to line and grade, with suitable supports properly spaced. All piping shall be installed without undue stresses and with provision for expansion and contraction.

E. All piping shall be new and free from foreign substances. American standard pipe threads shall be used for IPS threaded work. Joints in threaded piping shall be made up with Teflon tape applied to the male threads only. No screwed pipe joints shall be caulked or packed with rope or other packing materials. Pipe shall be free from tool marks, threads cut accurately with not more than two (2) threads showing beyond fitting. Friction wrenches shall not be used with plated, polished, or soft metal piping. All changes in pipe size shall be made with reducing fitting. Bushings will not be permitted.

F. Protect unattended openings in piping during construction.

G. Weld all pipe 2.5 inches and larger. Use the following procedure. All welders must be AWS certified. AWS B2.1 SMAW 6G Pipe Welding Procedure Specifications

Welding process: SMAW	Grove Angle: 60 degrees
Position: 6G Fixed position	Material/Spec: A 106
Weld Progression: Up	Thickness (pipe/tube): Groove (in) .280
Backing: No	Notes: Sch. 40 Pipe
Current/Polarity: DCEP	Filler Metal Class: E6010Rt/E7018F1

Root Opening: 1/16 to 1/8 Other Filler Metal Class: Rt. 1/8, 3/32 Filler

H. Welded joints shall be beveled and butt-welded. Reductions of pipe shall be made with forged steel welding fittings. Branch reductions of two or more pipe sizes smaller than the main, may be Bonney "Weld-O-Let" fittings, or equal. Job fabricated reductions and branches shall not be used. All pipe burrs shall be reamed out. Welding rods shall be as follows, or approved equal:

Pipe Size	Arc Welding	Gas Welding
2" and larger	Fleetweld #5	Oxweld #1 or Page Hi-Test M
1½" and smaller	None	Oxweld #1 or Page Hi-Test M

I. All copper tubing shall be formed in a workmanlike manner, in accordance with the Pipe and Tube Bending Handbook of the Copper and Brass Research Association. A tube bender giving support to the periphery of the tube shall be used. The tubing shall be protected against flatting or other injury.

J. All copper connections and joints shall be made in accordance with the Copper Tube Handbook, Copper and Brass Research Association. No swaged connections will be permitted. All valves, pumps, and similar equipment shall be connected to copper piping through union or flange adapter fittings.

K. All underground hydronic piping shall be installed per manufacturer's installation instructions. Provide protection of piping from damage due to expansion. Provide thrust blocks where required as indicated by the manufacturers installation instructions.

L. No water or drainage piping shall pass over electrical equipment unless adequate protection is provided to prevent damage by leaks or condensation.

M. Install air vents at all water piping high points when direction of flow is downward.

N. Install sediment drain faucets at all low points.

O. Valves, cocks, etc., shall be installed to allow convenient accessibility and operation.

P. Unions and flanges shall be installed to allow convenient replacement of all equipment and cleaning tubes.

Q. A union connection shall be installed downstream from all valves, at equipment connections and at other locations as required or directed.

R. Shut off valves shall be provided in all main services, and where required to permit proper servicing of equipment. Valves of one type shall be of one manufacturer.

S. All valves shall be of the same size as the pipelines in which they are installed, unless specifically sized on the Drawings. All hand controlled line valves shall be ball valves, except where throttling control or frequent operation is required, in which case globe or angle valves shall be used. Globe valves in horizontal lines shall be installed with stem in horizontal to permit line draining. All globe and angle valves shall be installed to close against pressure. Disc valves shall have discs suitable for the services for which they are to be used.

T. All valves shall be accessible and shall not be installed with the stems below the horizontal plane. Provide access panels at walls, ceilings, or floors.

U. Provide prime coated escutcheon plates at all points where exposed piping penetrates finished wall ceilings or floors.

V. Cutting or boring of joists or other structural members shall be done only when alternative routing is impossible and only upon written approval of the Architect or Owner.

1. Vents through roof shall be flashed with Semco #1100-4 lead flashing assemblies. Flashing shall extended over top of pipe and shall be turned down inside top of pipe.

3.09 CLEANING OF PIPING

A. All new piping shall be thoroughly cleaned of rust, scale, etc., prior to enclosing and placing in operation. Water shall be forced through pipes until the systems are free from foreign substances.

3.10 CLEANUP

A. Upon completion of the work of this Section, remove all material, debris, and equipment associated with or used in the performance of this work.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Balancing Air Systems
2. Additional Tests
   a. Sound testing
   b. Duct leakage testing
   c. Controls verification

1.03 SCOPE

A. The T&B Agency will provide the following services:

1. Provide all supervision, personnel, instruments, calibration equipment, and all other materials necessary to perform balancing and testing, and compile test data including calculations and services necessary for the heating, ventilating, and air conditioning systems for this project, all in accordance with the project Drawings and Specifications and as specified herein.
2. The T&B Agency shall be responsible for inspecting, balancing, adjusting, testing, and logging the data of the performance of fans, all dampers in the duct systems, all air distribution devices or heat exchangers, and the flows of water through all coils.
3. The T&B Agency shall balance, test, and adjust the systemic components to obtain optimum conditions in each conditioned space in the building. If construction deficiencies are encountered which preclude obtaining optimum conditions, the deficiencies will be recorded and given to the Owner's Representative. The T&B Agency is advised that deficiencies in the HVAC construction are often encountered during final T&B services, and should include in the bid an amount deemed advisable to compensate for time in identifying the deficiencies.

B. During construction, the T&B Contractor shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. Inspections shall be conducted a minimum of three times. Typically this is performed when 60% of the ductwork and piping are installed and again when 90% of the total system is installed and prior to insulation. A copy of the written report is to be issued to the Mechanical Engineer for review.

1.04 SUBMITTALS

A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures.

B. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists for use by systems installers in verifying system readiness for T&B.

Examination Report: Within 30 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in Part 3 "Examination", if issues are discovered that may preclude the proper testing and balancing of the systems.

C. Examination Report: Provide a summary report of the examination review if issues are discovered that may preclude the proper testing and balancing of the systems.

D. Certified T&B reports: Within 30 days of completion of balancing work, submit AABC-certified T&B report.

1. Submit one copy of the final T&B Report directly to the design professional of record. Provide three additional copies to the contractor.

1.05 QUALITY ASSURANCE

A. T&B Contractor Qualifications:

1. General Contractor will employ a T&B Agency that is certified by the Associated Air Balancing Council (AABC). The T&B Agency will have experience in the field of air system balancing, possess calibrated instruments, and employ qualified Supervisors and skilled Technicians to perform all required tests. The T&B Agency shall have a minimum of ten (10) years experience in the Testing, Adjusting, and Balancing field.

B. T&B technician shall perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified T&B reports.

2. Certify that the T&B team complied with the approved T&B plan and the procedures specified and referenced in this Specification.

3. Certify the T&B report

C. T&B Conference: If requested by the Owner or Construction Manager after approval of the T&B Agency's submittals, meet to develop a mutual understanding of the details

1. Agenda Items:
   a. The examination report.
   b. The Strategies and Procedures plan.
   c. Systems readiness checklists.
   d. Coordination and cooperation of trades and subcontractors.
   e. Coordination of documentation and communication flow.

D. Approved Test and Balance agencies in the area:

RS Analysis, Inc.
1035 Suncast Lane, Suite 130
El Dorado Hills, CA 95762
(916) 358-5672

National Air Balance Company, Inc.
4171 Business Center Drive
Fremont, CA 94538
(510) 623-7000

Raglen System Balance, Inc.
1121 University Terrace
Reno, NV 89502
(775) 747-0100

Pacific Test & Balance, Inc.
4771 Mangels Blvd.
Fairfield, CA 94534
(707) 696-2444

E. T&B Report Forms: Use standard T&B contractor's forms.

F. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in "AABC National Standards for Total Systems Balance."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES

A. Provide T&B agency one complete set of contract documents, change orders, and approved submittals in digital and hard copy formats. Project Schedule and Mechanical Contractor's Shop Drawings and Temperature Control Drawings shall be provided as issued or received.

B. Controls contractor shall provide required BAS hardware, software, personnel and assistance to T&B agency as required to balance the systems. Controls contractor shall also provide trending report to demonstrate that systems are complete.

C. Coordinate meetings and assistance from suppliers and contractors as required by T&B agency.

D. Provide additional valves, dampers, sheaves and belts to properly test and balance, which shall be installed by the Mechanical Contractor as directed by T&B agency, at no additional cost to owner.

E. Mechanical Contractor shall install test holes where indicated by the T&B Agency. Test holes shall be complete with removable and replaceable plugs

F. Flag all manual volume dampers with fluorescent or other high-visibility tape.

G. Provide access to all dampers, valves, test ports, nameplates and other appurtenances as required by T&B agency.

H. Replace or repair insulation as required by T&B agency.

I. Have the HVAC systems at complete operational readiness for T&B to begin. As a minimum verify the following:

1. Airside:
    a. All ductwork is complete with all terminals installed.
    b. All volume, smoke and fire dampers are open and functional.
    c. Clean filters are installed.
    d. All fans are operating, free of vibration, and rotating in correct direction.
    e. VFD start-up is complete and all safeties are verified.
    f. System readiness checklists are completed and returned to T&B agency.

J. Promptly correct deficiencies identified during T&B.

K. Maintain a construction schedule that allows the T&B agency to complete work prior to occupancy.

L. Before testing or balancing is started, the Mechanical Contractor shall adjust belts and sheaves; align all parts; oil and grease bearings in accordance with manufacturer's instructions; clean

exterior surfaces of coil tubes and fins; flush interior of coil tubes, pull until clean; and check mixing damper operation to insure free operation and activation by the correct thermostat

M. The Mechanical Contractor shall be responsible for certifying in writing that the system, as scheduled for balancing, is operational and complete. Completeness shall include not only the physical installation, but the Mechanical Contractor's certification that the prime movers are installed in good working order, and that full load performance has been preliminary tested under the certification of the Mechanical Contractor. Before any testing and balancing is started, a complete report shall be sent to the T&B Agency by the Mechanical Contractor.

N. The Mechanical Contractor shall be responsible for making all modifications to rectify discrepancies reported by the T&B Contractor as indicating non-compliance with the Contract Documents. By completing the work on time, the Mechanical Contractor shall provide sufficient time before the completion date so that balancing can be accomplished.

3.02 EXAMINATION & REVIEW

A. Review the Contractor shop drawing submittals for their effect on the test and balance process and overall performance of the HVAC system. Submit recommendations for enhancements or changes to the system.

B. Review location and type of volume damper inlet conditions to air terminals, air valves, and HVAC equipment.

C. Review location, type, and size of balancing valves, flow metering stations, and automatic control valves in the water flow station.

D. Review location of pressure sensors in the air and water distribution system.

E. Review automatic control systems as they affect the test and balance procedure.

F. Review sheet metal and piping shop drawings to verify the installation of flow control devices.

G. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for testing and balancing.

H. Review the approved submittals for HVAC systems and equipment.

I. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas.

J. Review equipment performance data including fan and pump curves.

K. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and controls are ready for operation.

L. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor and functioning.

M. Examine strainers to verify that Mechanical Contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.

N. Examine two-way valves for proper installation and function.

O. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

P. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

3.03 PREPARATION

A. Prepare a T&B plan that includes:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Prepare system-readiness checklists, as described in the *AABC National Standards for Total System Balance*, for use by contractors in verifying system readiness for T&B. These shall include, at a minimum:

1. Airside:
   a. All ductwork is complete with all terminals installed.
   b. All volume, smoke and fire dampers are open and functional.
   c. Clean filters are installed.
   d. All fans are operating, free of vibration, and rotating in correct direction.
   e. VFD start-up is complete and all safeties are verified.
   f. Automatic temperature-control systems are operational.
   g. Ceilings are installed.
   h. Windows and doors are installed.
   i. Suitable access to balancing devices and equipment is provided.

3.04 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for T&B procedures.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.05 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare single-line schematic diagram of systems for the purpose of identifying HVAC components.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check condensate drains for proper connections and functioning.

H. Check for proper sealing of air-handling-unit components.

3.06 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.
   a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
   b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
   c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
2. Measure fan static pressures as follows:
   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.
   c. Measure static pressure across each component that makes up the air-handling system.
   d. Report any artificial loading of filters at the time static pressures are measured.
3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust sub-main and branch duct volume dampers for specified airflow. Re-measure each sub-main and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure airflow at all inlets and outlets.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after all have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust, if necessary.

6. Measure and record all operating data.

E. Record final fan-performance data

3.07 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located 2/3 of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control setpoint so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows
   a. Adjust controls so that terminal is calling for maximum airflow (note some controllers require starting with minimum airflow. Verify calibration procedure for specific project).
   b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
   c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
   d. Adjust controls so that terminal is calling for minimum airflow.
   e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
   f. When in full cooling or full heating, ensure that there is no mixing of hot deck and cold deck airstreams unless so designed.
   g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After all terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
   a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
   b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
   c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
   d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
   a. Measure static pressure directly at the fan outlet or through the flexible connection.

b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
   a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
   b. Verify all terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure setpoint to the most energy-efficient setpoint to maintain the optimum system static pressure. Record setpoint and give to controls contractor.
9. Verify final system conditions as follows:
   a. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
   b. Re-measure and confirm total airflow is within design.
   c. Re-measure all final fan operating data, rpms, volts, amps, static profile.
   d. Mark all final settings.
   e. Test system in economizer mode. Verify proper operation and adjust, if necessary. Measure and record all operating data.
   f. Verify tracking between supply and return fans.

B. TOLERANCES

1. Set HVAC system's air flow rates and water flow rates within the following tolerances:
   a. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   b. Air Outlets and Inlets: Plus or minus 10 percent.
   c. Heating-Water Flow Rate: Plus or minus 10 percent.
   d. Cooling-Water Flow Rate: Plus or minus 10 percent.

C. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.08 FINAL TEST AND BALANCE REPORT

A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the T&B process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the AABC technicians or test and balance engineers.

B. The report must be organized by systems and shall include the following information as a minimum:

1. Title Page:
   a. AABC certified company name
   b. Company address
   c. Company telephone number
   d. Project identification number
   e. Location
   f. Project Architect
   g. Project Engineer

h. Project Contractor
i. Project number
j. Date of report
k. AABC Certification Statement
l. Name, signature, and certification number of AABC TBE

2. Table of Contents.

3. AABC National Performance Guaranty.

4. Report Summary:
   a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.

5. Instrument List:
   a. Type.
   b. Manufacturer.
   c. Model.
   d. Serial Number.
   e. Calibration Date.

6. T&B Data:
   a. Provide test data for specific systems and equipment as required by the most recent edition of the "AABC National Standards."

7. Print or sketch, reduced in size, showing all supply, return and exhaust air outlets for easy reference to report data.

C. One copy of the final test and balance report shall be sent directly to the Mechanical Engineer of record. Provide five additional copies to the contractor.

D. An approved copy of the balancing report shall be included in the maintenance manual submittal.

3.09 ADDITIONAL TESTS

A. Duct Leakage Test

1. All ductwork shall be tested for leaks, using necessary instruments before insulating any ductwork. Conduct test as follows and as recommended in SMACNA Balancing Manual.
   a. Seal all openings in duct section and plenum to be tested.
   b. Connect test apparatus to test section of cuts, using a flexible duct connection or hose (fitting provided by Mechanical Contractor).
   c. Close damper on blower suction side, to prevent excessive build-up of pressure.
   d. Start blower and gradually open damper on suction side of blower.
   e. Determine amount of air leakage and make repairs as required.
   f. Leakage factor allowable shall be 5% based on the total operating cfm of the section of duct under testing.
   g. Tested sections of ductwork shall be visually marked with certification sticker and initials of field test inspector. Tests shall be made before duct sections are concealed.

2. Witness the duct pressure testing performed by the mechanical/installing contractor.

3. Verify that proper test methods are used and that leakage rates are within specified tolerances.

4. Report any deficiencies observed.

B. Sound Level Reading

1. After the systems are balanced and the spaces are architecturally complete, sound level readings shall be taken in at least ten locations in the building with an Octave Band Analyzer.
2. In order to reduce the ambient noise level, the reading shall be taken at night.
3. Instrumentation:
   a. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
   b. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).
   c. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 HZ to 8000 HZ.
   d. The accuracy of the sound-testing meter shall be ±1 decibel.
4. Test Procedures
   a. Perform test at the quietest background noise period. Note any cause of unpreventable sound that may affect the test outcome.
   b. Equipment should be operating at design values.
   c. Calibrate the sound-testing meter prior to taking measurements.
   d. Use a microphone suitable for the type of noise levels measured that is compatible with the meter. Provide a windshield for outside or in-duct measurements.
   e. Record a set of background measurements in dB(A), and sound pressure levels in the eight un-weighted octave bands with the equipment off.
   f. Take sound readings in dB(A), and sound pressure levels in the eight un-weighted octave bands with the equipment on.
   g. Take readings no closer than 3' from a wall or from the operating equipment, and approximately 5' from the floor, with the meter held or mounted on a tripod.
   h. For outdoor measurements, move the sound-testing meter slowly and scan the area that has the greatest exposure to the noise source being tested. (This type of reading is generally performed using the A-Weighted scale).
5. Reporting
   a. The test data for each area will be recorded on Noise Criteria curves indicating the decibel level read in each Frequency Band - the NC level required and the NC level measured. The sound level shall not exceed NC 30 in all areas.
   b. The report must record: the location, the system tested, the dB(A) reading, and the sound pressure level in each octave band with equipment on and off.
   c. Plot all the sound pressure levels on the [work sheet, with the equipment on and off.
6. The T&B Agency will submit the test data and test equipment data to the Architect and Engineer for review, and include the approved forms in the T&B report.

