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# OREGON TECH

## Applied Behavioral Analysis Clinic

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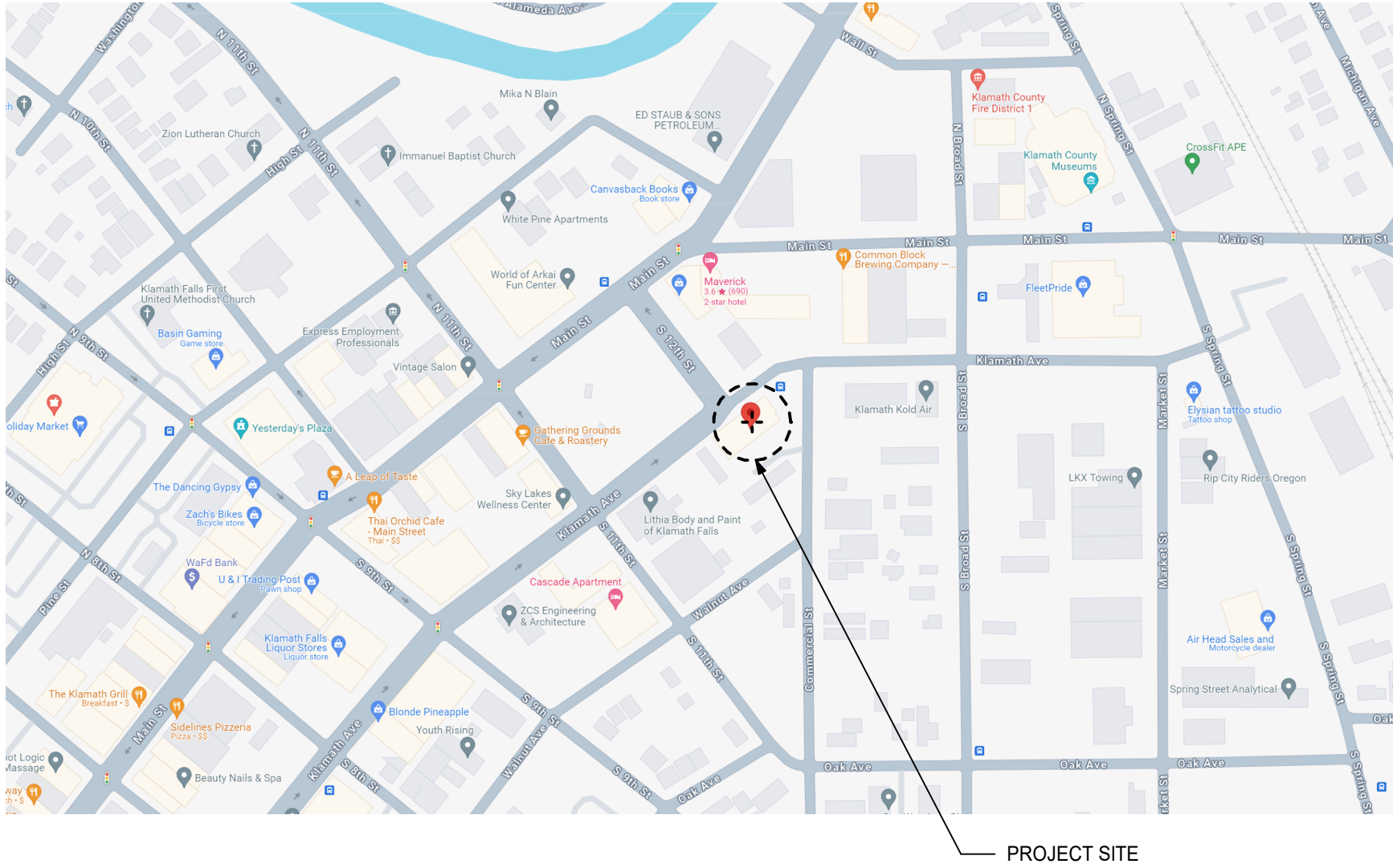
200 Commercial Street  
Klamath Falls, OR 97601

**Permit Set March 22nd, 2024**

**Soderstrom**  
Architects



VICINITY MAP:



OREGON TECH

PROJECT ADDRESS:

200 Commercial Street  
Klamath Falls, OR 97601

PROJECT SUMMARY:

PROJECT CONSISTS OF INTERIOR RENOVATIONS & SITEWORK INTENDED FOR USE AS MENTAL AND BEHAVIORAL HEALTH CLINIC.