C. Controls Verification

1. In conjunction with system balancing perform the following:
   a. Work with the temperature control contractor to ensure the system is operating within the design limitations, and gain a mutual understanding of intended control performance.
   b. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open position. This includes dampers in multi-zone units.
   c. Check that all valves are properly installed in the piping system in relation to direction of flow and location.
   d. Verify the proper application of all normally open and normally closed valves.

e. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
f. Check the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures, humidities, or pressures. Control Contractor will relocate as deemed necessary by the TAB Agency.
g. Check the sequence of operation for any control mode is in accordance with approved shop drawings. Verify that only minimum simultaneous heating and cooling occurs. Observe that heating cannot take place until the cooling zone of valve is completely closed.
h. Verify that all controller set points meet the design intent.
i. Verify the operation of all interlock systems.
j. Verify that controllers are calibrated and function as intended.
k. Verify that controller setpoints are as specified.
l. Verify the operation of lockout or interlock systems.
m. Verify the operation of all valve and damper actuators.
n. Verify that all controlled devices are properly installed and connected to the correct controller.
o. Verify that all controlled devices travel freely and are in the position indicated by the controller: open, closed, or modulating.
p. Perform all system verification to assure the safety of the system and its components.

2. Reporting
   a. The report shall include a summary of verifications performed, remaining deficiencies, and any variations from specified conditions.

3. A systematic check of the above requirements shall be included in the final TAB report.

3.10 FINAL ACCEPTANCE

A. At the time of final inspection, the T&B Agency shall recheck, in the presence of the Owner's Representative, specific and random selections of data, i.e. water and air quantities, recorded in the Certified Report.

B. Points and areas for recheck shall be selected by the Owner's Representative.

C. Measurement and test procedures shall be the same as approved for work forming basis of Certified Report.

D. Selections for recheck, specific plus random, will not normally exceed 25% of the total number tabulated in the report, except that special air systems may require a complete recheck for safety reasons.

E. If random tests elicit a measured flow deviation of 10% or more from that recorded in the Certified Report listings, by 10% or more of the selected recheck stations, 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 Report submitted, and new inspection tests made, all at no additional cost to the Owner.

F. Following final acceptance of the Certified Report by the Owner's Representative the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked by the T&B Agency, so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

END OF SECTION

SECTION 23 0923

ENERGY MANAGEMENT SYSTEM FOR HVAC (EMS)

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes equipment and performance criteria for furnishing all labor and materials for the installation and programming for Energy Management System for HVAC Systems utilizing wireless communication with cloud based servers.

1.02 RELATED SECTIONS

A. Division 01: General Requirements

B. Section 23 0000: Heating, Ventilating, and Air-Conditioning (HVAC)

1.03 SUBMITTALS

A. Shop Drawings and product data in accordance with the specifications.

B. All shop drawings shall be prepared in AutoCAD 2012 or newer. In addition, Contractor shall provide drawings in electronic format with x-ref and layer information to other trades as required.

C. All submittals shall be bound or in a three ring binder with a table of contents and related section tabs. Five (5) copies shall be submitted to the Architect for distribution and review prior to ordering or fabrication of the equipment. The Contractor, prior to submitting, shall check all documents for accuracy.

D. Shop drawings shall include basic floor plans depicting locations of all equipment and wiring installed by others, to be controlled by system and locations of thermostats, gateways and other equipment provided under this section. Drawings shall also show location of electrical power, low voltage wiring and data ports, provided by others, required for proper installation of systems of this section.

E. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification.

1.04 SCOPE OF WORK

A. Except as otherwise noted, the control system shall consist of all thermostats, and gateways to fill the intent of the specification and provide for a complete and operable system.

B. The EMS Contractor shall review and study existing building/site conditions where applicable and all new construction drawings for the project, including HVAC drawings, and the entire project specifications to familiarize themselves with the equipment and system operation prior to prior to bidding and submittal of a bid/price. The Contractor shall notify the Owner immediately of any conflicts between the project and the scope of work of this Section, including work to be completed by others.

C. All equipment and installation of control devices associated with the equipment listed below shall be provided under this Contractor.

D. When the EMS system is fully installed and operational, the EMS Contractor shall make themselves available to meet with the designated representatives of the Owner to review the as-installed condition of the system. At that time, the EMS Contractor shall demonstrate the

operation of the system and prove that it complies with the intent of the Drawings and Specifications.

E. The Contractor shall furnish and install a complete EMS control system including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation. Provide and install EMS controls for the HVAC equipment as noted on the Drawings:
   1. Provide technical support necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor and the owner's team.
   2. Contractor shall provide one training session in the operation of the system, for owner's personnel.

F. EMS Contractor shall provide economizer controller for the Daikin AEQ unit ventilators along with the thermostat. Provide thermostats and tie into Daikin AHF unit ventilators via a terminal strip.

G. EMS Contractor shall provide all wiring between sensors and wireless thermostats.

H. All work performed under this Section of the Specifications shall be in compliance with all codes and regulations as mandated by the authority having jurisdiction.

1.05 SYSTEM DESCRIPTION

A. The Energy Management System (EMS) shall consist of thermostats, gateways and related accessories as indicated below and all related programming for a complete and fully operational web based management system, using a cloud server program complying with the following specifications.

B. The entire Energy Management Solution (EMS) shall include a network of commercial Internet programmable thermostats which use IEEE 802.15.4 mesh wireless communication protocol to reach a Wireless Gateway (WG). The WG must connect to the owner's wide area network (WAN) over a TCP/IP connection. Access and control of EMS is through a web based management tool which sits on a cloud server and must be accessible either locally or remotely via the Internet.

1.06 WORK BY OTHERS

A. The EMS Contractor shall coordinate with other Contractors prior to performing the work on this project and cooperate as necessary to achieve a complete and neat installation. To that end, each Contractor shall consult the Drawings and Specifications for all trades to determine the nature and extent of others' work prior to fabrication and installation. The Owner's representative shall be immediately notified if an area of conflict occurs between trades prior to fabrication and installation. EMS Contractor shall provide field supervision to the Mechanical Contractor for pre-installation of control components.

B. Low voltage thermostat wiring between equipment and thermostat locations shall be furnished and installed by others. Unless noted otherwise all new low voltage wiring shall be multiple conductor thermostat wiring (wire count as indicated in thermostat manufacture's installation instructions) installed per Owner's specifications. (Wiring in existing installations shall be minimum 3 conductor / 24 gauge wires per EMS manufacturer's standard specifications, multiple c conductor/24-gauge thermostat wiring preferred - see Installation Instructions for specific conductor counts depending on heating and cooling modes of existing equipment.)

C. Related work provided by others:
   1. 110 V outlets shall be provided within 5 feet of each gateway location.
   2. 1 Data port shall be provided within 10 feet of each gateway location.

D. Equipment start-up and servicing

1.07 CODE COMPLIANCE

A. Provide EMS components and ancillary equipment which are code compliant.

B. All wiring shall conform to the National Electrical Code.

C. All products of the EMS shall reside with the following agency approvals.
1. California 2016 Title 24 Compliant.
2. California Energy Commission Occupant Control Smart Thermostat (OCST) certified.
3. Open ADR2.0 certified.

1.08 SYSTEM STARTUP & COMMISSIONING

A. Each EMS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the EMS shall be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report shall be submitted to the Owner indicating that the installed system functions in accordance with the Drawings and Specifications.

B. The EMS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The EMS Contractor shall have a trained technician available on request during the balancing of the systems. The EMS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract to assist with functional testing of system as it relates to EMS.

1.09 TRAINING

A. The EMS Contractor shall provide training for two owner's representatives and/or maintenance personnel. The EMS Contractor shall provide on-site training to the District's representative(s) and maintenance personnel per the following description:
1. On-site training shall consist of a minimum of one hour of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include
a. System Overview
b. System Software and Operation
c. System access
d. Software features overview
e. Changing set points and other attributes
f. Scheduling
g. Editing programmed variables
h. Displaying color graphics
i. Running reports
j. Workstation maintenance
k. Application programming
l. Operational sequences including start-up, shutdown, adjusting and balancing.
m. Equipment maintenance

1.10 OPERATING AND MAINTENANCE MANUALS

A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire EMS. This documentation shall include specific part numbers.

B. Following project completion and testing, the EMS Contractor shall submit as-built documentation reflecting the exact installation of the system.

1.11 WARRANTY

A. The EMS contractor shall warrant the system for 12 months after system acceptance and beneficial use by the District. During the warranty period, the EMS contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the specification. EMS equipment shall be warranted for a period of 5 years from the time of system acceptance.

B. Warranty of equipment is limited to replacement of defective products.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Unless noted otherwise, all products shall be of a single manufacturer. The standard of design and quality shall be products as manufactured by Pelican Wireless Systems.

B. Products of other manufacturers shall be considered for acceptance provided they equal or exceed the material requirements and functional requirements of the specified product. A request for Architect's approval must be submitted with complete technical data to allow for proper evaluation. All materials for evaluation must be received by Project Manager at least 10 days prior to bid due date.

2.02 WIRELESS GATEWAY (WG)

A. A single WG shall be capable of providing communication between a dedicated cloud server using TCP/IP and the on-site Internet Programmable Thermostats using the IEEE 802.15.4 wireless communication protocol. Additional WGs can be used for a single site, but each WG must meet or exceed these requirements.

B. The WG must provide the following hardware features as a minimum:
   1. Single Ethernet Port.
   2. One micro-USB 5VDC power input.
   3. 2.4 GHz IEEE std. 802.15.4 built-in communication processor.

C. The WG shall provide the communication link between the entire system and a cloud based server. Communication with cloud server shall be secured using AES (Advanced Encryption Standard).

D. The WG shall be able to support 2000 Internet Programmable Thermostats.

2.03 INTERNET PROGRAMMABLE THERMOSTAT (IPT)

A. Internet Programmable Thermostat shall be a wireless communicating commercial programmable thermostat that uses IEEE 802.15.4 for networking communication and a wiring terminal block for controlling a single zone HVAC unit.

B. The IPT shall provide a keypad for setting:
   1. Temperature Set points.
   2. System Mode (Heat, Cool, Auto, Off).
   3. Fan Mode (Auto, On).
   4. Light Button.

C. The IPT shall include a wiring terminal for controlling a single zone HVAC unit. The wiring terminal must be able to be removed from the IPT for installations where only 3-wires exist or are available between where the IPT shall be placed and its connection with the HVAC unit it shall be controlling. Over these 3-wires the thermostat must still be able to control the HVAC unit based on these specifications.

D. The IPT must be configurable using a Web Based App. No thermostat configuration, other than setting the IPT to Conventional, Heat Pump - O, or Heat Pump -B, shall be done at the thermostat. Web based Configuration Setting options shall include:
1. Naming the thermostat
2. Grouping multiple thermostats.
3. Heat Pump or Conventional system setting.
4. If Heat Pump; reversing valve O or B setting.
5. Cycles Per Hour (1 - 6).
6. Anticipation Degrees (0˚F - 0.5˚F)
7. Calibration Degrees (2.0˚F - -2.0˚F)
8. Heat Stages (0 - 2)
9. If Heat Pump; Aux Heat (Disabled and/or Enabled Option)
10. Cool Stages (0 - 2)
11. Fan Stages (1 - 2)
12. Fan Circulation Minutes Per Hour.
13. Temperature Display (Fahrenheit or Celsius)
14. Heat Range Temperature Setting Limitation
15. Cool Range Temperature Setting Limitation
16. Ability to disable and enable Keypad Control through schedule.
17. Heat consumption (kw, btu, ton, or watt)
18. Cool consumption (kw, btu, ton, or watt)
19. Notification Sensitivity (High, Medium, Low)
20. Alarm of exceeding temperature based on a Safe Range
21. Schedule set times (2, 3, 4, or Variable).

E. IPT settings and control through the Web Base App shall be in real-time and include:
1. Space Temperature
2. System Mode (Heat, Cool, Auto, Off).
3. Fan Mode (Auto, On).
4. Current set point.
5. Relay status (Heat/Cool and Fan).
6. Historical Trend Graphs.
7. Scheduling
8. Lock and Unlock Entire Thermostat's Keypad
9. Lock and Unlock the Thermostat's Fan Mode setting Only

2.04 WEB BASED GRAPHICAL USER INTERFACE

A. The Web Based App (WBA) shall be able to run on any PC that uses Safari, Chrome, Firefox, or any other web browser that meets these browsers' functionality.

B. The WBA Platform shall be able to run on any Internet Accessible Smartphone and/or Tablet that has a Web Browser compatible with HTML5.

C. The WBA shall allow up to a minimum of 100 simultaneous users/clients to access the Energy Management System.

D. The Web Based client shall support at a minimum, the following functions:
1. User log-on identification and password shall be required.

2. HTML programming shall not be required to display any graphics or data on the Web page.
3. Storage of data shall reside within the cloud server and shall not sit within the client's computer or device. EMS that requires data storage on a client computer or an on-site server is not acceptable.
4. Users shall have administrator and user definable access privileges.
5. Open API interface with XML data output.

E. Schedules:
1. The WBA shall provide user with access to setting Internet Programmable Thermostat (IPT) schedules. Up to 12 schedule periods per day shall be available for each IPT.
2. Schedules shall be available as Weekly (7-day), Daily, or Weekday/Weekend (5-2).
3. The WBA shall provide the user the ability to:
   a. View Schedules.
   b. Add/Modify Schedules.
   c. Assign Thermostat to a Group Schedule.
   d. Delete Schedules.

F. Trending
1. The WBA shall provide real-time trend information on:
   a. Each IPT's space temperature.
   b. Each IPT's temperature set points.
   c. Each IPT's current call; heat, cool, and/or fan.
   d. Each IEE's call for economization
2. The WBA shall be able to record and provide at least two years of past trend data for every thermostat in the wireless network. Trend data shall include:
   a. space temperature; with resolution of every 1/10th of a degree Fahrenheit.
   b. IPT's temperature set points.
   c. indication of whether the thermostat was calling for; heat, cool, and/or fan.
3. Trend data shall be viewable on the WBS

G. Alarm Notifications
1. The WBA shall provide automatic alarming functionally based on real-time monitoring of at least:
   a. space temperature and temperature change.
   b. IPT's temperature set points.
   c. IPT's current call; heat, cool, and/or fan.
2. The WBA shall be able to provide a user with the ability to:
   a. View Alarms.
   b. Set Alarm Notification sensitivity level to High, Medium, or Low.
   c. Delete Alarms.
3. Alarms shall be able to be sent via email and/or text message to up to 100 or more clients.

H. Consumption Usage
1. The WBA shall be able to calculate and graphically display the consumption of running a single zone HVAC unit based on a user defined HVAC unit heat and/or cool consumption rate multiplied by the thermostat heat/cool call time.
2. The WBA shall be able to calculate and graphically display the cost of consumption of running a single zone HVAC unit based on taking a user defined HVAC unit heat and/or cool consumption and multiplying that by the client defined cost per kw and/or therm.
3. The WBA shall be able to display consumption usage for a single thermostat, multiple thermostats at a single time, or all the thermostats in the EMS.
4. The WBA shall be able to record and display up to at least two years of consumption usage information.

2.05 WIRED REMOTE TEMPERATURE SENSORS AND DIGITAL ALARM INPUT

A. Input Temperature Sensor (ITS).
   1. The ITS shall connect to the Internet Programmable Thermostat over 3-wires.
   2. ITS shall provide at least one external 10K Type II thermistor temperature sensor input.
   3. Web Based App shall be able to record and provide at least two years of past temperature data for ITS.
   4. The trend data shall be viewable on the WBA.
   5. ITS must be accurate to ±1.0℉
   6. ITS must be able to be installed up to 500' away from IPT using standard thermostat wiring.

2.06 INTERNET ENABLED ECONOMIZER (IEE)

A. The IEE shall connect to the Internet Programmable Thermostat (ITS) with ONLY 3-wires. No additional wiring must be required between the IEE and the ITS to gain complete Title 24 compliant economization control.

B. IEE shall provide up to three 10K Type II external thermistor temperature sensor input.

C. Web Based App shall be able to record and provide at least two years of past data for IEE. Data must represent historical representations of:
   1. Calls for Economization
   2. Outside Air Damper Position
   3. Supply and Outside Air Temperature
   4. The trend data shall be viewable on the WBA.
   5. IEE must be able to send California Title 24 Fault and Diagnostics codes to the WBA, email addresses, and or text messages.
   6. IEE must be able to be installed up to 500' away from IPT using standard thermostat wiring.
   7. IEE must have a settable 0-10VDC output for Outside Air Damper Actuator control.
   8. IEE must have a settable 0-10VDC output for Variable Frequency Drive (VFD) control.
   9. IEE must be configurable for different VFD speeds based on calls for cold, heat, and ventilation.
   10. IEE must have a 0-10VDC input for Outside Air Damper Position Feedback.

2.07 WIRELESS PROXIMITY SENSORS

A. Wireless Proximity Sensor (WPS).
   1. The WPS shall connect with the Internet Programmable Thermostat over the 802.15.4 wireless network.
   2. WPS shall be powered by 2 AA batteries or equivalent.
   3. WPS must be able to be used for either:
      a. Accepting a motion sensor's 2-wire dry contact output.
         1) The WPS shall be able to notify an Internet Programmable Thermostat if a motion sensor's dry contact is in either the open or closed position.
         2) Dry contact open positions shall indicate that the space is occupied and the IPT must be able to automatically setback its temperature setting by a range of 0℉ - 10℉ or OFF.
         3) Dry contact closed position shall indicate that the space is unoccupied and set the temperature to a comfort setting when the space is occupied.
         4) Setback settings and comfort settings must be settable through the Internet Programmable Thermostat's schedule through the Web Based App (cannot be settable at thermostat).

5) Web Based App must be able to display when a space is "Unoccupied".

b. Detecting if a Window or Door is Opened or Closed.
   1) The WPS must have a built-in magnetic sensor and come with a magnet that can be installed on a door or window.
   2) The WPS must be able to notify an Internet Programmable Thermostat if the door is open and the IPT must automatically turn to the OFF position.
   3) The WPS must be able to notify an Internet Programmable Thermostat if the door is closed and the IPT must automatically return to its last temperature and system settings.
   4) Web Based App must be able to display when the Door or Window is Open and must be able to be set to indicate "Door" or "Window".

c. Web Based App shall be able to notify if the WPS batteries are low and record and provide at least two years of past history on occupancy and/or door/window status for each space a WPS is installed in.

d. The trend data shall be viewable on the Web Based App.

e. Internet Programmable Thermostat must be able to connect with at least 8 WPS, each WPS must have a unique serial number and each WPS shall be settable, through the Web Based App, as either a motion sensor input or as a door/window sensor.

PART 3 - EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES

A. General
   1. Installation of the Energy Management System shall be performed by an approved Contractor. The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor without prior written approval of the owner.

B. Demolition
   1. Remove controls which do not remain as part of the Energy Management System. The Owner shall inform the Contractor of any equipment which is to be removed that shall remain the property of the Owner. All other equipment which is removed shall be disposed of by the Contractor.

C. Access to Site
   1. Unless notified otherwise, entrance to building is restricted. No one shall be permitted to enter the building unless their names have been cleared with the District or the District's Representative.

D. Code Compliance
   1. All wiring shall be installed in accordance with all applicable electrical codes and shall comply with equipment manufacturer's recommendations.

E. Cleanup
   1. At the completion of the work, all equipment pertinent to this Section shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this Section.

3.02 WIRING, CONDUIT, AND CABLE

A. All control wires between HVAC units and thermostat locations to be furnished and installed by others. The EMS contractor shall not begin work on this contract until all wiring is installed to the satisfaction of the EMS contractor. The EMS contractor shall provide wiring between remote

temperature sensors, TA1 and thermostats as required, unless noted otherwise in Drawings or Specifications.

3.03 HARDWARE INSTALLATION

A. Installation Practices for Devices
   1. All devices are to be mounted level/plumb and per the manufacturer's installation documentation.

B. Identification
   1. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
   2. All field enclosures, other than controllers, shall be identified with a back lite nameplate. The lettering shall be in white against a black or blue background.
   3. Junction box covers shall be marked to indicate that they are a part of the EMS system.
   4. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
   5. All I/O field devices inside FIP's shall be labeled.

C. Existing Controls.
   1. Existing controls are not to be reused. All EMS devices shall be new.

D. Control System Switch-over
   1. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics shall be on site so that the entire switch-over can be accomplished in a reasonable time frame.

E. Location
   1. The location of sensors is per mechanical and architectural drawings.
   2. Space humidity or temperature sensors shall be mounted away from machinery generating heat, direct light and diffuser air streams.
   3. If Input Temperature Sensor(s) (ITS) is used as Outdoor air sensor, Outdoor air sensors shall be mounted on the north building face directly in the outside air. Install sensors such that the effects of heat radiated from the building or sunlight is minimized.
   4. If any line voltage electrical control is being installed, field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.04 SYSTEM PROGRAMMING

A. General.
   1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software.
   2. Contractor shall work with owner's representative to determine programming parameters including but not limited to hours of operation, set points, system variables, thermostat naming, and site naming. Thermostat & Site naming shall be performed by the contractor. Naming convention (equipment # or name, or space served) shall be provided by or agreed upon with the Owner.

3.05 COMMISSIONING AND SYSTEM STARTUP

A. EMS device functional testing.
   1. Each system for which a EMS device has been installed shall be tested for proper installation and functional operation. Test shall include on-site control test to verify each wireless device is responding to signals sent from cloud based servers and responding in accordance with manufacture's specifications.

END OF SECTION

DIVISION 26 - ELECTRICAL

SECTION 26 0500 - BASIC ELECTRICAL REQUIREMENTS

A. Comply with all Federal and State Codes, including the latest edition of the International Building Code, National Electric Code, and International Fire Code.
B. All work shall comply with all applicable UL standards and District Standards.
C. Provide new electric service substructures (coordinated with PG&E), including new facility main electric panel and electrical distribution system with branch panels.
D. Provide new telecom service pathways from the existing MDF at the District Office, using existing spare raceways already crossing under the Street, towards the High School. Intercept and extend new conduits to the new facility MDF and IDF, for cabling by the District.
E. Provide new interior and exterior lighting systems, including bus yard lighting, parking lot lighting, emergency exit and egress lighting (where required by code), and lighting controls throughout.
F. Provide branch circuit conduit and wire and connections to all equipment requiring electrical services.
G. Provide a new stand-alone manual fire alarm system with off-site monitoring.
H. Provide new facility telecommunications system pathways in and between each building, for jacks, cabling, patch panels, terminations, and testing by the District.
I. New installation to meet IBC 2010 Seismic Certification requirements for equipment with an importance factor of 1.0. For emergency inverter, use importance factor of 1.5.
J. Provide all incidental demolition, trenching, and electrical testing.

SECTION 26 0800 - TESTING

A. Electrical testing to include all new lighting and power circuits and feeders, tested to NETA ATS-2017 standards.
B. Test new service and distribution system panels and branch panels, including feeders, grounding, and new branch circuiting throughout.
C. Test new lighting and lighting controls and new emergency lighting inverter (if used).
D. Test all new telecommunications systems.

SECTION 26 2400 – SERVICE AND DISTRIBUTION EQUIPMENT

A. Coordinate with local electric utility company (PG&E) for new service to the site, including primary connection across the Street to the South.
B. All new gear to utilize commercial grade, bolt-on type breakers with ratings exceeding the connected loads and available fault current in accordance with applicable sections of the National Electric Code.
C. Protect branch circuits serving exterior receptacles or circuits located in toilets, damp, or wet locations with ground fault circuit interrupters.

SECTION – 26 2700 - BASIC ELECTRICAL MATERIALS AND METHODS

A. Conduit and Fittings: Schedule 80 PVC, Rigid steel, intermediate metal conduit, and electrical metallic tubing. Use set screw conduit fittings for all concealed metal raceways. Use compression type conduit fittings for exposed work.
B. Wiring: All copper 600-volt, type THWN insulation, except that all wiring #1/0 and larger shall be XHHW.
C. Wire sizes #12 and smaller shall be solid. #10 and larger shall be stranded.
D. Wiring Devices: Receptacles 125-volt, 20-ampere specification grade comparable to Hubbell Cat. #5262, or approved equal, single phase, 3-wire, grounding type except as noted otherwise. Snap switches 125-volt, 20-ampere specification grade, silent type.

SECTION 26 5100 - LIGHTING

A. All new lighting shall be designed in compliance with IES recommended illuminance levels.
B. All luminaires shall be dimmable LED.

SECTION 26 5700 – LIGHTING CONTROL SYSTEM

A. New lighting controls to be Wattstopper to match other recent District projects.
B. Use digital wall switch type 0-10V LED compatible dimmers.
C. Use individual digital multi-zone room controllers for each space, as required by code.
D. Use digital ceiling mounted occupancy motion sensors.
E. Use digital ceiling mounted photosensors for all areas with adequate daylighting.

DIVISION 27 - COMMUNICATIONS

SECTION 27 0000 - TELECOMMUNICATIONS SYSTEM

A. Provide and install complete voice and data communications system pathways, to allow the District to provide and install jacks, cabling, patch panels, and all terminations and testing.
B. Provide a new telecom cabinet / rack at both buildings, for District provided equipment, patch panels, and all wiring.
C. Include new site raceways tapped from the existing raceway system noted above, for District provided telecom cabling that will originate at the District Office Server Room.
D. The installation shall not include any active network components such as routers, switches, hubs, wireless communications system transceivers, antennae, base stations and concentrators or servers, which shall be supplied by the District.

DIVISION 28 - ELECTRONICS SAFTEY AND SECURITY

SECTION 28 3101 - FIRE ALARM SYSTEM

A. This project shall include the furnishing, installation, connection, programming, commissioning, and testing of a new Notifier fire alarm system and equipment required to form a complete coordinated system ready for operation at the new facility.
B. It shall include, but not be limited to a new fire alarm control panel, new alarm initiating devices, alarm notification appliances (including horns and strobes), auxiliary control devices, and power supply extender panels (as required), and all associated wiring.
C. All notification devices shall be horn/strobes or strobe lights. Voice evacuation is not required for this project.
B. Installation shall meet National Electrical Code Article 760 and NFPA Standard 72.

APPENDIX C

Liberty High School

New Maintenance, Operations & Transportation Facilities

850 2nd Street, Brentwood, California 94513

Luminaire Catalog Pages

100% Design Development Set

May 10, 2018

O'MAHONY & MYER
ELECTRICAL ENGINEERING & LIGHTING DESIGN

4340 Redwood Hwy., Suite 245, San Rafael CA 94903

Metalux AP Series

Luminaire Type **CB**
Storage, Mechanical, Electrical & Telecom Rooms

DESCRIPTION

CWPLD series is a versatile LED wraparound series with uniform, soft light at up to 60% energy savings over fluorescent light sources. This fixture has all of the commercial features contractors expect in a Metalux product, including Universal Voltage, 0-10 Volt dimming electronics and quick row or suspension mount capability. Patent pending easy mounting channel reduces installation time when row mounting fixtures together. Premium optical linear prisms provide even light distribution, minimizing the number of fixtures required to light a space. These CWPLD series are an ideal choice for commercial, retail or residential applications.

CWPLD
LED

Commercial Model LED Wraparound

SPECIFICATION FEATURES

Construction
Housing consists of cold rolled steel with embosses for extra rigidity. Post-fab painted with reflective, baked-on white enamel using pretreated metal to ensure maximum adhesion. End caps formed from a high-impact polymer for finished aesthetic. Frosted, high-impact polycarbonate lens with linear prisms provides soft, uniform, glare-free light output.

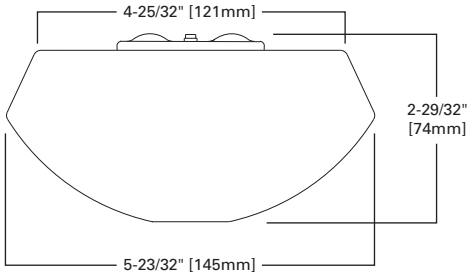
Electrical
Long-Life integrated LED and driver electrical system optimized to deliver superior performance and efficacy of 110 lm/W. Clean, bright white 4000K Color Temp LED's with minimum 80 CRI for accurate color rendering. The CWPLD series offers 0-10V dimming from 10-100%.

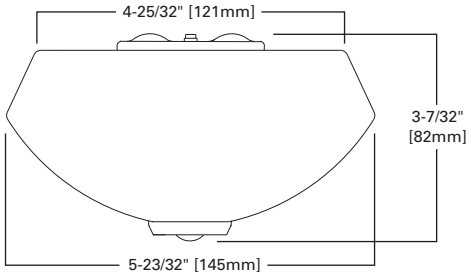
Finish
Post painted with high reflective paint – standard.

Installation
Easy mounting channel reduces installation time when row mounting fixtures together. Lens and LEDs are factory preinstalled and do not need to be removed during installation. Suitable for single surface, row mounting, or suspension mount applications.

Reliability
Five year comprehensive fixture warranty. LED's projected life of 50,000 hours at 70% lumen output.

Compliance
cULus 1598 listed for damp locations. Meets FCC part 15 class B requirements. Complies with IESNA LM-79 test standards. RoHS and ADA compliant. DesignLights Consortium® Qualified and classified for DLC Standard, refer to www.designlights.org for details. Suitable for use in clothes closets when installed in accordance with the NEC 410.16 spacing requirements.

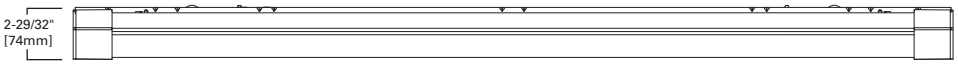




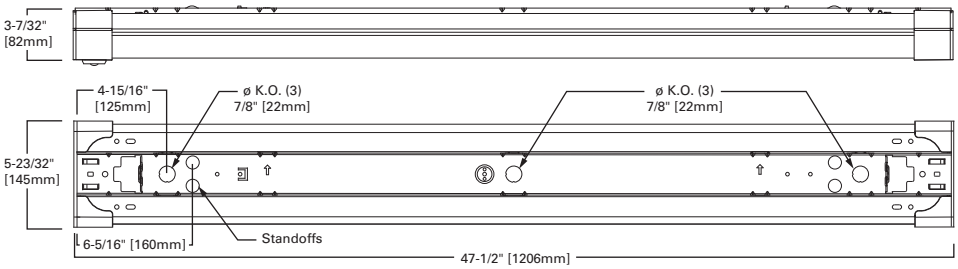
WITH SENSOR

MOUNTING DATA

4'



4' WITH SENSOR



Catalog Number	Product Description	Unit UPC
4CWPLD4040C	4 LED Commercial Wraparound, 4700 lumen, 4000K UNV	080083749072
4CWPLD4040CS	4 LED Commercial Wraparound, 4700 lumen, 4000K UNV, with Occupancy Sensor	080083749065

ORDERING INFORMATION

CWPLD Standard Series Catalog Number	Typical Lumen	Input Watt	Efficacy (lm/W)	CRI	Color Temp K	Controls	Dimming Compatibility	Start Temp/Op Temp	LED Lumen Maint.	Installation
4CWPLD4040C or 4CWPLD4040CS	4,700	43	110	83	4000K	UNV 0-10V Dimming to 10%	0-10V eaton.com/lighting/resources/library/literature *see full link below	-20C/45C	L70 @ 50,000 hrs.	Surface, wall, suspended, row

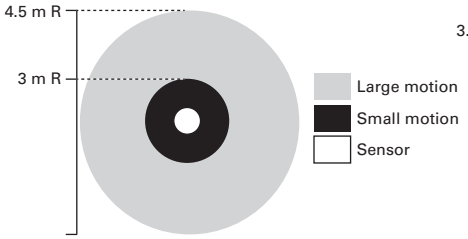
***0-10V Dimming Link:**
http://www.cooperindustries.com/content/dam/public/lighting/products/documents/metalux/technical_information/METALUXLED-AP-SERIES-ContrCompat-WP502001EN-tis.pdf

ACCESSORIES (ORDER SEPARATELY)

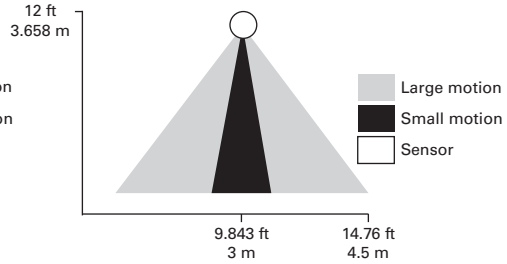
HBAYC-CHAIN/SET-U=(2) V-Hanger, 36 in. Chain, S-Hooks
4CWPLDLNS=4 ft. Replacement Lens

SENSOR COVERAGE

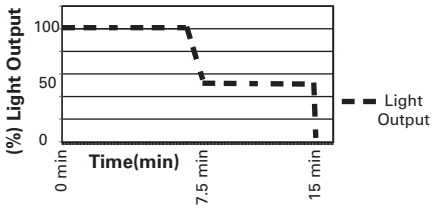
SENSOR COVERAGE PATTERN TOP VIEW



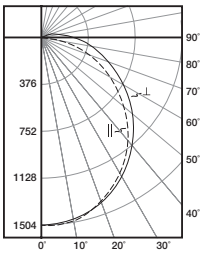
SENSOR COVERAGE PATTERN SIDE VIEW



LIGHT OUTPUT VERSUS TIME



PHOTOMETRICS



4CWPLD4040C
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.24 x mounting height, (⊥) 1.27 x mounting height
Lumens: 4753
Input Watts: 43W
Efficacy: 110 lm/W
Test Report: 4CWPLD4040C.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	1494	1494	1494
5	1499	1487	1489
10	1477	1466	1471
15	1439	1434	1444
20	1388	1388	1401
25	1325	1329	1345
30	1250	1258	1279
35	1163	1179	1207
40	1071	1091	1125
45	969	996	1039
50	864	894	946
55	754	790	851
60	637	683	754
65	513	576	658
70	386	475	563
75	258	379	478
80	140	293	394
85	45	218	323
90	1	155	255

Coefficients of Utilization

	Effective floor cavity reflectance																	
rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	118	118	118	118	115	115	115	115	109	109	109	104	104	104	99	99	99	96
1	106	101	96	92	103	98	94	90	93	90	86	89	86	83	85	82	80	78
2	96	87	80	74	93	85	78	73	81	75	70	77	72	68	73	70	66	64
3	88	76	68	61	85	74	67	60	71	64	59	68	62	57	65	60	56	53
4	80	67	58	51	77	66	57	51	63	55	50	60	54	49	57	52	47	45
5	73	60	51	44	71	59	50	44	56	49	43	54	47	42	52	46	41	39
6	68	54	45	38	66	53	44	38	51	43	37	49	42	37	47	41	36	34
7	63	49	40	34	61	48	39	33	46	38	33	44	38	32	43	37	32	30
8	58	45	36	30	57	44	36	30	42	35	29	41	34	29	39	33	29	27
9	55	41	33	27	53	40	32	27	39	32	26	37	31	26	36	30	26	24
10	51	38	30	24	50	37	29	24	36	29	24	35	28	24	34	28	23	22

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1159	24.4
0-40	1898	39.9
0-60	3380	71.1
0-90	4579	96.3
0-180	4753	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	10837	9544	9490
55	10306	8731	8826
65	9380	7800	8182
75	7467	6894	7713
85	3367	6332	7756

Powering Business Worldwide

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

VANLED10YFFRW

Low-profile vandal-resistant fixture covers the footprint of most traditional canopy lights. Available in flat or drop lens with frosted and unfrosted options.

Color: White

Weight: 11.8 lbs

Luminaire Type **CC**
Bus Wash Bay
Riding Equipment Storage

Driver Info		LED Info	
Type:	Constant Current	Watts:	10W
120V:	0.30A	Color Temp:	3000K
208V:	0.20A	Color Accuracy:	75 CRI
240V:	0.17A	L70 Lifespan:	100000
277V:	0.15A	Lumens:	1449
Input Watts:	13W	Efficacy:	111 LPW
Efficiency:	77%		

Technical Specifications

Listings

UL Listing:

Suitable for Wet Locations. Covered Ceiling Mount Only.