PLANNING INFORMATION:

MAP & TAX LOT: 38S09E32AA TAX LOT 01900  
SUBDIVISION LOT & BLOCK: CANAL ADDITION LOTS 1, 17 18 & 19 IN BLOCK 4  
ZONING: GENERAL COMMERCIAL  
LOT AREA: 19,503 SF

PROJECT TEAM

**OWNER**  
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APPLICABLE CODES

2022 OREGON STRUCTURAL SPECIALTY CODE  
2021 OREGON ENERGY EFFICIENCY SPECIALTY CODE  
2022 OREGON MECHANICAL SPECIALTY CODE  
2023 OREGON PLUMBING SPECIALTY CODE  
2023 OREGON ELECTRICAL SPECIALTY CODE  
2022 OREGON FIRE CODE

DEFERRED SUBMITTALS

REFER TO SPECIFICATION SECTION 01 1150 FOR BIDDER DESIGN REQUIREMENTS FOR BOTH AHJ REVIEW ITEMS AND NON-AHJ DEFERRED ITEMS. SUBMITTAL DOCUMENTS FOR AHJ DEFERRED SUBMITAL ITEMS SHALL BE SUBMITTED TO THE ARCHITECT OF RECORD BY THE GENERAL CONTRACTOR. ARCHITECT AND APPROPRIATE ENGINEER OF RECORD SHALL REVIEW AND RETURN. THE GENERAL CONTRACTOR SHALL THEN FORWARD AHJ SUBMITTAL ITEMS TO THE BUILDING OFFICIAL FOR AHJ APPROVAL WITH A NOTATION INDICATING THAT THE DEFERRED SUBMITTAL DOCUMENTS HAVE BEEN REVIEWED AND THAT THEY HAVE BEEN FOUND IN GENERAL CONFORMANCE WITH THE DESIGN OF THE BUILDING. THE AHJ DEFERRED SUBMITAL ITEMS SHALL NOT BE INSTALLED UNTIL THEIR DESIGN AND SUBMITAL DOCUMENTS HAVE BEEN APPROVED BY THE BUILDING OFFICIAL.

AUTHORITY HAVING JURISDICTION (AHJ) DEFERRED SUBMITTAL ITEMS:

- A. FIRE ALARM SYSTEM  
B. STRUCTURAL

SEE SPECIFICATION SECTION 01 1150 SUBMITTAL REQUIREMENTS FOR NON-AHJ BIDDER DESIGNED/ENGINEERED ITEMS.