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label

Electrical

Driver:

Class 2, Constant Current, 100-277V, 50-60Hz, 280mA

THD:

8.1% at 120V, 13.2% at 277V

Power Factor:

99.4% at 120V, 94.6% at 277V

Construction

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F) ambient temperatures

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Housing:

Die-cast aluminum housing and lens frame with (4) 1/2" NPS side conduit entries and weatherproof rear wire plug and access plate

Mounting:

Ceiling mount to recessed junction with knockout template or directy to ceiling surface, utilizing side conduit entry points

IP Rating:

Ingress Protection rating of IP66 for dust and water

Lens:

Vandal-resistant polycarbonate textured opaque for low glare flat lens

Reflector:

Semi-specular, vacuum-metalized polycarbonate

Gaskets:

High-temperature silicone gaskets

Finish:

Our environmentally friendly polyester powder coatings are formulated for high-durability and long-lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOCs or toxic heavy metals.

LED Characteristics

LEDs:

Discreet LEDs on PCB board

Color Stability:

RAB LEDs exceed industry standards for chromatic stability

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. See our full warranty

Replacement:

Replaces up to 50W Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

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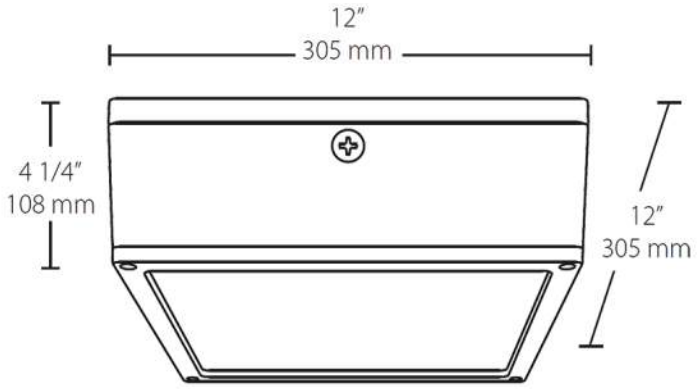
VANLED10YFFRW

RAB

Dimensions



Features

- Fits the footprint of older canopy lights
- Vandal resistant and UV resistant lens
- Ultra-high efficiency
- Clean, contemporary, low-profile design
- Available with drop lens or flat lens
- IP66 rated, keeps dust, bugs and water out
- Photo and motion sensor options available

Ordering Matrix

Family	Wattage	Color Temp	Lens	Motion Sensor & Finish	Driver Options	Photocell Options
VANLED						
	10 = 10W **20** = 20W **40** = 40W **52** = 52W **65** = 65W **75** = 75W	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Drop lens **F** = Flat lens **FR** = Frosted Drop Lens **FFR** = Frosted Flat Lens	**Blank** = Bronze, no sensor **W** = White, no sensor **MS** = Bronze w/ SMS500 mini-sensor (not available w/ D10 models) **MSW** = White w/ SMS500 mini-sensor (not available w/ D10 models)	**Blank** = On/Off driver **/D10** = 0-10V Dimming (not available for 10w) **/480** = 480V (not available for 10W or 20W) **/480/D10** = 480V w/ 0-10V dimming (not available for 10W or 20W)	**/PCS** = 120V Swivel **/PCS2** = 277V Swivel **/PCS4** = 480V Swivel

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Metalux

DESCRIPTION

FPanel LED panel series provide premium performance and pleasing aesthetics. It is optimized for shallow plenum grid ceilings or surface mounting. Developed with Eaton's latest generation of solid state components and electronic driver technologies, these panels are ideal for new construction and to replace fluorescent troffers. Its refined visual optics and integrated grid retention clips provide the features needed for speed and installation flexibility. LED FPanels are an excellent lighting solution for commercial office spaces, schools, healthcare and retail merchandising areas.

Luminaire Type **CD**
M&O Shop & Storage (under mezzanine)
Locksmith

SPECIFICATION FEATURES

Construction/Mounting
Narrow aluminum bezel is tightly held to code gauge steel back plate to protect the LEDs and optical area. Corners are seamless with a narrow flange to provide a refined finish and maximize the light emitting surface. Integral grid locking clips and separate suspension clips are included on the panel to ensure installation flexibility in ceiling systems and to meet code when additional retention is required. Junction box is constructed of code gage galvanized steel with an easy access hinged door for high voltage and low voltage wiring access and includes trade size knockouts. The luminaire is less than 2 inches in depth making it an ideal choice for shallow plenums and low ceilings. May also be surface mounted using the optional kit.

Controls
The FPanel is standard with a 0-10V continuous dimming driver which dims to 10% and works with most standard 0-10V control/dimmers. Combine with energy-saving products like wall dimmers, Room Controller, occupancy and daylight sensors, and lighting relay panels. Or, go wireless with optional field installed controls for either WaveLinx or LumaWatt Pro.

Electrical
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3500K, 4000K and 5000K with a minimum of 80 CRI and a 90 CRI option that is 3000K. Projected lumen maintenance based on TM21 is L73 > 60,000 hours. Electronic drivers are cULus recognized and available for 120-277V. Emergency battery pack options are available in 7 watts and 14 watts. These emergency battery packs meet critical life-safety lighting requirements and are sold separately for field installation and remote mounting.

Optical Shielding
Light guide is constructed of acrylic with specialized features to optimize light extraction providing excellent efficiency. White frost lens with smooth pattern provides uniform illumination as well as scratch and impact resistance.

Compliance
Constructed of UL recognized components these indoor luminaires are cULus listed for 25°C ambient environments, IC rated for direct insulation contact, RoHS compliant, damp location listed, and comply with IESNA LM-79 and LM-80 standards. NEMA 410 Compliant. DesignLights Consortium® Qualified and classified for DLC Standard, refer to www.designlights.org for details.

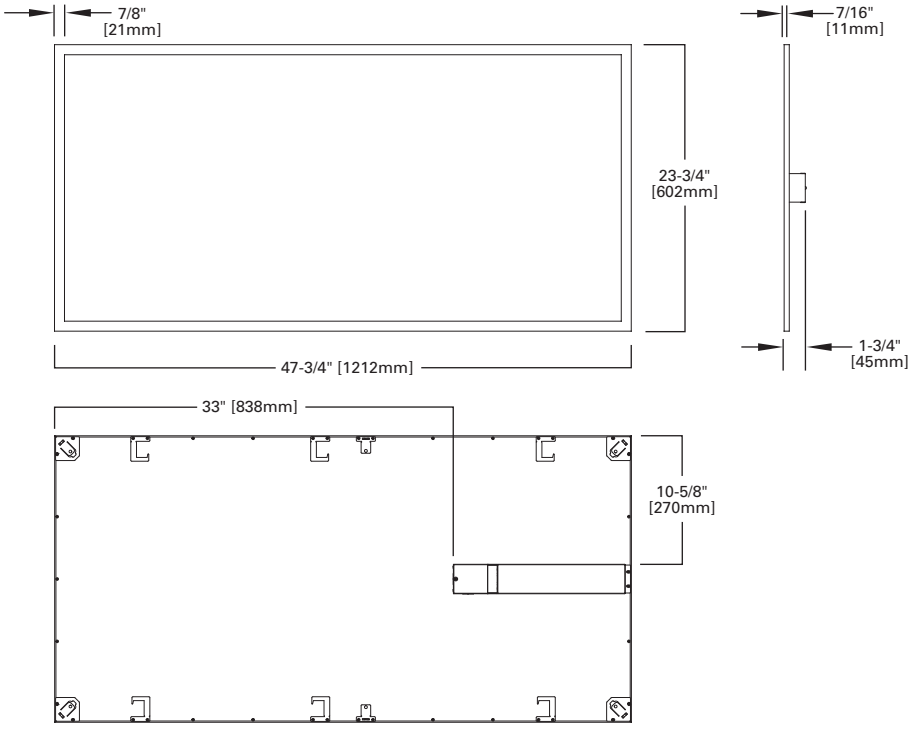
Warranty
Five year warranty.

24FP
LED

2' X 4' LED PANEL

General LED Panel.
Recessed in Insulated
Ceilings or Surface Mount

DIMENSIONS



LOAD DATA

Thd	13%
Power Factor	0.96
Weight	18.5
Low Temp. Start	-20°C

EATON
Powering Business Worldwide

ORDERING INFORMATION/PERFORMANCE

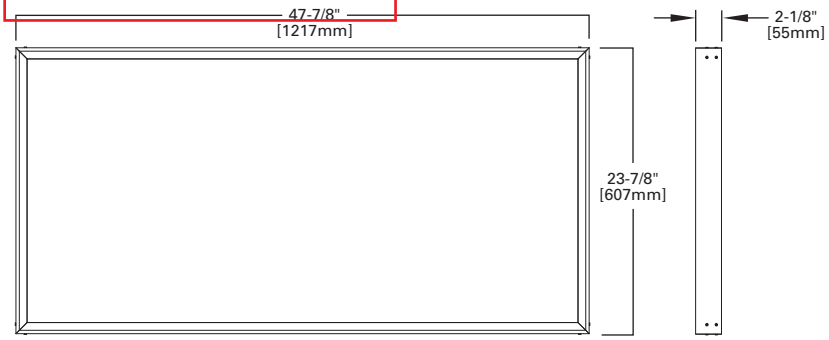
Catalog	UPC	CCT	CRI (Min)	Delivered Nominal Lumens	Watts	Efficacy (lm/W)	Input Current (A)	
							120V	277V
24FP4735C	080083801466	3500K	80	4990	40.4	124	.36	.15
24FP4740C	080083801480	4000K	80	4858	40.3	121		
24FP4750C	080083801503	5000K	80	5005	40.3	124		
24FP6435C	080083801527	3500K	80	6602	58.8	112	.51	.22
24FP6440C	080083801541	4000K	80	6611	59.4	111		
24FP6450C**	080083800704	5000K	80	6746	59.4	114		
24FP3830C9*	080083801909	3000K	90	3886	40.3	96	.36	.15
24FP5830C9*	080083801923	3000K	90	5282	58.2	91	.51	.22

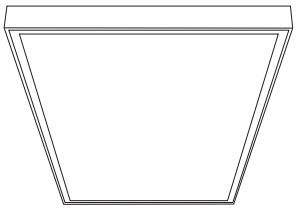
*May have extended lead-times.
**Stock available October/November 2017. Check FLASH for availability.

ACCESSORIES/ORDERING INFORMATION

SURFACE MOUNT KIT**

Catalog	UPC
FPSURF24	080083802746

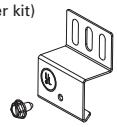




CEILING RETENTION**

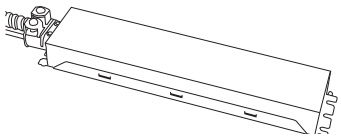
Catalog	UPC
FPEQ	080083802685

Required by some local codes
Order one set for each fixture
(Four clips per kit)



EMERGENCY BATTERY

Catalog	UPC	Watts
EBPLED7W	080083832265	7
EBPLED14W	080083832272	14



DRYWALL FRAME KIT

Catalog	UPC
DF-24W-U	662401232970

SHIPPING DATA

Size	Wt.	Pallet (30" x 56")
2' x 4'	22 lbs.	17

Powering Business Worldwide

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

isolite

Luminaire Type **EX**
Exit Sign

EDC

Economical Die Cast LED Exit Sign

Features

- Ultra-bright, energy efficient, long-life Red or Green LEDs.
- Internal solid-state transfer switch automatically connects the internal battery to LED board and LED lamp heads for minimum 90-minute emergency illumination.
- Fully automatic solid-state, two-rate charger initiates battery charging to recharge a discharged battery in 24 hours.
- 4.8V long-life, maintenance-free, rechargeable NiCd battery.
- Charge rate/power "ON" LED indicator light and push-to-test switch for mandated code compliance testing.
- 120/277 VAC field-selectable inputs.

Arrows

- Field selectable knockout chevron directional indicators.

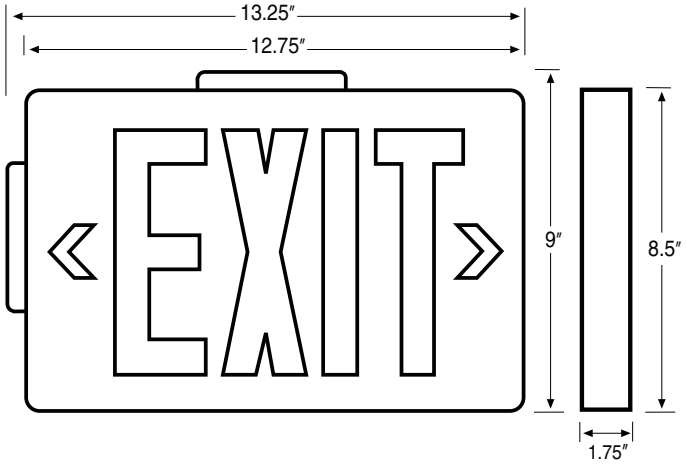
Construction

- Premium-grade, aluminum housing. Also available in black or white powder-coat finishes.

isolite

EDC

Economical Die Cast LED Exit Sign



Weight

- 5 lb

Temperature Rating

- From 32°F to 122°F

Approvals

- UL 924
- NFPA Life Safety Code 101
- NFPA 70-NEC
- OSHA

Warranty

- Isolite offers a 3-year limited warranty. For further details, refer to General Warranty and Obligations in the Isolite manual or on our website. Lamps not warranted.

Ordering Information

Series
EDC

Operation
AC = AC only
EM = NiCad battery

Letters
R = Red
G = Green

Faces
S = Single
D = Double
U = Universal

Mounting
UN = Universal Canopy

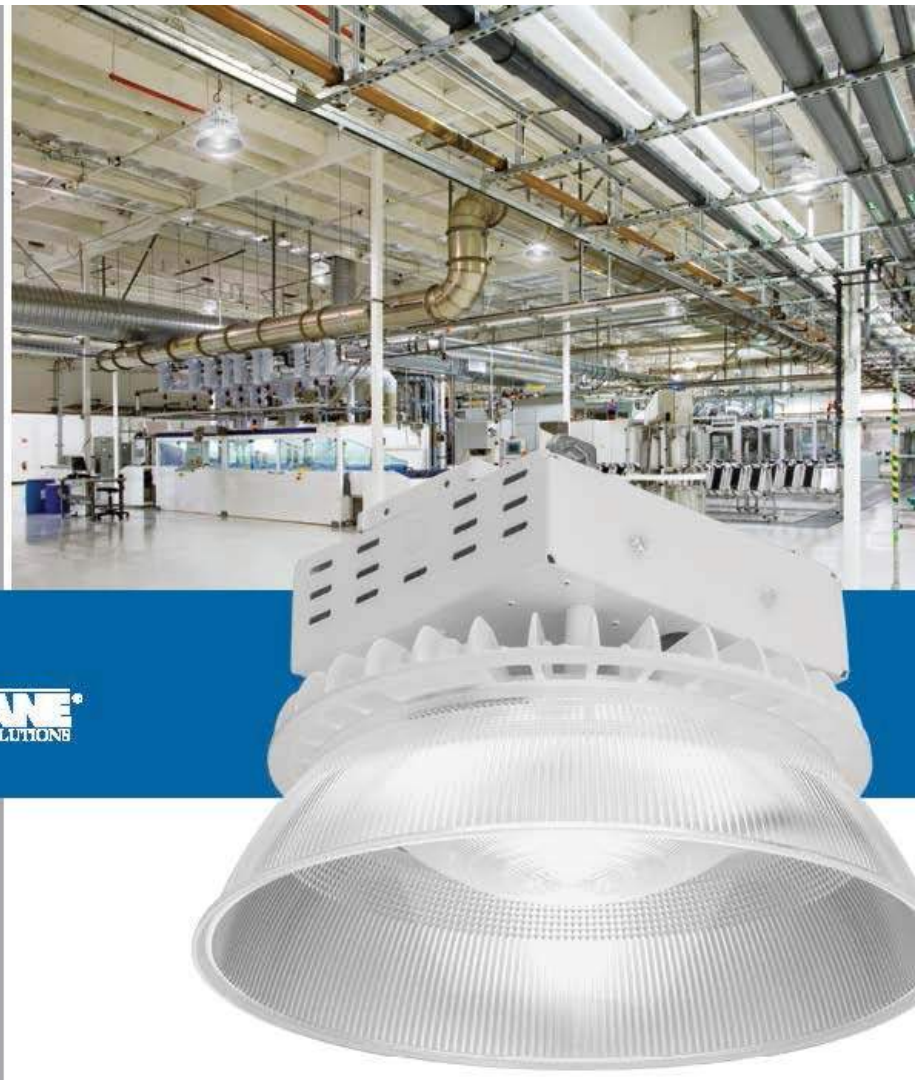
Housing Color
AB = Brushed Face, Black Trim
BK = All Black
WH = All White
AA = All Brushed Aluminum

Options
SD = Self Diagnostics[1]
2C = Dual Circuit[2]
TP = Tamper Proof Screws

Notes
1 = EM Only
2 = Specify Voltage

www.isolite.com
Headquarters: 31 Waterloo Avenue • Berwyn, PA 19312 • 800-888-5483 • 610-647-8200
Western Office: 3563 Sueldo, Suite M • San Luis Obispo, CA 93401 • 800-799-5343 • 805-546-9669
D-7.2.3.0-168, REV-D, 2018-01-09

Luminaire Type **PA**
Bus and M&O Shops
Shipping & Receiving



HOLOPHANE®
LEADER IN LIGHTING SOLUTIONS

Phuzion™ PHG LED High Bay

Beyond Basic Performance For Your Basic Needs

AcuityBrands.

HOLOPHANE®
LEADER IN LIGHTING SOLUTIONS

Phuzion™

PHG LED High Bay

Approximately 12% uplight

Description

The PHG LED luminaire is designed for light industrial applications where environments are less extreme, but comfortable, uniform lighting and dependable performance are still highly desired. Typical applications include manufacturing, warehouses, automotive, retail, food storage and gymnasiums.

Optics

- One-piece prismatic borosilicate glass reflector and refractor offer the highest levels of uniformity and glare-free performance in its class. Refractor protects LEDs from unwanted dust, helping to maintain delivered lumens.
- Borosilicate glass won't fade and offer the highest levels of luminosity over time.
- IP65 rated refractor protects LEDs from unwanted dust helps maintain delivered lumens.
- Prismatic acrylic available for food storage areas or where glass is not preferred.

Mechanical

- Hands free wiring design allows for quick and easy installations.
- Open ventilated design naturally pulls heat up and away from luminaire, extending the life of critical components.
- Robust cast aluminum heat sink (0.6% CU content) and offset aluminum electrical compartment maximize thermal performance.
- Ambient range -40°F (-40°C) up to 131°F (55°C) ambient rating.
- "H" mounting standard.

Electrical

- Standard 0-10volt dimming.
- Fault-tolerant LED light engine.
- Integral surge protection tested in accordance with IEEE/ANSI C62.41.2 to industrial standards 6kV/3kA.
- CCT: 3000K, 3500K, 4000K, 5000K.
- CRI: 70CRI, 80CRI & 90CRI.
- Dynamic temperature sensing is standard to protect the electronic components in the event the maximum operating ambient temperature is exceeded.

Listings

- CSA Certified to UL and C-UL standards for ambient temperatures ranging from -40°F (-40°C) up to 131°F (55°C).
- Damp locations.
- DesignLights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

Warranty

5-year limited warranty. Complete warranty terms located at: www.acuitybrands.com/CustomerResources/Terms_and_Conditions.aspx

NOTE: Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25 °C.

Specifications subject to change without notice.

Typical Applications	
• Light Manufacturing	• Food Storage
• Warehousing	• Automotive
• Retail	• Gymnasium

Dimensions: *Inches (millimeters) unless otherwise noted.*

Diameter: 19.8"
Height: 12.65"
Weight: Glass 29 lbs., Acrylic 17 lbs.
Emergency Internal: Add 10.5 lbs.

A+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or XPoint™ Wireless control networks marked by a shaded background*

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details

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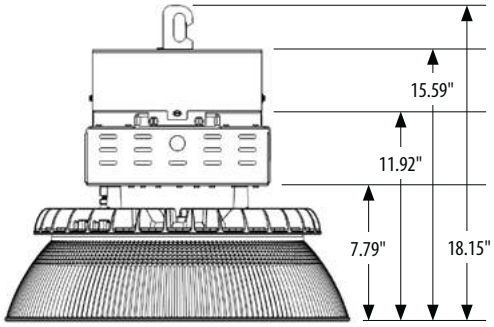
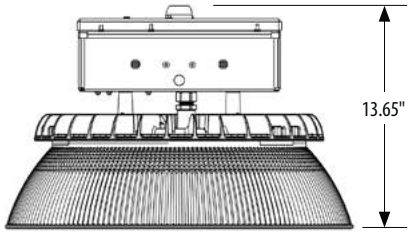
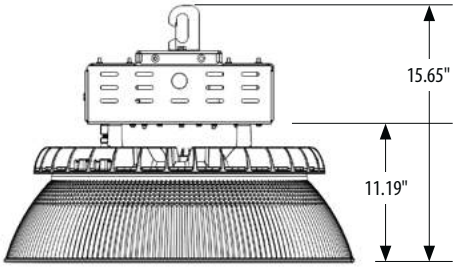
DIMENSIONAL DATA



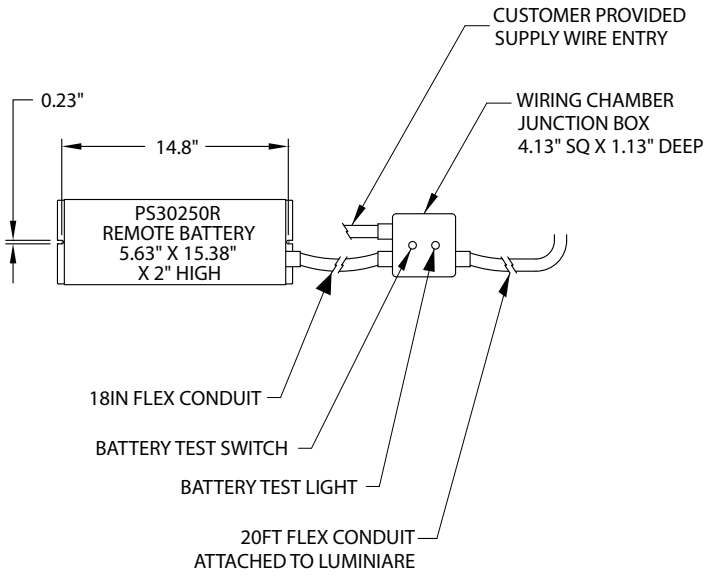
"H" mount with PS30250 internal battery pack



"P" mount



"H" mount



PS30250R Remote battery back-up

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A+ Capable options indicated by this color background.

ORDERING INFORMATION

Example: PHG 18L 4K 80CRI AS H G WGG

Series	Lumens[1]	Color temperature	Color rendering index	Voltage		Mounting	Finish
PHG	9L 9,000 nominal lumens	3K 3000K CCT	70CRI	AS Auto sensing (120-277)	27 277V	H Wire hook[2]	G Super durable gray
	12L 12,000 nominal lumens	35K 3500K CCT	80CRI	12 120V	AH Auto sensing (347/480)	P Pendant 3/4" female[3]	W Super durable white
	15L 15,000 nominal lumens	4K 4000K CCT	90CRI	20 208V	34 347V	Q Quick disconnect[4]	L Super durable satin nickel
	18L 18,000 nominal lumens	5K 5000K CCT		24 240V	48 480V	N Non-disconnect thru-wire[5]	K Super durable black
	24L 24,000 nominal lumens					QR Quick disconnect retrofit[6]	H Super durable graphite
	30L 30,000 nominal lumens					QN Non-disconnect retrofit[7]	

Optics		Options			
NGG	Narrow glass refractor and glass reflector	LCOZU	Passive infrared indoor occupancy sensor, high bay aisleway, default time delay 10 minutes (with minimum 15 minutes on time)[1,9]	CDP-L5-15-X	120V cord and plug, specify cord length=X[21]
MGG	Medium glass refractor and glass reflector	LCHOSZU	Passive infrared indoor occupancy sensor, high mount aisleway, dim level minimum dim level of driver, default time delay 10 minutes (with minimum 15 minutes on time)[1,10]	CDP-L6-15-X	208V/240V cord and plug, specify cord length=X[22]
WGG	Wide glass refractor and glass reflector	LCPZU	Passive infrared indoor occupancy sensor, high bay aisleway, switching photocell on/off.[1,11]	CDP-L7-15-X	277V cord and plug, specify cord length=X[23]
NAA	Narrow acrylic refractor and acrylic reflector[8]	LA0ZU	Passive infrared indoor occupancy sensor, high mount 360°, default time delay 10. minutes (with minimum 15 minutes on time)[1,12]	CDP-L24-20-X	347V cord and plug, specify cord length=X[24]
WAA	Wide acrylic refractor and acrylic reflector[8]	LAHOSZU	Passive infrared indoor occupancy sensor, high mount 360°, dim level minimum dim level of driver, default time delay 10 minutes (with minimum 15 minutes on time)[1,13]	CDP-L8-20-X	480V cord and plug, specify cord length=X[25]
NGA	Narrow glass refractor and acrylic reflector	LAPZU	Passive infrared indoor occupancy sensor, high mount 360°, switching photocell (on/off) default time delay 10 minutes (with minimum 15 minutes on time)[1,14]	CDP-5-15-X	Straight blade 120V plug and cord, specify cord length=X[26]
MGA	Medium glass refractor and acrylic reflector	AXA10	XPoint wireless enabled[1,15]	A	Holoflex I[27]
WGA	Wide glass refractor and acrylic reflector	MSI6XADL DSCXA	XPoint wireless enabled with photocell sensor & occupancy sensor[1,16]	S	Holoflex II (OCS)[28]
		D	Dimming terminal external[17]	PF-129	Anti-rotational hook, 3/4" male[29]
		A0	Field adjustable output dimming, easy access[18]	PF-105	Loop, 3/4" male[30]
		HA	55°C High Ambient, 24L only	PF-121-A	Safety hook, 3/4" male[31]
		nPP16D	nLight enabled[19]	HK-455	Safety hook aluminum, 3/4" male[32]
		NSG	Non-silicone gaskets.	CD-3	3 ft. cord[33]
		SPD	Secondary surge device, 10Kv[20]	CD-6	6 ft. cord[33]
		FR	Frosted glass only	CD-X	Specify cord length=X[33]
				CD5K-XX	5-wire drop cord for use with external low voltage dimming controls - Black, Specify cord length=XX[34]
				CD5W-XX	5-wire drop cord for use with external low voltage dimming controls - White, Specify cord length=XX[34]
				PHCB	Powerhook cord for 120-277, 347V
				PHCB-L8-480	Powerhook cord for 480V
				WG	Wireguard
				C3	3ft safety chain
				C6	6ft safety chain
				CX	Specify chain length=X
				PS30250	Internal battery backup using PS30250 Power Sentry (0-40°C max) 33W[35]
				PS30250R	Remote battery backup using PS30250R Power Sentry (0-50°C max) 33 W[36]
				GRR	Rod and ring optic assembly[37]

For accessories and footnotes, see page 4.

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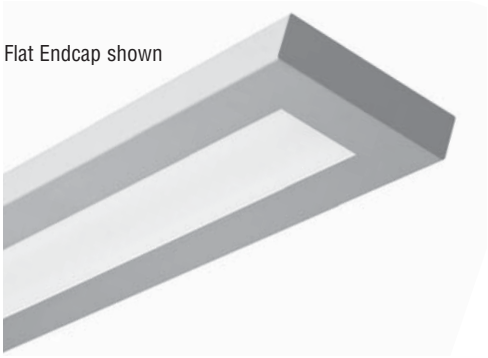
FINELITE

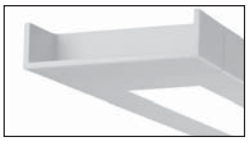
Refer to spec page for details

Luminaire Type PB
Offices

Series 16 LED Indirect/Direct - 2E, 3E, & 4E

Flat Endcap shown





Extended Endcap

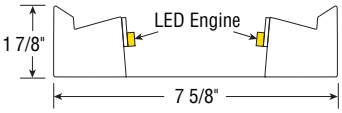
Signal White is standard finish

DESCRIPTION

Series 16 LED is a low profile rectilinear form scaled to blend into any interior architecture and is available with three light engine models - 2E, 3E, and 4E. The luminaire uses mid-power LEDs for long life and enhanced performance.

LIGHT ENGINES

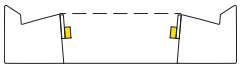
2-Engines



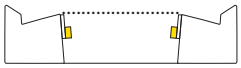
OPTIC & DISTRIBUTION RATIO OPTIONS

Open

Frosted Top Optic (FTO)

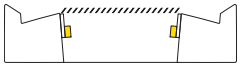


Clear Top Optic (CTO)



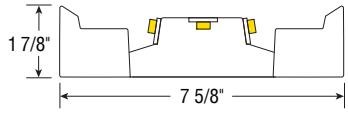
Distribution Ratios

Total Direct Optic (TDO)

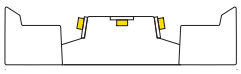


10%↑/ 90%↓ 30%↑/ 70%↓
20%↑/ 80%↓ 40%↑/ 60%↓

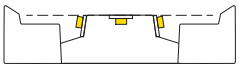
3-Engines



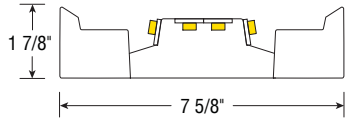
Open



Frosted Top Optic (FTO)

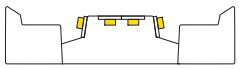


4-Engines

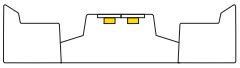


Available with factory presets in 3000, 4000, and 5000 lumens.

Distribution Ratios



Total Direct Optic (TDO)



10%↑/ 90%↓ 30%↑/ 70%↓
20%↑/ 80%↓ 40%↑/ 60%↓

Due to continuing product improvements, Finelite reserves the right to change specifications without notice. Please visit www.finelite.com for the most current data.

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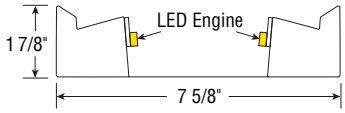
2E FEATURES

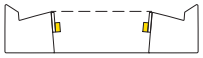
DIMENSIONS & LIGHT ENGINES



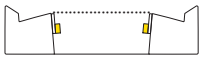
OPTIC OPTIONS

Open

Frosted Top Optic (FTO)

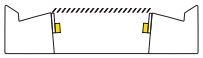


Clear Top Optic (CTO)



DISTRIBUTION RATIO OPTIONS

Total Direct Optic (TDO)



10U90D - 10%↑/ 90%↓
(includes CTO standard)

20U80D - 20%↑/ 80%↓
(includes FTO standard)

30U70D - 30%↑/ 70%↓
(includes FTO standard)

40U60D - 40%↑/ 60%↓
(includes FTO standard)

ORDERING GUIDE:
Sample Number: S16 LED ID - DCO - 8' - 2E - S - 835 - 20U80D - 120V - SC - FA - FE - C1 - OBO

Finelite **Series 16 LED ID***
Shielding (**DCO, WCB**)
Length (**4'**, **8'**, multiples standard)
Light Engine System (**2E** - 2 Light Engines)
Light Output (**S** - Standard, **B** - Boosted Standard, **H** - High, **V** - Very High)
LED CRI/CCT (**830** - 80 CRI min, 3000K; **835** - 80 CRI min, 3500K;
840 - 80 CRI min, 4000K; **930** - 90 CRI min, 3000K;
935 - 90 CRI min, 3500K; **940** - 90 CRI min, 4000K)
Optic or Distribution Ratio (**OPEN** - standard, **FTO** - Frosted Top Optic, **CTO** - Clear Top Optic,
TDO - Total Direct Optic, **10U90D** - 10% up / 90% down,
20U80D - 20% up / 80% down, **30U70D** - 30% up / 70% down,
40U60D - 40% up / 60% down)
Voltage (**120V**, **277V**)
Circuiting (**SC** - Single Circuit)**
Mounting (**FA** - Fully Adjustable (standard), **AC** - semi-adjustable)
Endcap (**FE** - Flat Endcap (standard), **EE** - Extended Endcap)
Ceiling Type (**C1** - 1" T-bar, **C2** - 9/16" T-bar, **C3** - slot grid, **C4** - hard ceiling)
Integrated Sensors (**OBD** - Daylight, **OBO** - Occupancy)

* Indirect luminaires available on 2E.
** Contact factory for switching options.

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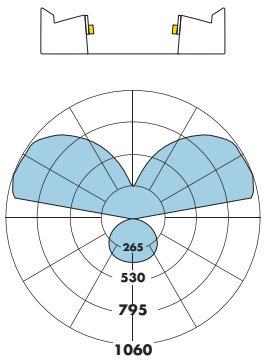
2E OPEN AND FTO PHOTOMETRY - 4 ft. Luminaire

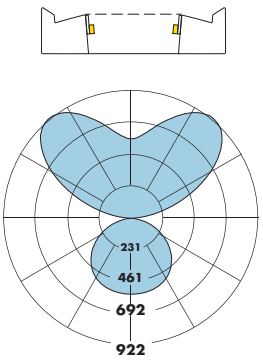
Series 16-LED-ID-DCO-**2E**-V-835-**OPEN**
Distribution: 76% up / 24% down
Efficacy: 127 lumens per watt
Total Luminaire Output: 4722 lumens (1181 lumens/foot)
37.3 watts (9.3 watts/foot)
ITL LM79 Report 85120

Series 16-LED-ID-DCO-**2E**-V-835-**FTO***
Distribution: 63% up / 37% down
Efficacy: 119 lumens per watt
Total Luminaire Output: 4442 lumens (1111 lumens/foot)
37.3 watts (9.3 watts/foot)
ITL LM79 Report 85121

2E OPEN - REPORT 85120



2E FTO* - REPORT 85121



*For applications where a soft beam edge on wall or vertical surface is desired.

Refer to LM-79 reports for candlepower summaries

2E OPEN AND FTO

Total Light Output, 3500K, 80 CRI (Lumens) - 4 ft. Luminaire				
	S*	**B***	**H***	**V****
OPEN	1933	2430	3673	4722
FTO	1818	2286	3455	4442

Light Output, 3500K, 80 CRI (Lumens Per Foot)				
	S*	**B***	**H***	**V****
OPEN	483	608	918	1181
FTO	455	571	864	1111

Power (Watts Per Foot)				
	S*	**B***	**H***	**V****
OPEN	3.7	4.6	7.2	9.3
FTO	3.7	4.6	7.2	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)				
	S*	**B***	**H***	**V****
OPEN	132	131	128	127
FTO	125	123	121	119

* Family Correlation based on 4 ft. luminaire 3500K Very High Output (**V**) test - 120V.
** Correlation based on ITL reports above.
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

High Output (H), Open, 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
3673 lm x 0.789 = 2898 lm

Total Light Output per Foot =
918 lm/ft x 0.789 = 724 lm/ft

watts/foot = 7.2 W/ft

$$\textit{Efficacy} = \frac{724\ \frac{lm}{ft}}{7.2\ \frac{W}{ft}} = 101\ \text{lm/W}$$

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SPECIFICATIONS

CONSTRUCTION: Body is 20-gauge die-formed steel with an 18-gauge die-formed internal joiner system. Plug-together wiring standard. All components are hard-tooled to tolerances of +/- 0.010".

ENDCAPS: The Flat Endcap (FE) is standard and made of 20-gauge die-formed steel adding 1/8" at each end. The optional Extended Endcap (EE) is an aluminum die-cast endcap with a 1/8" reveal adding 2-1/2" at each end.