PROJECT NOTES

1. THE CONSTRUCTION CONTRACT IS FOR THE CONSTRUCTION OF A COMPLETE AND FULLY FUNCTIONING INSTALLATION. THESE DOCUMENTS DESCRIBE THE DESIGN INTENT AND SPECIFIC REQUIREMENTS OF THE INSTALLATION. THESE DOCUMENTS DO NOT INTEND TO SHOW EVERY ITEM REQUIRED TO CONSTRUCT THE WORK. ITEMS SUCH AS FASTENERS, CONNECTORS, FILLERS, MISCELLANEOUS CLOSURE ELEMENTS, ANCILLARY CONTROL WIRING AND POWER WHERE REQUIRED FOR THE CONTROL OR OPERATION OF THE PROVIDED EQUIPMENT ARE NOT ALWAYS SHOWN BUT ARE CONSIDERED INCLUDED IN THE SCOPE OF THE WORK. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE A FULLY FUNCTIONING INSTALLATION WHICH MEETS THE DESIGN INTENT, INCLUDING THE SPECIFIC REQUIREMENTS INCLUDED IN THESE DOCUMENTS.
2. ALL ITEMS IN THESE DOCUMENTS ARE NEW UNLESS OTHERWISE NOTED.
3. THESE DOCUMENTS DESCRIBE A SINGLE CONSTRUCTION CONTRACT. THE USE OF SUBCONTRACTORS IS THE ELECTION OF THE CONTRACTOR. THESE DOCUMENTS DO NOT INTEND TO DIVIDE THE WORK AMONG THE CONTRACTOR'S SUBCONTRACTORS. WHERE THE DOCUMENTS IDENTIFY WORK WHICH IS "NOT IN MECHANICAL WORK" OR "NOT IN ELECTRICAL WORK" IT MEANS THAT WORK IS NOT FURTHER DESCRIBED OR SPECIFIED IN THE MECHANICAL OR ELECTRICAL DRAWINGS OR SPECIFICATIONS. IT DOES NOT PRECLUDE THE CONTRACTOR FROM DELEGATING THE WORK TO THE ENTITIES OF HIS ELECTION. IN ADDITION THE DIVISION OF THE CONTRACT DOCUMENTS INTO ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL AND OTHER DESIGN DISCIPLINES NEITHER DIVIDES THE WORK FOR THOSE DISCIPLINES AS SHOWN ONLY IN THOSE DRAWINGS OR SPECIFICATIONS.
4. ITEMS INDICATED IN THIS SET NOTED BY OWNER ARE NOT IN THE CONTRACT (N.I.C.) UNLESS OTHERWISE NOTED. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR AND THE SUBCONTRACTORS TO REVIEW ALL DRAWINGS, PROJECT MANUAL, ADDENDA, ETC. IN ORDER TO ASSURE THE COORDINATION OF ALL WORK AFFECTING EACH TRADE. FAILURE TO REVIEW AND COORDINATE ALL CONTRACT DOCUMENTS BY THE GENERAL CONTRACTOR WITH ALL THE SUBCONTRACTORS FOR APPLICABLE ITEMS OF THE WORK SHALL NOT RELIVE THE RESPONSIBLE PARTY FROM PERFORMING ALL WORK SO REQUIRED AS PART OF THE CONTRACT.
5. UNLESS OTHERWISE NOTED, THE PROJECT MANUAL, WHICH INCLUDES THE GENERAL CONDITIONS, SUPPLEMENTAL CONDITIONS, AND TECHNICAL SPECIFICATIONS, AND THE DRAWINGS ARE COMPLEMENTARY AND TOGETHER DESCRIBE THE PROJECT REQUIREMENTS. WHERE THERE ARE DISCREPANCIES BETWEEN THE PROJECT MANUAL AND THE DRAWINGS, THE CONTRACTOR SHALL ADVISE THE ARCHITECT AND REQUEST A CLARIFICATION. THE ORDER OF PRECEDENCE BETWEEN THE DRAWINGS AND THE PROJECT MANUAL IS AS DEFINED IN THE PROJECT MANUAL.
6. UNLESS OTHERWISE NOTED, THE CONTRACTOR SHALL LAYOUT AND SEQUENCE THE INSTALLATION OF THE WORK SO THAT THE DIFFERENT SYSTEMS DO NOT OBSTRUCT THE INSTALLATION OF SUCCESSIVE WORK. IN GENERAL, SYSTEMS INSTALLED FIRST SHOULD BE KEPT AS HIGH AND TIGHT TO STRUCTURE AS POSSIBLE TO LEAVE SPACE AVAILABLE FOR SYSTEMS WHICH FOLLOW.
7. REFER TO THE PROJECT MANUAL FOR SPECIFICATIONS, GENERAL INFORMATION, PRODUCTS AND EXECUTION REQUIREMENTS. REQUIREMENTS OF THE SPECIFICATIONS APPLY TO ALL ASPECTS OF THE WORK AND ARE INCLUDED AS ADDITIONAL INFORMATION FOR EACH ITEM SPECIFIED. IF DISCREPANCIES EXIST BETWEEN THE SPECIFICATIONS AND DRAWINGS, THE MORE STRINGENT REQUIREMENTS SHALL PREVAIL. THE GENERAL CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVES OF ANY DISCREPANCIES.
8. THE GENERAL CONTRACTOR AND ALL SUBCONTRACTORS WILL VISIT THE SITE PRIOR TO BIDDING IN ORDER TO FAMILIARIZE THEMSELVES WITH THE EXISTING SITE CONDITIONS AND THE IMPACT OF THE PROPOSED NEW WORK. INDICATED ON THE DRAWINGS AND SPECIFICATIONS, ON THESE CONDITIONS. ANY QUESTIONS REGARDING THE COORDINATION OF NEW WORK OR EXISTING CONDITIONS MUST BE SUBMITTED TO THE OWNER'S REPRESENTATIVE IN WRITING PRIOR TO BID SUBMISSION AND WITH ADEQUATE TIME FOR RESPONSE TO ALL BIDDERS. THE OWNER'S REPRESENTATIVE WILL RESPOND TO QUESTIONS, SUBMITTED IN A TIMELY MANNER, WITH WRITTEN CLARIFICATIONS FORWARDED TO ALL BIDDERS.
9. THE EXISTING DIMENSIONS AND CONDITIONS SHOWN ON THESE DRAWINGS ARE ASSUMED TO BE ACCURATE BASED ON AVAILABLE INFORMATION. THE CONTRACTOR SHALL, PRIOR TO THE START OF CONSTRUCTION, VERIFY ALL EXISTING CONDITIONS, PROVIDE A COMPLETE FIELD LAYOUT ON THE JOB SITE, AND NOTIFY THE OWNER'S REPRESENTATIVE OF ANY DEVIATIONS OR CONFLICTS WITH THESE DRAWINGS.
10. THE DRAWINGS SHALL NOT BE SCALED. THE GENERAL CONTRACTOR SHALL REFER TO THE DIMENSIONS INDICATED OR THE ACTUAL SIZES OF CONSTRUCTION ITEMS, WHERE NO DIMENSIONS OR METHOD OF DETERMINATION IS GIVEN, VERIFY CORRECT DIMENSIONS OR LOCATION WITH THE OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION.
11. THE DRAWINGS AND REFERENCED DETAILS HAVE BEEN DIMENSIONED IN ORDER TO ESTABLISH THE CONTROL AND GUIDELINES FOR FIELD LAYOUT. WHERE A DISCREPANCY EXISTS BETWEEN THE DRAWING AND THE DETAIL, THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE FOR CLARIFICATION PRIOR TO INSTALLATION.
12. DIMENSIONS ARE TO FACE OF FINISH UNLESS OTHERWISE NOTED.
13. WHERE DIMENSIONS ARE NOTED TO BE VERIFIED IN THE FIELD (VIF) THE DIMENSION SHOWN IS THE DESIGN BASIS, BUT MAY DIFFER FROM ACTUAL CONDITIONS. CONTRACTOR SHALL VERIFY THESE DIMENSIONS WHILE LAYING OUT THE WORK AND REPORT ANY DISCREPANCIES BETWEEN THE DESIGN BASIS AND ACTUAL DIMENSIONS TO THE OWNER'S REPRESENTATIVE PRIOR TO PROCEEDING WITH THE WORK. WHERE DIMENSIONS ARE NOTED "+/-" FIELD DIMENSIONS MAY VARY FROM THE NOTED DIMENSIONS BY MINOR AMOUNTS. IF THE CONTRACTOR IDENTIFIES DIMENSIONS IN THE FIELD THAT DIFFER BY MORE THAN 1" FROM THE +/- DIMENSIONS INDICTED IN THE DRAWINGS, THE CONTRACTOR SHOULD CONFIRM DIFFERENTIAL WITH ARCHITECTS.
14. INTERIOR DETAILS ARE KEYED TO THE PLANS AT TYPICAL LOCATIONS. TYPICAL DETAILS APPLY TO ALL LOCATIONS WHICH ARE SIMILAR BUT ARE NOT OTHERWISE DETAILED. THE CONTRACTOR AND SUBCONTRACTORS ARE RESPONSIBLE TO COORDINATE THE LOCATION OF TYPICAL DETAILS AND INSTALL THE WORK INDICATED. IF DISCREPANCIES EXIST OR QUALIFICATION IS REQUIRED, THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE FOR CLARIFICATION PRIOR TO PROCEEDING.
15. INTERIOR FINISHES ARE KEYED TO THE DRAWINGS AT TYPICAL LOCATIONS. THE FINISHES APPLY TO ALL LOCATIONS WHICH ARE SIMILAR BUT ARE NOT OTHERWISE DETAILED. CONTRACTOR AND SUBCONTRACTORS ARE RESPONSIBLE TO COORDINATE THE LOCATION ALL TYPICAL DETAILS AND INSTALL THE WORK INDICATED. IF DISCREPANCIES EXIST OR QUALIFICATION IS REQUIRED, THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE FOR CLARIFICATION PRIOR TO PROCEEDING.
16. WALL FIRE RATING INDICATIONS ON THE FLOOR PLANS SHOW EXTENT OF FIRE RATED PARTITION. FIRE RATING IN A PARTITION SHALL CONTINUE OVER DOOR OR WINDOW OPENING WHETHER OR NOT THEY APPEAR IN PLAN.
17. IT IS THE GENERAL CONTRACTOR'S RESPONSIBILITY TO VERIFY SIZE AND INVERT ELEVATION OF OPENINGS / SLEEVES THROUGH CONCRETE AND MASONRY WALLS AND CONCRETE FOUNDATION WALLS. OPENINGS / SLEEVES ARE NOT LIMITED TO THOSE SHOWN ON STRUCTURAL DRAWING SHEETS.
18. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO COORDINATE AND MAKE PROVISIONS FOR ALL PIPE / CONDUIT SLEEVES THROUGH CONCRETE WALLS. ELEVATIONS ARE TO TOP OF CONCRETE OR OTHER HARD SURFACE MATERIAL. DO NOT SCALE DRAWINGS. USE DIMENSIONS INDICATED.
19. DETAILS ARE INTENDED TO SHOW METHOD AND MANNER OF ACCOMPLISHING THE WORK. MINOR MODIFICATIONS MAY BE REQUIRED TO SUIT JOB DIMENSIONS OR CONDITIONS AND SHALL BE INCLUDED AS PART OF THE WORK.
20. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS AND EXISTING CONDITIONS AT THE SITE BEFORE COMMENCING WORK AND REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO START OF THE WORK. IN CASE OF CONFLICT BETWEEN ARCHITECTURAL AND CONSULTANTS DRAWINGS, THE ARCHITECT WILL DETERMINE THE CORRECT INTENTION OF THE WORK.
21. THE BUILDING SHALL BE PROVIDED WITH A FULL SPRINKLER SYSTEM COMPLYING WITH APPLICABLE CODES OF THE AUTHORITY HAVING JURISDICTION.
22. PROVIDE PEDESTRIAN PROTECTION AS NECESSARY AND AS REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
23. ALL CONSTRUCTION RELATING TO BUILDING, PARKING OR SITE DEVELOPMENT SHALL CONFORM TO STATE OF OREGON AND JURISDICTIONAL ACCESSIBILITY REQUIREMENTS.
24. THE CONTRACTOR SHALL COORDINATE ANY AND ALL REQUIREMENTS FOR OFF-SITE IMPROVEMENTS, INCLUDING BUT NOT LIMITED TO SIDEWALKS, DRIVEWAYS, CURBS, GUTTERS, UTILITIES, ETC. OFF SITE IMPROVEMENTS SHALL MEET THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION (AHJ).
25. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES, SYMBOLS, AND TYPICAL DETAILS. SPECIFIC NOTES ON DETAILS APPLY TO SIMILAR CONDITIONS UNLESS NOTED OTHERWISE (UNO / UON).
26. ELEVATORS SHALL COMPLY WITH THE 'OREGON ELEVATOR SPECIALTY CODE'.
27. WHERE FIRE RATED OPENING PROTECTION IS REQUIRED, THE FIRE DOORS AND SMOKE AND DRAFT CONTROL ASSEMBLIES INSTALLED IN CORRIDOR OPENINGS SHALL BE TESTED AND LABELED IN ACCORDANCE WITH OSSC CURRENT EDITION SECTION 714. IN ACCORDANCE WITH THE REQUIREMENTS OF THE LISTED ASSEMBLY, THE MANUFACTURER'S INSTALLATION INSTRUCTIONS SHALL BE PROVIDED WITH EACH ASSEMBLY FOR INSTALLATION AND FOR REVIEW BY THE INSPECTION AUTHORITY.