OPTICS & DISTRIBUTION RATIOS:

Open	Standard (2E, 3E)
FTO	Frosted Top Optic (2E, 3E)
CTO	Clear Top Optic (2E)
TDO	Total Direct Optic (2E, 4E)
10U90D	10% up / 90% down (2E, 4E)
20U80D	20% up / 80% down (2E, 4E)
30U70D	30% up / 70% down (2E, 4E)
40U60D	40% up / 60% down (2E, 4E)

SHIELDING: Diffuse Center Optic **(DCO)**, 73% transmissive, 99% diffusion. Visible diffuser: UV-stabilized and impact-resistant frosted virgin acrylic, 1/8" thick. Inner diffuser: 1/8" thick with 40% round perforations white/white. White Cross Baffle **(WCB)**, 87 cell baffles spaced 1/2" apart and finished with 96% reflective white paint.

LIGHT OUTPUT:

2E & 3E: Four lumen packages available: Standard (**S**), Boosted Standard (**B**), High (**H**), and Very High (**V**).

4E: Three lumen packages available, Standard (**S**), 3000 lumens, Boosted Standard (**B**), 4000 lumens, High (**H**), 5000 lumens.

A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%-100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: ≥ 0.9. Total Harmonic Distortion (THD): < 20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Optional Chicago Plenum available.

2E: A factory-choice low-profile backup battery is available (8 ft. minimum fixture length). Backup batteries deliver 1700 lumens. A 4 ft. section will be illuminated in emergency mode.

3E: A factory-choice low-profile backup battery is available (8 ft. minimum fixture length). Backup batteries deliver 1500 lumens. The down-light engine will be illuminated in a 4 ft. section in emergency mode.

4E: A factory-choice low-profile backup battery is available (8 ft. minimum fixture length). Backup batteries deliver 1500 lumens. The down-light engine will be illuminated in a 4 ft. section in emergency mode.

INTEGRATED SENSORS: Daylight sensors and Integrated PIR (Passive Infrared) occupancy sensors available. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: 50" Fully Adjustable (FA) plated steel aircraft cable with safety stop hardware standard. Contact factory for additional lengths up to 150". Optional semi-adjustable Aircraft Cable (AC) (± 1/2") in lengths of 12", 15", 18", 21", 24", 27", 30", and 36".

FINISHES: Finelite Signal White powder coat standard. Optional Adders: 185 RAL colors.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when fixture current exceeds 5 amps.

LENGTHS: Standard 4 ft. and 8 ft. section lengths can be combined to make longer runs. Contact factory additional lengths.

LABELS: Fixture and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 3.0 lb/ft.

DLC QUALIFIED: Configurations of this product are listed on the DLC Qualified Products List (QPL). www.designlights.org/search

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

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Metalux

Luminaire Type **RA**
Staff Offices

DESCRIPTION

FPanel LED panel series provide premium performance and pleasing aesthetics. It is optimized for shallow plenum grid ceilings but may be surface or suspension mounted. Developed with Eaton's latest generation of solid state components and electronic driver technologies, these panels are ideal for new construction and to replace fluorescent troffers. Its refined visual optics and integrated grid retention clips provide the features needed for speed and installation flexibility. LED FPanels are an excellent lighting solution for commercial office spaces, schools, healthcare and retail merchandising areas.

SPECIFICATION FEATURES

Construction/Mounting
Narrow aluminum bezel is tightly held to code gauge steel back plate to protect the LEDs and optical area. Corners are seamless with a narrow flange to provide a refined finish and maximize the light emitting surface. Integral grid locking clips and separate suspension clips are included on the panel to ensure installation flexibility in ceiling systems and to meet code when additional retention is required. Junction box is constructed of code gage galvanized steel with an easy access hinged door for high voltage and low voltage wiring access and includes trade size knockouts. The luminaire is less than 2 inches in depth making it an ideal choice for shallow plenums and low ceilings. May also be surface or suspension mounted using the optional kits.

Controls
The FPanel is standard with a 0-10V continuous dimming driver which dims to 10% and works with most standard 0-10V control/dimmers. Combine with energy-saving products like wall dimmers, Room Controller, occupancy and daylight sensors, and lighting relay panels. Or, go wireless with optional field installed controls for either WaveLinx or LumaWatt Pro.

Electrical
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3500K, 4000K and 5000K with a minimum of 80 CRI and a 90 CRI option that is 3000K. Projected lumen maintenance based on TM21 is L73 > 60,000 hours. Electronic drivers are cULus recognized and available for 120-277V. Emergency battery pack options are available in 7 watts and 14 watts. These emergency battery packs meet critical life-safety lighting requirements and are sold separately for field installation and remote mounting.

Optical Shielding
Light guide is constructed of acrylic with specialized features to optimize light extraction providing excellent efficiency. White frost lens with smooth pattern provides uniform illumination as well as scratch and impact resistance.

Compliance
Constructed of UL recognized components these indoor luminaires are cULus listed for 25°C ambient environments, IC rated for direct insulation contact, RoHS compliant, damp location listed, and comply with IESNA LM-79 and LM-80 standards. NEMA 410 Compliant. DesignLights Consortium® Qualified and classified for DLC Standard, refer to www.designlights.org for details.

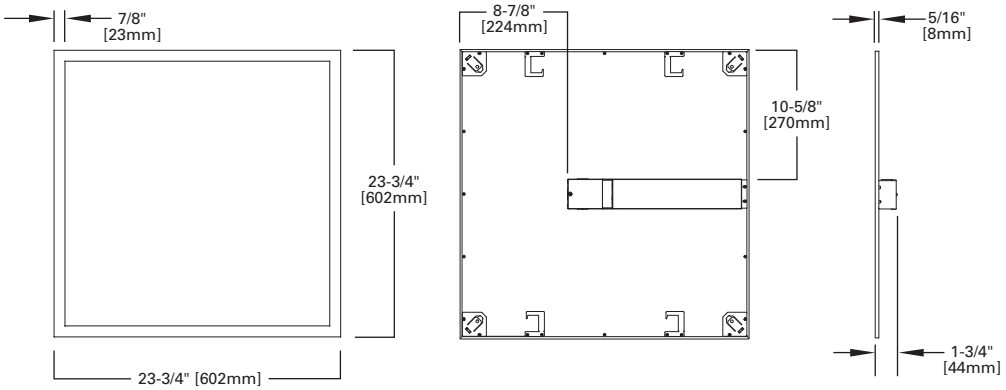
Warranty
Five year warranty.

22FP
LED

2' X 2' LED PANEL

General Recessed LED Panel for use in Insulated Ceilings or Suspended/Surface Mount

DIMENSIONS



LOAD DATA

Thd	14%
Power Factor	0.96
Weight	9.4 lbs.
Low Temp. Start	-20°C

Powering Business Worldwide

ORDERING INFORMATION/PERFORMANCE

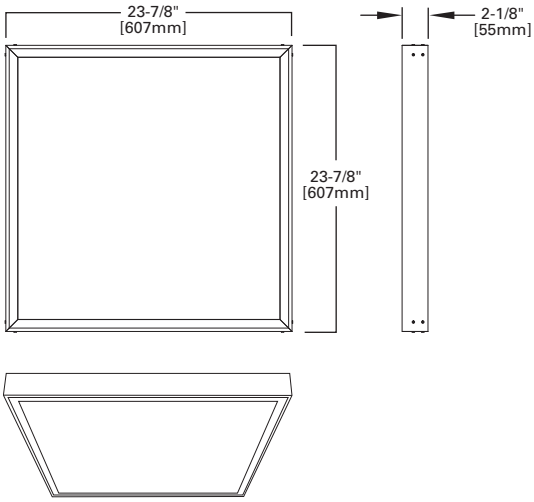
Catalog	UPC	CCT	CRI (Min)	Delivered Nominal Lumens	Watts	Efficacy (lm/W)	Input Current (A)	
							120V	277V
22FP4235C	080083801565	3500K	80	4641	38.9	119	.34	.15
22FP4240C	080083801688	4000K	80	4567	39.3	116		
22FP4250C	080083801701	5000K	80	4704	39.3	120		
22FP3235C	080083801749	3500K	80	3417	29.4	116	.26	.11
22FP3240C	080083801725	4000K	80	3560	30.0	119		
22FP3250C**	080083801862	5000K	80	3667	29.5	124		
22FP3830C9*	080083801848	3000K	90	3654	39.1	93	.34	.15
22FP2830C9*	080083801886	3000K	90	2734	29.5	93	.26	.11

*May have extended lead-times.
**Stock available October/November 2017. Check FLASH for availability.

ACCESSORIES/ORDERING INFORMATION

SURFACE MOUNT KIT**

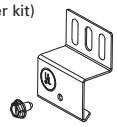
Catalog	UPC
FPSURF22	080083802722



CEILING RETENTION**

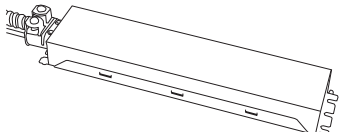
Catalog	UPC
FPEQ	080083802685

Required by some local codes
Order one set for each fixture
(Four clips per kit)



EMERGENCY BATTERY

Catalog	UPC	Watts
EBPLED7W	080083832265	7
EBPLED14W	080083832272	14



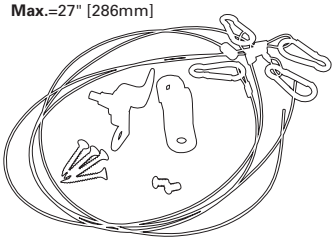
DRYWALL FRAME KIT

Catalog	UPC
DF-22W-U	662401232963

SUSPENSION KIT

Catalog	UPC
FPSUS2	080083802784

Mounting height from ceiling
Min.=7-1/4" [184mm]
Max.=27" [286mm]



SHIPPING DATA

Size	Wt.	Pallet (30" x 56")
2' x 2'	12 lbs.	34

Powering Business Worldwide

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

PHILIPS

GARDCO

Site & Area

EcoForm

Luminaire Types
SA - Bus Parking
SB -Staff/Public Parking

Deliver more than expected

It's not just about meeting technical requirements. It's about looking out for the best interests of your customers, and going the extra mile to uncover new savings and conveniences. Outdoor lighting should support these goals, and the right place to start is with the next generation of **Philips Gardco EcoForm LED** site and area luminaires.

In any outdoor site and area project, EcoForm luminaires are more than sources of illumination; they offer the best of all worlds: saving energy, saving time, and saving money for significant and enduring value.

PHILIPS

GARDCO

Site & Area

EcoForm

ECF-S small

The Philips Gardco EcoForm Gen-2 combines economy with performance in an LED area luminaire. Capable of delivering up to 26,400 lumens or more in a compact, low profile LED luminaire, EcoForm offers a new level of customer value. EcoForm features an innovative retrofit arm kit, simplifying site conversions to LED by eliminating the need to drill additional holes in most existing poles. Integral control systems available for further energy savings.

Ordering guide

example: ECF-S-64L-900-NW-G2-AR-5-120-HIS-MGY

Prefix	Number of LEDs	Drive Current	LED Color - Generation	Mounting	Distribution	Voltage	Options: Dimming controls	Options: Motion sensing	Options: Photo-sensing	Options: Electrical	Options: Luminaire	Finish
ECF-S												
EcoForm site and area, small	**32L** 32 LEDs (2 modules)	**530** 530 mA **700** 700 mA **1A** 1050 mA **1.2A** 1200 mA	**WW-G2** Warm White 3000K, 70 CRI Generation 2 **NW-G2** Neutral White 4000K, 70 CRI Generation 2 **CW-G2** Cool White 5000K, 70 CRI Generation 2	**AR** Arm Mount (standard)[9] *The following mounting kits must be ordered separately (See accessories)* **SF** Slip Fitter Mount[11] (fits to 2 3/8" O.D. tenon) **WS** Wall mount with surface conduit rear entry permitted **RAM** Retrofit arm mount kit[9]	**Type 2** **2** Type 2 **2-90** Rotated left 90° **2-270** Rotated right 270° **Type 3** **3** Type 3 **3-90** Rotated left 90° **3-270** Rotated right 270° **Type 4** **4** Type 4 **4-90** Rotated left 90° **4-270** Rotated right 270° **Type 5** **5** Type 5 **5W** Type 5W **AFR** Auto Front Row **AFR-90** Auto Front Row, Rotated left 90° **AFR-270** Auto Front Row, Rotated right 270°	**120** 120V **208** 208V **240** 240V **277** 277V **347** 347V **480** 480V **UNV** 120-277V (50/60Hz) **HVU** 347-480V (50/60Hz)	**DD** 0-10V External dimming (by others)[5] **DCC** Dual Circuit Control[6] **FAWS** Field Adjustable[14] **SW** Interface module for SiteWise[12,13] **LLC2** Integral module with #2 lens[1,6] **LLC3** Integral module with #3 lens[1,6] **LLC4** Integral module with #4 lens[1,6] **DynaDimmer:** Automatic Profile Dimming **CS50** Safety 50% Dimming, 7 hours[1] **CM50** Median 50% Dimming, 8 hours[1] **CE50** Economy 50% Dimming, 9 hours[1] **DA50** All Night 50% Dimming[1] **CS30** Safety 30% Dimming, 7 hours[1] **CM30** Median 30% Dimming, 8 hours[1] **CE30** Economy 30% Dimming, 9 hours[1] **DA30** All Night 30% Dimming[1]	**IMRI3** Integral with #3 lens[8] **IMRI7** Integral with #7 lens[8] **IMRO** Pole mounted motion sensor[5] (see accessories)	**PCB** Photocontrol Button[2,3] **TLRD5** Twist Lock Receptacle 5 Pin[15] **TLRD7** Twist Lock Receptacle 7 Pin[15] **TLRPC** Twist Lock Receptacle w/ Photocell[2]	**Fusing** **F1** Single (120, 277, 347VAC)[2] **F2** Double (208, 240, 480VAC)[2] **Pole Mount Fusing** **FP1** Single (120, 277, 347VAC)[2] **FP2** Double (208, 240, 480VAC)[2] **FP3** Canadian Double Pull (208, 240, 480VAC)[2] **Surge Protection** (10kA standard) **SP2** Increased 20kA	Square Pole Adapter included in standard product **TB** Terminal Block[7] **RPA** Round Pole Adapter (fits to 3"- 3.9" O.D. pole)[10] **HIS** Internal Housing Side Shield[4]	**Textured** **BK** Black **WH** White **BZ** Bronze **DGY** Dark Gray **MGY** Medium Gray **Customer specified** **RAL** Specify optional color or RAL (ex: RAL7024) **CC** Custom color (Must supply color chip for required factory quote)
	48L 48 LEDs (3 modules)	**900** 900 mA **1A** 1050 mA **1.2A** 1200 mA										
	64L 64 LEDs (4 modules)	**900** 900 mA **1A** 1050 mA										

1. Available only on **120**, **208**, **240**, and **277** (or **UNV**)
2. Specify Voltage
3. Not available with **347** or **480** voltage
4. **HIS** not available with Type **5** or **5W** optics
5. **DD** is required for **LLCR**. Dimming leads are supplied through back of luminaire. **Must be ordered separately** (See accessories page)
6. **DCC** and **LLC2/3/4** not available with any other controls
7. **TB** not available with **DCC**
8. **ECF-IMRI** equipped with out-boarded sensor housing when voltage is **HVU** (347-480V)
9. Mounts to a 4" round pole with adapter included for square poles.
10. Not available with **SF** and **WS**. **RPA**s provided with black finish standard
11. Limited to a maximum of 45 degrees aiming above horizontal
12. **SW** option is not available with any other control options with the exception of **IMRI3**, **IMRI7** and **SW-IMRO** motion response options
13. Available only on **120V** and **277V**
14. Not available with **DCC**, **IMRI3**, **IMRI7**, **SW**, **LLC** and **CS/CM/CE/DA** (**DynaDimmer**).
15. **TLRD5/7** option not available with **LLC**, **PCB**, **TLRPC** or **DCC**. Max aiming angle 45°. Works with 3 or 5 pin NEMA photocell/dimming. Dimming will not be connected to NEMA receptacle if ordering with **DD**, **CS/CM/CE/DA**, **IMRI** and **IMRO**.