SHEET INDEX

01 - GENERAL

G100 COVER SHEET  
G101 PROJECT INFO

02 - ARCHITECTURAL

A101 SITE PLAN  
A201 DEMO FLOOR AND CEILING PLANS  
A202 FLOOR PLAN AND CEILING PLAN  
A301 SECTION, FINISH SCHEDULE AND DETAILS  
A401 ENLARGED PLANS AND INTERIOR ELEVATIONS  
A801 DOOR SCHEDULE AND TYPES, DETAILS  
A802 DETAILS

03 - MECHANICAL

M001 SYMBOL LIST AND GENERAL NOTES - MECHANICAL  
M002 SCHEDULES - MECHANICAL  
M201 FLOOR PLAN - MECHANICAL  
M500 DETAILS - MECHANICAL

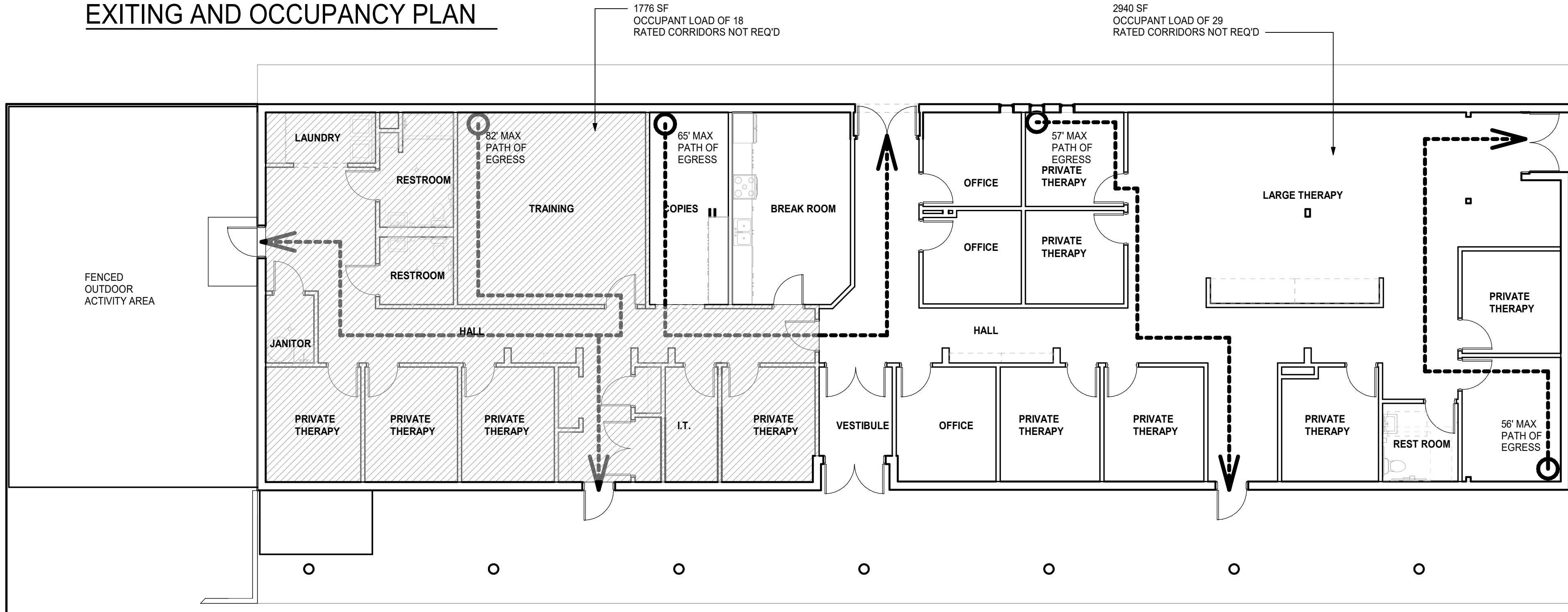
04 - ELECTRICAL

E001 SYMBOL LIST AND GENERAL NOTES - ELECTRICAL  
E002 LUMINAIRE SCHEDULE & SEQUENCE OF OP.  
E201 CEILING PLAN - LIGHTING  
E301 FLOOR PLAN - POWER  
E501 ONE LINE DRAWINGS & SCHEDULES - ELECTRICAL  
E700 DETAILS - ELECTRICAL  
E800 SPECIFICATIONS - ELECTRICAL

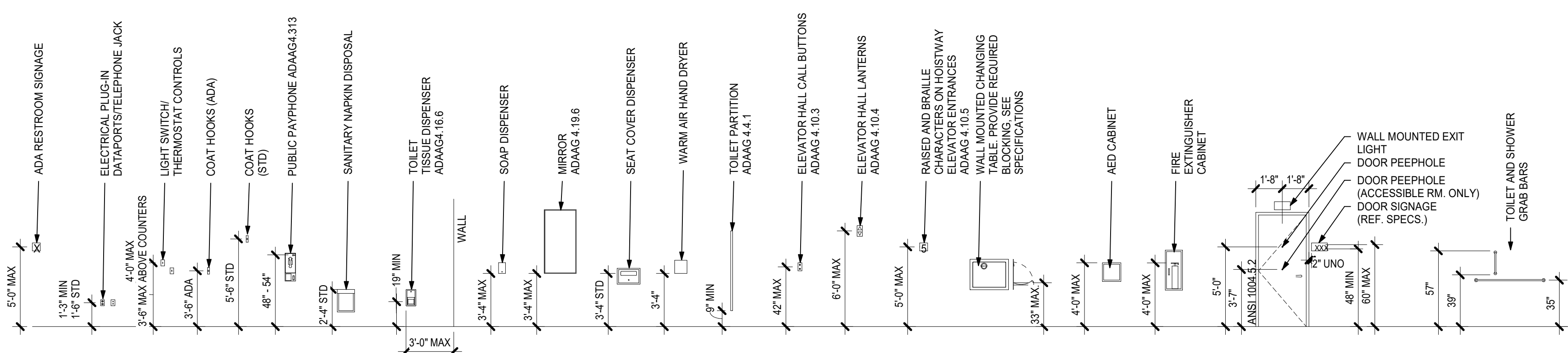
05 - PLUMBING

P001 SYMBOL LIST AND GENERAL NOTES - PLUMBING  
P002 SCHEDULES - PLUMBING  
P200 UNDERGROUND PLAN - PLUMBING  
P201 FLOOR PLAN - PLUMBING

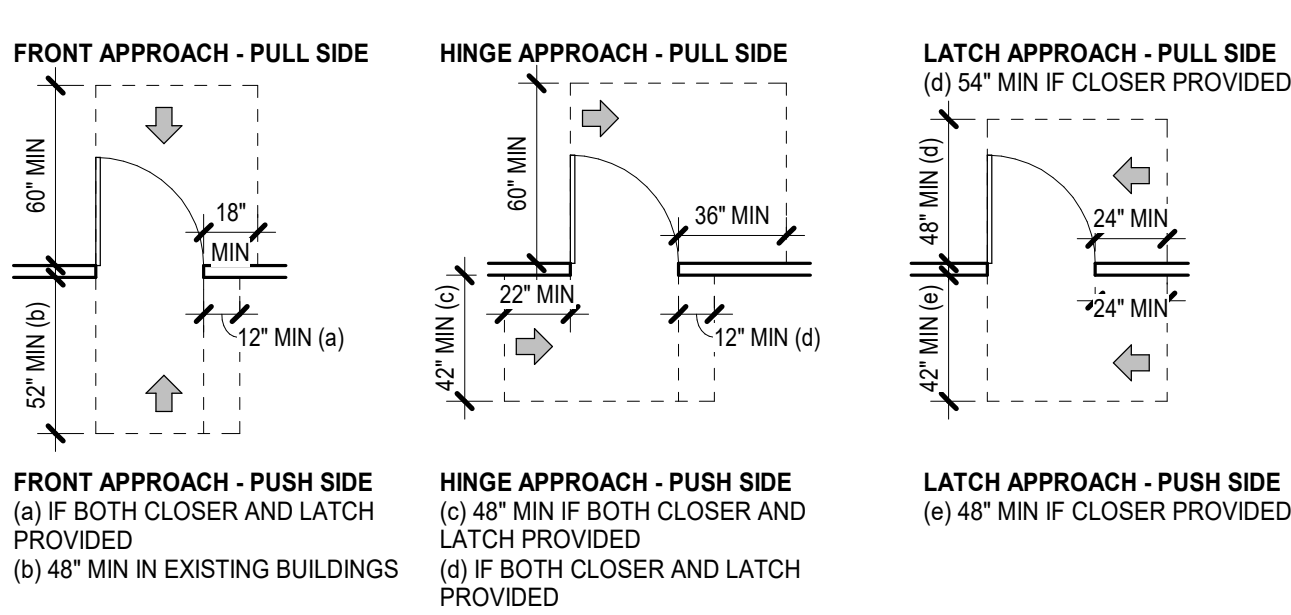
EXITING AND OCCUPANCY PLAN



ADA MOUNTING HEIGHTS



ADA DOOR MANEUVERING CLEARANCES



CODE SUMMARY

EXISTING GROSS BUILDING AREA - 5163 SF  
EXISTING NET BUILDING AREA - 4716 SF  
EXISTING OCCUPANCY - B  
PROPOSED OCCUPANCY - B, OFFICE USE, WITH B NON-AMBULATORY OUTPATIENT CLINIC.