ECF-S EcoForm small

Site & Area

EcoForm Accessories (ordered separately, field installed)

Controls Accessories

Pole Mount Motion Sensor

MS-A-120V[11] 120V Input
MS-A-277V[11] 277V Input

Wireless systems
Remote mount module

LLCR2-(F)[11] #2 lens
LLCR3-(F)[11] #3 lens
LLCR4-(F)[11] #4 lens

Central Remote Motion Response
(used connected to SiteWise main panel)

MS2-A-FVR-3
MS2-A-FVR-7

Shielding Accessories[10]

House Side shield

Standard orientation:
HIS-32-H[12] Internal House Side Shield for 32 LEDs (2 modules)
HIS-48-H[12] Internal House Side Shield for 48 LEDs (3 modules)
HIS-64-H[12] Internal House Side Shield for 64 LEDs (4 modules)

At 90 or 270 orientation:
HIS-32-V[12] Internal House Side Shield for 32 LEDs (2 modules)
HIS-48-V[12] Internal House Side Shield for 48 LEDs (3 modules)
HIS-64-V[12] Internal House Side Shield for 64 LEDs (4 modules)

Luminaire Accessories

ECF-BD-G2 Bird deterrent
PTF2-(F) Pole top fitter fits 2 3/8-2 1/2" OD x 4" depth tenon with 1, 2, 3 or 4 luminaires at 90°
PTF3-(F) Pole top fitter fits 3-3 1/2" OD x 6" depth tenon with 1, 2, 3 or 4 luminaires at 90°
PTF4-(F) Pole top fitter fits 3 1/2-4" OD x 6" depth tenon with 1, 2, 3 or 4 luminaires at 90°
ECF-SF-G2-(F) Slip Fitter Mount (fits to 2 3/8" O.D. tenon)
ECF-RAM-G2-(F) Retrofit Arm mount kit
ECF-WS-G2-(F) Wall mount with surface conduit rear entry permitted

(F) = Specify finish

11. **DD** option required
12. Not available with Type **5** or **5W** optics

Predicted Lumen Depreciation Data

Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions.L_{70} is the predicted time when LED performance depreciates to 70% of initial lumen output. Calculated per IESNA TM21-11. Published L_{70} hours limited to 6 times actual LED test hours

Ambient Temperature °C	Driver mA	Calculated L_{70} Hours	L_{70} per TM-21	Lumen Maintenance % at 60,000 hrs
25°C	up to 1200 mA	>100,000 hours	>60,000 hours	>88%

LED Wattage and Lumen Values

Ordering Code	Total LEDs	LED Current (mA)	Color Temp.[3]	Average System Watts[1]	Type 2			Type 3			Type 4		
					Lumen Output[1,2]	BUG Rating	Efficacy (LPW)	Lumen Output[1,2]	BUG Rating	Efficacy (LPW)	Lumen Output[1,2]	BUG Rating	Efficacy (LPW)
ECF-S-32L-530-NW-G2-x	32	530	4000	56	6,864	B2-U0-G2	123	6,715	B1-U0-G2	121	7,025	B1-U0-G2	126
ECF-S-32L-700-NW-G2-x	32	700	4000	73	8,853	B2-U0-G2	121	8,661	B2-U0-G2	119	9,062	B1-U0-G2	124
ECF-S-32L-1A-NW-G2-x	32	1050	4000	106	12,464	B3-U0-G2	118	12,194	B2-U0-G2	115	12,757	B2-U0-G3	121
ECF-S-32L-1.2A-NW-G2-x	32	1200	4000	122	13,826	B3-U0-G3	114	13,526	B2-U0-G3	111	14,151	B2-U0-G3	116
ECF-S-48L-900-NW-G2-x	48	900	4000	135	16,409	B3-U0-G3	121	16,053	B2-U0-G3	119	16,795	B2-U0-G3	124
ECF-S-48L-1A-NW-G2-x	48	1050	4000	159	18,581	B3-U0-G3	117	18,178	B3-U0-G3	115	19,018	B2-U0-G4	120
ECF-S-48L-1.2A-NW-G2-x	48	1200	4000	183	20,627	B3-U0-G3	113	20,180	B3-U0-G4	110	21,112	B3-U0-G4	116
ECF-S-64L-900-NW-G2-x	64	900	4000	178	21,717	B3-U0-G3	122	21,246	B3-U0-G4	119	22,228	B3-U0-G4	125
ECF-S-64L-1A-NW-G2-x	64	1050	4000	206	24,467	B3-U0-G3	119	23,936	B3-U0-G4	116	25,043	B3-U0-G4	122

Ordering Code	Total LEDs	LED Current (mA)	Color Temp.[3]	Average System Watts[1]	Type 5			Type 5W			Type AFR		
					Lumen Output[1,2]	BUG Rating	Efficacy (LPW)	Lumen Output[1,2]	BUG Rating	Efficacy (LPW)	Lumen Output[1,2]	BUG Rating	Efficacy (LPW)
ECF-S-32L-530-NW-G2-x	32	530	4000	56	7,414	B3-U0-G2	133	7,175	B3-U0-G2	129	7,111	B2-U0-G1	128
ECF-S-32L-700-NW-G2-x	32	700	4000	73	9,563	B3-U0-G2	131	9,255	B4-U0-G2	127	9,172	B2-U0-G1	126
ECF-S-32L-1A-NW-G2-x	32	1050	4000	106	13,462	B4-U0-G2	127	13,030	B4-U0-G2	123	12,912	B3-U0-G2	122
ECF-S-32L-1.2A-NW-G2-x	32	1200	4000	122	14,933	B4-U0-G2	123	14,453	B4-U0-G2	119	14,322	B3-U0-G2	118
ECF-S-48L-900-NW-G2-x	48	900	4000	135	17,723	B4-U0-G2	131	17,154	B5-U0-G3	127	16,999	B3-U0-G2	126
ECF-S-48L-1A-NW-G2-x	48	1050	4000	159	20,069	B5-U0-G3	126	19,424	B5-U0-G3	122	19,248	B3-U0-G2	121
ECF-S-48L-1.2A-NW-G2-x	48	1200	4000	183	22,279	B5-U0-G3	122	21,563	B5-U0-G3	118	21,368	B3-U0-G2	117
ECF-S-64L-900-NW-G2-x	64	900	4000	178	23,456	B5-U0-G3	132	22,702	B5-U0-G3	128	22,497	B3-U0-G2	127
ECF-S-64L-1A-NW-G2-x	64	1050	4000	206	26,427	B5-U0-G3	128	25,577	B5-U0-G4	124	25,346	B3-U0-G2	123

1. Wattage and lumen output may vary due to LED manufacturer forward volt specification and ambient temperature.
   Wattage shown is average for 120V through 277V input. Measured wattage may vary due to variation in input voltage.
2. Lumen values based on photometric tests performed in compliance with IESNA LM-79.
3. Warm white color temperature will result in decreased lumen output.

Contact outdoorlighting.applications@philips.com for details or additional information.

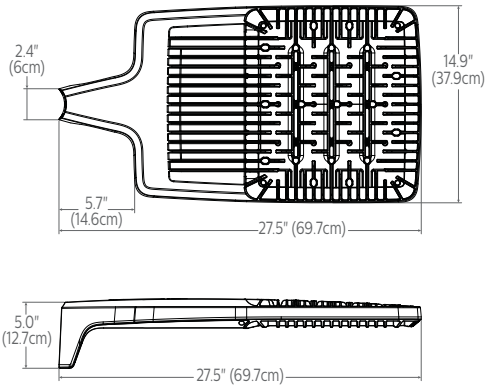
ECF-S EcoForm small

Site & Area

Dimensions

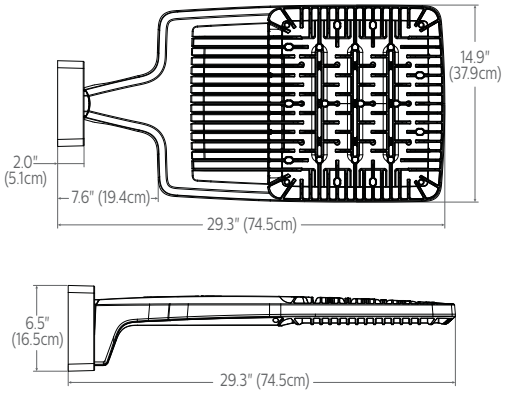
Standard Arm (**AR**)

Weight: 22 Lbs (9.9 Kg) EPA: 0.21ft² (.019m²)



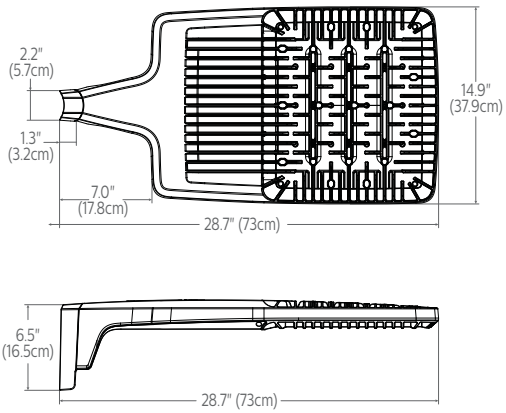
Wall (**WS**)

Weight: 27 Lbs. (12. 2Kg) EPA: 0.27ft² (.025m²)



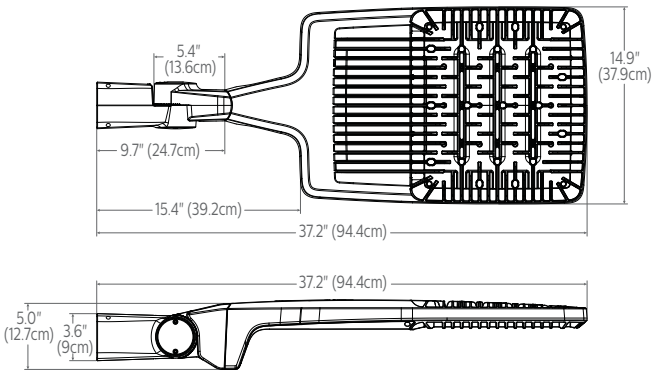
Retrofit Arm (**RAM**)

Weight: 24 Lbs (10.9 Kg) EPA: 0.24ft² (.022m²)

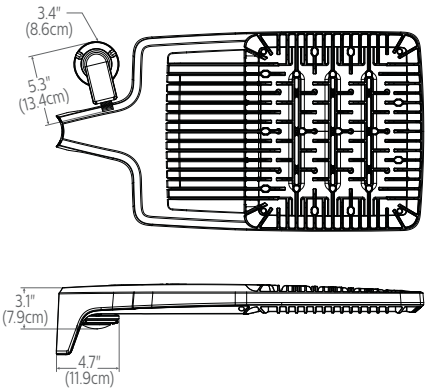


Slip fitter (**SF**)

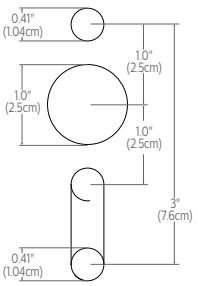
Weight: 27 Lbs (12.2 Kg) EPA: 0.33ft² (.031m²)



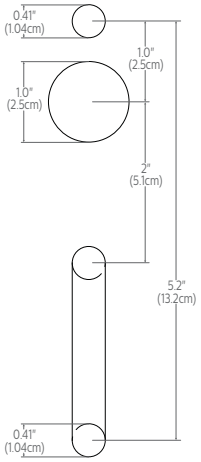
Outboard **IMR-HVU** sensor



Standard Arm (**AR**) drill pattern



Retrofit Arm (**RAM**) drill pattern



ECF-S EcoForm small

Site & Area

Luminaire options

DD: 0-10V dimming driver with leads supplied through back of luminaire (for secondary dimming controls by others).

TLRD5: Twist Lock Receptacle with 5 pins enabling dimming, can be used with a twistlock photoelectric cell or a shorting cap. Can also be used with Philips or third party control system. Receptacle located on top of luminaire housing.

TLRD7: Twist Lock Receptacle with 7 pins enabling dimming and additional functionality (by others), can be used with twistlock photoelectric cell or a shorting cap. Can also be used with Philips or third party control system. Receptacle located on top of luminaire housing.

TLRDPC: Receptacle with twistlock photoelectric cell (must specify voltage). Receptacle located on top of luminaire housing.

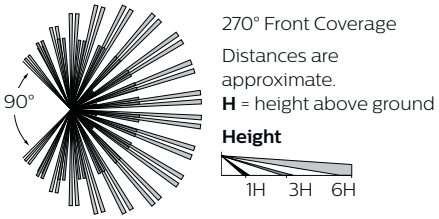
Dynadimmer Automatic Profile Dimming: Automatic dimming profiles (CS50/CM50/CE50) offer safety, median, or economy settings, for shorter or longer duration. Dimming profiles provide flexibility towards energy savings goals while optimizing light levels during specific dark hours. 50% dimming is standard. DA50 offers 50% instantaneous dimming all night (during all dark hours). 75% and 25% dimming is also available if different light levels are required (contact Technical Support for details).

	Dimming		
Profile	Level	Duration	Example
Economy	50%	9 hours	9 PM - 6 AM
Median	50%	8 hours	10 PM - 6 AM
Safety	50%	7 hours	11 PM - 6 AM
Reactive 50	50%	dynamic	all night

IMRI3, IMRI7: Infrared Motion Response Integral. IMRI module is mounted integral on driver door and is available with two different sensor lens types to accommodate various mounting heights and occupancy detection ranges (see charts for approximate detection patterns on page 7). Motion response used in combination of Dynadimmer and SiteWise are not programmable and used to override controllers schedule when motion is detected. When used not combined with any controller, IMRI is set/operates in the following fashion: The motion sensor is set to a constant 50%. When motion is detected by the PIR sensor, the luminaire returns to full power/light output. Dimming on low is factory set to 50% with 5 minute default in "full power" prior to dimming back to low. When no motion is detected for 5 minutes, the motion response system reduces the wattage by 50%, to 50% of the normal constant wattage reducing the light level. IMRI can also be specified with automatic profile dimming for the added benefit of a combined dimming profile with sensor detection, where the PIR sensor will override the dimming profile when occupancy is detected. Passive infrared (PIR) motion sensor.

IMRO: Infrared Motion Response Outboard pole mounted sensor, must be specified with an available automatic profile dimming option. Combines the benefits of both automatic profile dimming and motion response using the Philips DynaDimmer technology. PIR sensor features a pole mounted Wattstopper EW-200-120-W or the EW-200-277-W. One motion sensor per pole is required (order MS-A-120 or MS-A-277 separately). Available in 120 or 277V only, IMRO sensors require single voltage 120V or 277V input (see chart for approximate detection patterns). If motion is detected during the time that the luminaire is operating at profile dimming mode specified, the luminaire returns to 100% power and light output. The luminaire remains on high until no motion is detected for the duration period, after which the luminaire returns back to automatic profile dimming. Duration period is factory set at 15 minutes, and is field adjustable from 5 minutes up to 15 minutes. The area motion detector provides coverage equal to up to 6 times the sensor height above ground, 270° from the front-center of the sensor.

Pole Details: IMRO requires that the pole include an additional hand hole 15 feet above the pole base, normally oriented 180° to the standard hand hole. For Philips Gardco poles, order the pole with the Motion Sensor Mounting (MSM) option which includes the hand hole and a special hand hole cover plate for the sensor with a 1/2" NPT receptacle centered on the hand hole cover plate into which the motion sensor mounts. Once the motion sensor is connected to the hand hole cover plate, then wiring connections are completed in the pole. The plate (complete with motion sensor attached and wired) is then mounted to the hand hole. If poles are supplied by others, the customer is responsible for providing suitable mounting accommodations for the motion sensor in the pole (see Gardco Poles specification sheets for more information).



DCC: Dual Circuit Control permits separate switching of a specific number of LED modules. Available as an option with 2 through 4 modules.

SW: SiteWise option is a fully integrated controller that connects to Philips SiteWise system in order to offer a complete area lighting management system. The communication signal is based on Philips patented central dimming technology. SiteWise delivers it deliver optimal energy savings using your site's existing cabling. No additional wiring required, installation and commissioning are simple. An intuitive, mobile app makes it easy for authorized users to set schedules to meet site specific lighting needs, local regulations, and energy codes.

Wireless systems: Controller radio/sensor module attached to luminaire arm and includes radio, photocell and motion sensor. Available with #2 lens (LLC2) for 8' to 15' mounting height" or #3 lens (LLC3) for 15-25' mounting heights or #4 lens (LLC4) for 25-40' mounting heights. Also available with remote pod accessory where pod is mounted separate from luminaire to pole or wall (see accessories and wireless system information page 5-7).

F1: Fusing Single (for 120, 277 or 347VAC)

F2: Fusing Double (for 208, 240 or 480VAC)

FP1: Fusing Pole Single (pole mounted near handhole, for 120, 277 or 347VAC)

FP2: Fusing Pole Double (pole mounted near handhole, for 208, 240 or 480VAC).

FP3: Fusing Pole Canadian Double Pull (pole mounted near handhole, for 208, 240 or 480VAC)

SP1: Surge Protection, 10kV/5kA, 120-277V or 347-480V

SP2: Surge Protection, 20kV/10kA , 120-277V or 347-480V

HIS: Internal House Side Shield. Injection molded in black finish. Ships installed with 1 per 16 LED module. Also available shipped separately as an accessory for 2-4 LED modules.

FAWS: Field Adjustable Wattage Selector, pre-set to the highest position, can be easily switched in the field to the required position. This reduces total luminaire wattage consumption and reduces the light level – see the FAWS multiplier chart for more details. *Note: It is not recommended to use FAWS with other dimming or controls; if you do, set the switch to position 10 (maximum output) to enable the other dimming or controls. Switching FAWS to any position other than 10 will disable the other dimming or controls.*

Field adjustable wattage (FAWS) multiplier chart

FAWS Position	Typical Delivered Lumens Multiplier	Typical System wattage
1	0.31	0.28
2	0.53	0.50
3	0.62	0.58
4	0.70	0.67
5	0.78	0.75
6	0.83	0.81
7	0.89	0.87
8	0.92	0.91
9	0.96	0.95
10	1.00	1.00

Note: Typical value accuracy +/- 5%

ECF-S EcoForm small

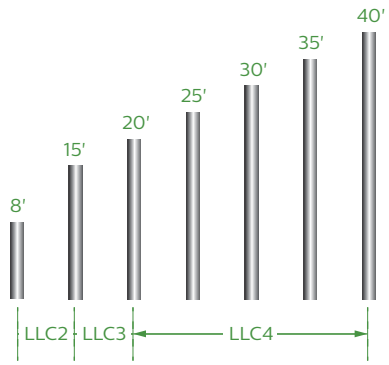
Site & Area

Wireless system – luminaire configuration information

LLC2/LLC3/LLC4 Luminaire Mounted Controller

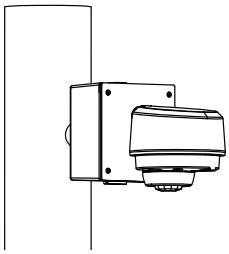
Controller pod attached to luminaire and Includes radio, photocell and motion sensor with #2, #3 or #4 lens for 8-40' mounting heights.

Recommended Sensor by Pole Height



LLCR2/LLCR3/LLCR4 Pole Mounted Controller

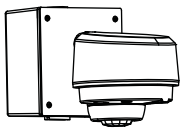
In this configuration, the wireless controller will be mounted to the pole at a fifteen foot mounting height. The number of luminaires on each pole, as well as the specific wattage chosen, will determine how many controllers will be required.



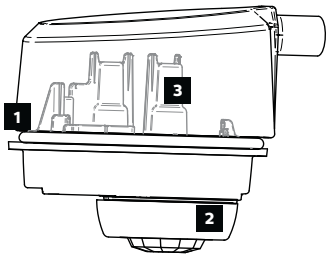
When using the wireless remote accessory option (LLCR-F) in a pole mount application, specify pole option (CL=Coupling Internal Thread, 3/4" size). Confirm required orientation of luminaire and wireless controller. Indicate height above pole base and orientation to hand hole. Recommended min pole height is 18ft, with option (CL) 15ft above pole base. Other heights are possible when choosing the appropriate sensor lens type. See pole specification sheets for more information.

Remote Mount Wireless Controller

Used to extend the communication on site, to extend motion response and add other luminaires that are not pole mounted. Consult factory for more information.