EXISTING CONSTRUCTION TYPE - TYPE V-B, NO CHANGE PROPOSED  
FIRE PROTECTION - NONE

ALLOWABLE HEIGHT - 40'  
ACTUAL HEIGHT - 16'

ALLOWABLE STORIES - 2  
ACTUAL STORIES - 1

ALLOWABLE AREA - 9,000 BASE AREA, ALLOWABLE INCREASES FOR FRONTAGE NOT NEEDED  
ACTUAL AREA - 5163 SF

ACCESSIBLE PARKING  
ORS 447.233 MANDATES THE NUMBER OF ACCESSIBLE PARKING SPACES BASED ON THE TOTAL NUMBER OF SPACES ON THE PROPERTY. THIS PROPOSED PARKING LAYOUT CONTAINS LESS THAN 25 PARKING SPACES, SO 1 IS REQUIRED TO BE ACCESSIBLE AND MARKED FOR BOTH VAN ONLY AND WHEELCHAIR ONLY USE. VAN PARKING DIMENSIONS REQUIRE A 9 FOOT WIDE SPACE WITH AN ADJACENT 8 FOOT WIDE AISLE.

OCCUPANT LOAD: 4716 SF/100 OUTPATIENT CLINIC LOAD FACTOR (TABLE 1004.5) = 47

EXITING  
PER TABLE 1006.3.4, THE MAXIMUM ALLOWED EXIT ACCESS TRAVEL DISTANCE IS 75 FEET. DESIGN SHOWS EXITS WITH ACTUAL TRAVEL DISTANCE AT 55 FEET..

PLUMBING FIXTURES:  
PER TABLE 2902.1, A B OCCUPANCY REQUIRES 1 WATER CLOSET AND 1 LAVATORY FOR THE FIRST 50 IN THE OCCUPANT LOAD. THREE OF EACH ARE PROVIDED.