Wireless system sensor



1. Photocell

- Ambient light photocell on every wireless radio that averages the light levels of up to 5 controllers for an accurate reading and optimal light harvesting activity.
- Reports ambient light readings to 1500 Fc.

2. Motion Response

- Detects motion through passive infrared sensing technology with three different lens configurations.
- Motion sensor coverage can be adjusted from a narrow to a wide detection range, which helps reduce false triggers to further increase energy savings.
- Sensing profiles can be updated to adapt to activity levels in the environment, such as occupancy level, wind, and mounting height.

3. Wireless Radio

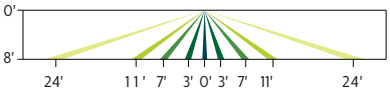
- 1.8 Watts max (no load draw)
- Operating voltage 120-277 VAC RMS
- Communicates using the ZigBee protocol
- Carries out dimming commands from Gateway
- Reports ambient light readings to 1500 Ft-Cd
- Transmission Systems Operating within the band 2400-2483.5Mhz
- RoHS Compliant

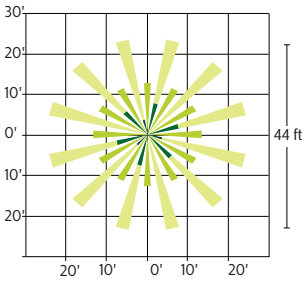
ECF-S EcoForm small

Site & Area

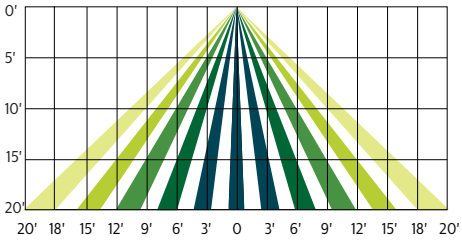
Infrared Motion Response – Coverage Patterns

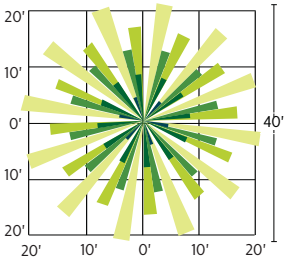
LLC2/LLCR2
Luminaire or remote mount controller with #2 lens



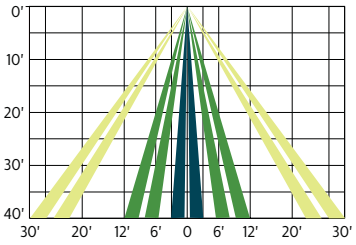


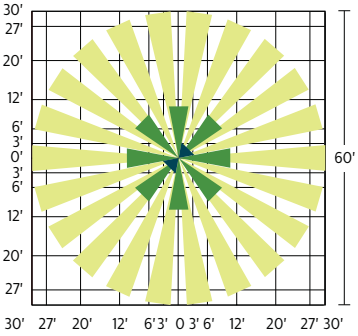
IMRI3/LLC3/LLCR3
Luminaire or Remote mount controller with #3 lens



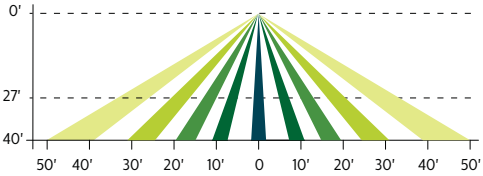


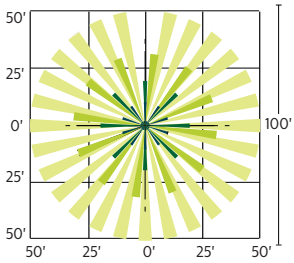
LLC4/LLCR4
Luminaire or Remote mount controller with #4 lens





IMRI7
Integral motion response with #7 lens





FINELITE

Luminaire Type **WA**
Corridors, Restrooms

Series 17 LED ADA WM Technical Sheet

ACF

Angled Curved Fascia - Solid (SF)

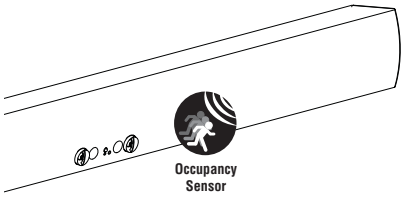
VCF

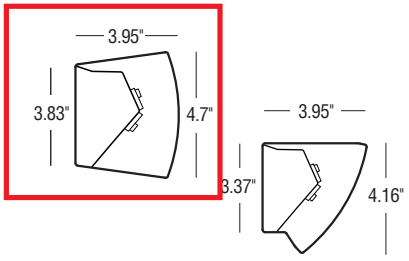
Vertical Curved Fascia - Perforated (PF)

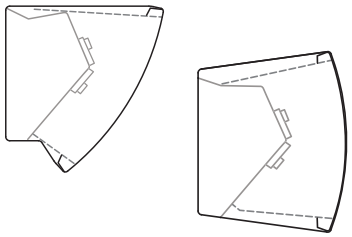
Signal White is standard finish

DESCRIPTION

Light up corridors, stairwells and reception areas without glare and in high style with Series 17 LED ADA Wall Mount luminaires. Choose from Angled Curved Fascia (ACF) or Vertical Curved Fascia (VCF) in solid or perforated design. Series 17 LED uses mid-powered LEDs for long life and evenly distributed illumination.







INTEGRATED SENSORS:

Each unit is available with an optional integrated ultrasonic occupancy sensor.

DIMENSIONS AND LIGHT ENGINE:

Extending less than 4" from the wall, Series 17 is ADA compliant and uses mid-powered LEDs yielding long life and even light distribution.

DIFFUSERS:

Standard with frosted acrylic diffuser on the top and bottom openings.

ORDERING GUIDE

Sample Number: S17-LED - VCF - PF - 4' - S - 8 - 35 - 277 - SC - OBO

S17-LED

Finelite **Series 17-LED**
Shape (VCF - Vertical, ACF - Angled)
Fascia (PF - Perforated, SF - Solid)
Run Length (2', 3', 4', and 8' Multiples Standard)
Light Output (S - Standard Output , B - Boosted Standard Output, H - High Output, V - Very High Output)
LED CRI (8 - 80 CRI Min (standard), 9 - 90 CRI Min (optional))
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Integrated Sensor (OBO - Occupancy Sensor)*

* Not available on 2' luminaires.

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Due to continuing product improvements, Finelite reserves the right to change specifications without notice. Please visit www.finelite.com for the most current data.

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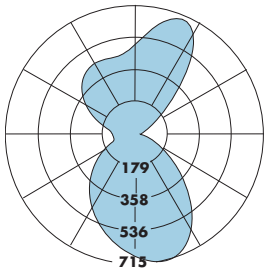
CTK0046. 04/16

FINELITE

Series 17 LED ADA WM Technical Sheet

VCF PHOTOMETRY

S17-LED-VCF-SF - 4' Luminaire
Very High Output - 120V
Efficacy (lumens per watt): 87.6
Total luminaire output: 3222 lumens (806 lumens/foot)
36.8 watts (9.2 watts/foot)
Peak Candela Value: 708 @ 15°
CCT: 3500K
ITL LM79 Report: 85158



CANDLEPOWER SUMMARY

	0	22.5	45.0	67.5	90.0	Flux
0	687	687	687	687	687	
5	706	700	684	668	663	65
15	708	696	656	618	607	185
25	637	639	597	552	545	273
35	495	524	509	473	473	310
45	323	379	400	388	396	293
55	175	235	287	299	314	238
65	73	117	183	212	231	165
75	12	35	96	133	156	93
85	0	0	26	97	150	55
90	0	0	0	100	154	
95	0	0	18	110	163	59
105	0	2	79	181	227	100
115	8	36	163	264	313	159
125	55	156	258	337	392	221
135	196	361	350	391	444	274
145	478	550	425	419	466	290
155	660	631	478	432	458	241
165	660	617	510	453	450	151
175	572	556	522	495	487	50
180	524	524	524	524	524	

VCF PF PHOTOMETRY - 4' LUMINAIRE

Total Light Output, 3500K, 80 CRI (Lumens)			
S*	**B***	**H***	**V****
1319	1658	2506	3222

Linear Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
330	415	627	806

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.0	9.2

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
91.7	90.2	89.6	87.6

S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output
* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85158

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

High Output (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2506 lm x 0.789 = 1977 lm

Total Light Output per Foot =
627 lm/ft x 0.789 = 495 lm/ft

watts/foot = 7.0 W/ft

$$Efficacy = \frac{495\ \frac{lm}{ft}}{7.0\ \frac{W}{ft}} = 70.7\ \text{lm/W}$$

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FINELITE

Series 17 LED ADA WM Technical Sheet

SPECIFICATIONS

CONSTRUCTION: Fixture channel is 6063-T6 extruded aluminum. Fascia covers are die-formed 20-gauge steel. Mounting clips are constructed from 22-gauge die-formed steel. All components are hard-tooled to tolerances of +/- 0.010".

ENDCAPS: Flat endcap, 14-gauge die-formed steel, adds 0.1" to each end.

REFLECTORS: 96W standard reflector, die-formed painted steel, 96% reflectance white finish. Virgin acrylic UV stabilized lensed diffuser behind perforated fascia is standard.

DIFFUSERS: Standard with top 0.080" and bottom 0.060" frosted acrylic diffusers

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: ≥0.9. Total Harmonic Distortion (THD) <20%. Step-dimming driver (limited programable outputs. Contact Factory). Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, backup battery. Factory-choice, low-profile, battery backup delivers 800 lumens (ACF) or 1400 (VCF). Minimum luminaire length for battery pack: 8'. The downlight alway will be illuminated in the 4' section.

Occupancy Sensor **INTEGRATED SENSORS:** Available with integrated ultrasonic occupancy sensors. Not available on 2' luminaries.

MOUNTING: Standard with mounting clips to the wall and not visible from normal viewing angles once installed. One mounting clip is provided for every 16 inches of luminaire for a secure connection to the wall. Luminaire is snapped into place on the mounting clips and secured using locking screws.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when fixture current exceeds 5 amps. Optional 6' flex conduit whips available.

FINISHES: Finelite Signal White is standard. Optional adders: 185 finishes available from Tiger Drylac's RAL color chart.

LENGTHS: Modular section lengths of 2', 3', 4' and 8' section lengths can be combined to make longer runs. Contact factory for additional lengths.

LABELS: Fixture and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: Fixture weight = 2 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

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PHILIPS

GARDCO

Wall Mount

LED mini sconce 111L

Luminaire Type **WB**
Exterior Wall- mounted

Philips Gardco 111 LED mini sconce luminaires are compact in size, perfect for low mounting height wall mount applications. 111 LED luminaires are designed to integrate naturally to wall surfaces. 111 LED luminaires are available with three (3) different distribution patterns, providing full cutoff performance (in the normal downlight position) and featuring LED arrays. Luminaires provide performance excellence and advanced Philips Gardco LED thermal management technology. High performance Class 1 LED systems offer potential energy savings of 50 % or more compared to HID systems. 111 LED luminaires are also available with 0-10V Dimming.

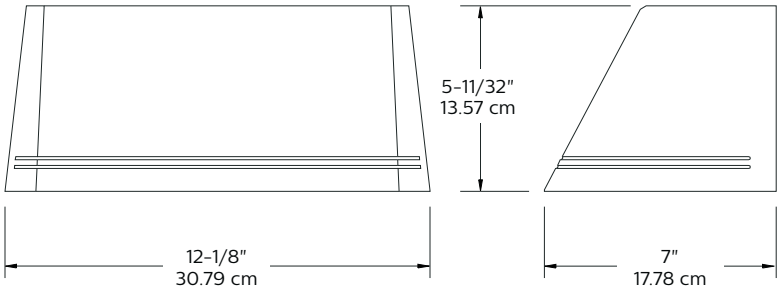
Ordering guide

example: 111L-16L-350-CW-G2-2-UNV-DD-BK

Prefix	No. of LEDs	Drive Current	Color/Generation	Distribution	Voltage	Controls	Electrical/Luminaire	Finish
111L	**16L**	**350**	**CW-G2**	**2**	**UNV**	**PCB**	**F1**	**Textured**
Trapezoidal Wedge LED	16 LED module	350mA	Cool White 5700K, 70 CRI generation 2	Type II Wide Throw Optic, with maximized lateral throw	120-277V 50hz/60hz	Photocontrol Button[2]	Single fusing (120, 277VAC)[1]	**BK** Black
		550 550mA	**NW-G2** Neutral White 4000K, 70 CRI generation 2	**3** Type III Preferred Wide Throw Optic, with improved forward throw	**120** 120V	**DD** 0-10V Dimming	**F2** Double fusing (208, 240VAC)[1]	**WH** White
		750 750mA	**WW-G2** Warm White 3000K, 70 CRI generation 2	**4** Type IV Maximized forward throw optic	**208** 208V		**F3** Canadian double pull fusing (208, 240VAC)[1]	**BZ** Bronze
					240 240V			**DGY** Dark Grey
					277 277V		**DL** Diffusing Lens	**MGY** Medium Grey
							WS Wall Mounted Box for Surface Conduit	**Customer specified**
								RAL Specify optional color or RAL (ex: OC-LGP or OC-RAL7024)
								CC Custom color (must supply color chip for required factory quote)

1. Provide specific input voltage.

Dimensions



Note: Mounting plate center is located in the center of the luminaire width and 2.38" (6.03cm) above the luminaire bottom (lens down position). Splices must be made in the J-box (by others). Mounting plate must be secured by max. 1/4" (.64cm) diameter bolts (by others) structurally to the wall.

111 Mini Sconce LED

110 Line LED, Wall Mount

LED Wattage and Lumen Values

Ordering Code	Total LEDs	LED Current (mA)	Avg System Wattage[1] (W)	Type 2			Type 3			Type 4		
				Lumen Output[2]	Bug Rating	Efficacy (LPW)	Lumen Output[2]	Bug Rating	Efficacy (LPW)	Lumen Output[2]	Bug Rating	Efficacy (LPW)
111L-16L-350-NW-G2	16	350	18	1908	B1-U0-G0	106	1799	B0-U0-G0	100	1768	B0-U0-G0	98
111L-16L-550-NW-G2	16	550	29	2900	B1-U0-G0	101	2735	B1-U0-G1	95	2688	B1-U0-G1	93
111L-16L-750-NW-G2	16	750	40	3807	B1-U0-G1	95	3591	B1-U0-G1	90	3529	B1-U0-G1	88

1. Wattage and lumen output may vary by +/- 8% due to LED manufacturer forward volt specification and ambient temperature. Wattage shown is average for 120V through 277V input. Actual wattage may vary by an additional +/- 10% due to actual input voltage.
2. Tests available for luminaires with the DL option and other color temperatures. Contact outdoorlighting.applications@philips.com if any approximate estimates are required for design purposes.
3. Absolute lumens for Cool White (CW) matches the Neutral White (NW) lumen outputs. Warm White (WW) performance is reduced by 12% compared to Neutral White (NW) values shown.

Specifications

Housing

Housings are die cast aluminum. A memory retentive gasket seals the housing to the door frame to exclude moisture, dust, insects and pollutants from the optical system. A black, die cast ribbed backplate dissipates heat for longer system life. Main body cast housing and back plate made of a low copper die cast. Hinged door allows access to driver and LED compartment.

Mounting

Mounting is completed through integral back plate that features a separate recessed feature for hook and lock quick mount plate that secures with two set screws from bottom of luminaire. Luminaire ships fully assembled, ready to install.

Light Engine

Composed of 4 main components: Heat Sink/ LED Module/Optical System/Driver. Electrical components are RoHS compliant. Metal core board ensures greater heat transfer and longer lifespan.

IP Rating

Luminaires are rated IP66.

Predicted Lumen Depreciation Data

Ambient Temperature °C	System Current	LED Current	Calculated L_{70}hrs[1,2]	L_{70} per TM21[2,3]	Lumen Maintenance @ 60,000hrs
25 °C	750 mA	750 mA	>100,000	>60,000	97%

1. Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions.
2. L70 is the predicted time when LED performance depreciates to 70% of initial lumen output.
3. Calculated per IESNA TM 21-11. Published L70 hours limited to 6 times actual LED test hours.

Optical systems

The advanced LED optical systems provide IES Types 2, 3, 4. Composed of high performance UV stabilized optical grade polymer refractor lenses to achieve desired distribution optimized to get maximum spacing, target lumens and a superior lighting uniformity. Performance shall be tested per LM-63, LM-79 and TM-15 (IESNA) certifying its photometric performance. Dark sky compliant with 0% uplight and U0 per IESNA TM-15.

Door Frame

A single-piece die cast aluminum door frame integrates to the housing form. The door frame is hinged closed and secured to the housing with captive stainless steel fasteners. The heat and impact resistant 1/8" (.32cm) tempered glass lens and one-piece gasket are mechanically secured to the door frame with galvanized steel retainers. A clear tempered glass lens is included. A diffuse lens is available as an option.

Thermal Management

Philips Gardco 111 LED luminaires utilize extruded aluminum integral thermal radiation fins to provide excellent thermal management critical to long LED system life.

Finish

Five standard colors offered in textured black, white, bronze, dark gray and medium gray. Color in accordance with the AAMA 2604 standard. Application of polyester powder coat paint 2.5 mils minimum. The thermosetting resins provides a discoloration resistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard. RAL and custom color matching available.

LED Useful Life

Luminaire Useful Life accounts for LED lumen maintenance. Refer to IES files for energy consumption and delivered lumens for each option. Based on ISTMT in situ thermal testing in accordance with UL1598 and UL8750, LED LM-80/ TM-21, expected to reach 100,000+ hours with >L70 lumen maintenance @ 25°C.

Certifications and Compliance

cULus Listed for Canada and USA suitable for wet locations when mounted downward facing. cULus Listed for Canada and USA suitable for damp locations when inverted upward facing when mounted in covered ceiling application. DesignLights Consortium qualified on models as listed on DLC QPL. Luminaire is rated for operation in ambient temperature of -40°C (-40°F) up to +40°C (+104°F)4.

Limited Warranty

5-year limited warranty. See philips.com/ warranties for details and restrictions. Visit our eCatalog or contact your local sales representative for more information.

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