Project

Consultant

Revisions

No. Description

Date

Stamp



Issuance

Permit Set

Date

March 22nd, 2024

Project Number

23020

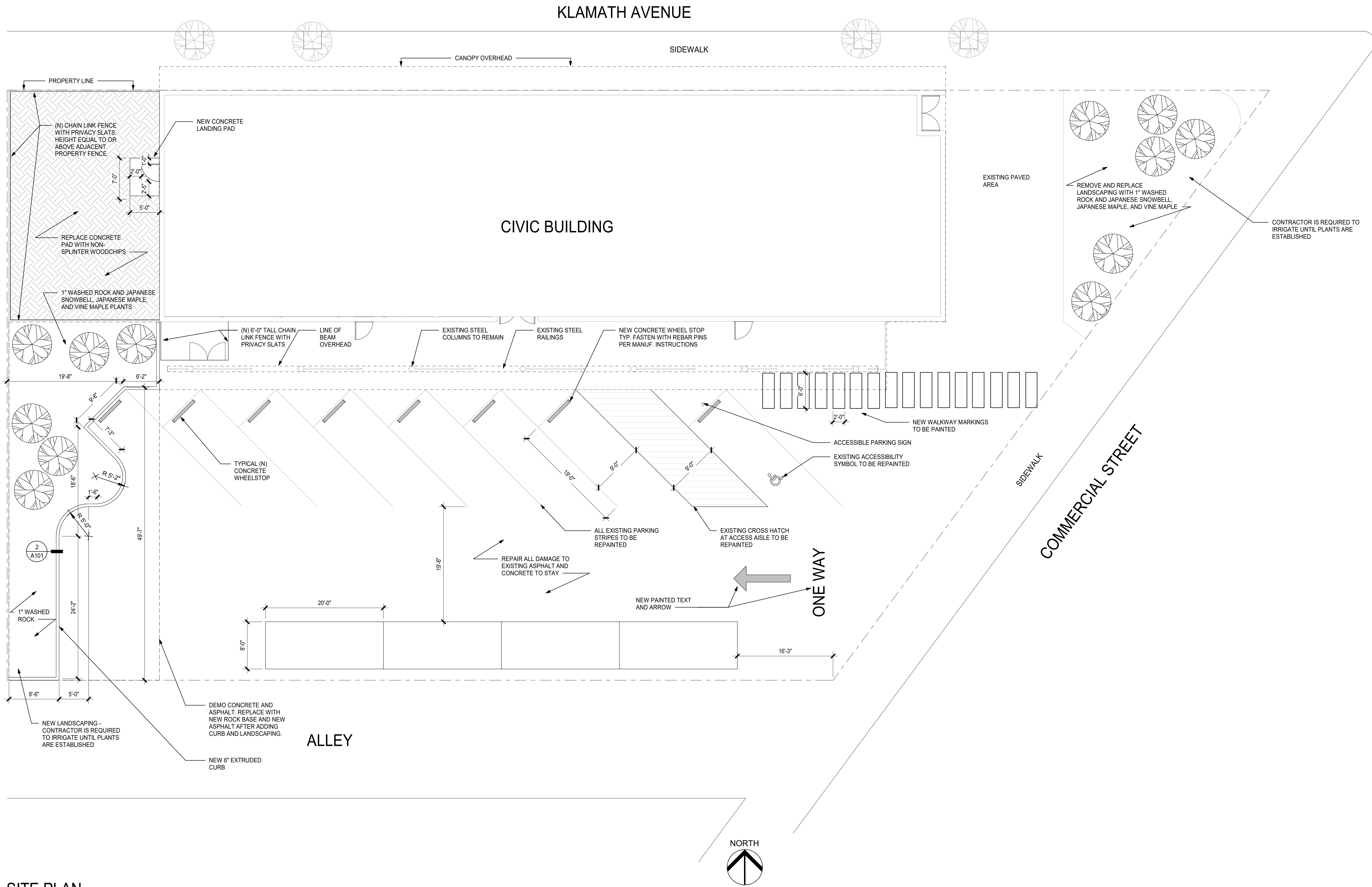
Drawing Title

PROJECT INFO

Sheet No

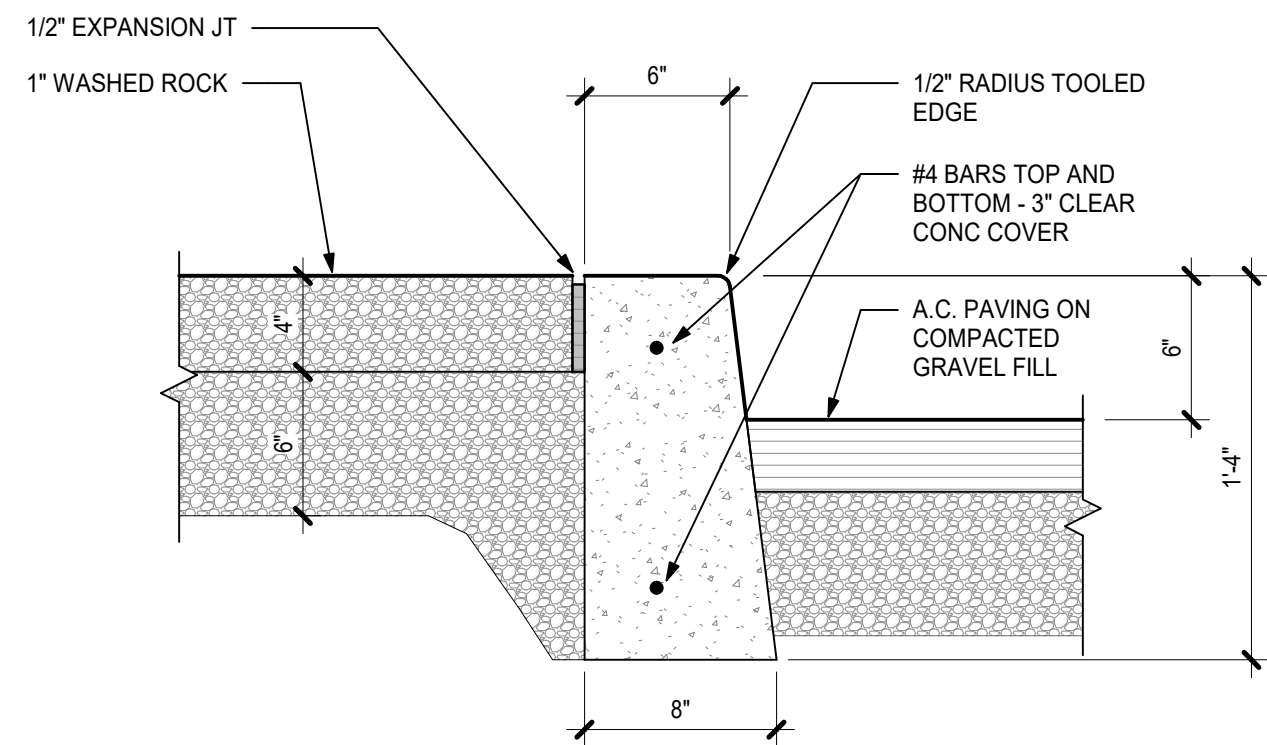
G101





## 1 SITE PLAN

A101 ( 1/8" = 1'-0" )



## 2 CURB SECTION

A101 ( 1 1/2" = 1'-0" )



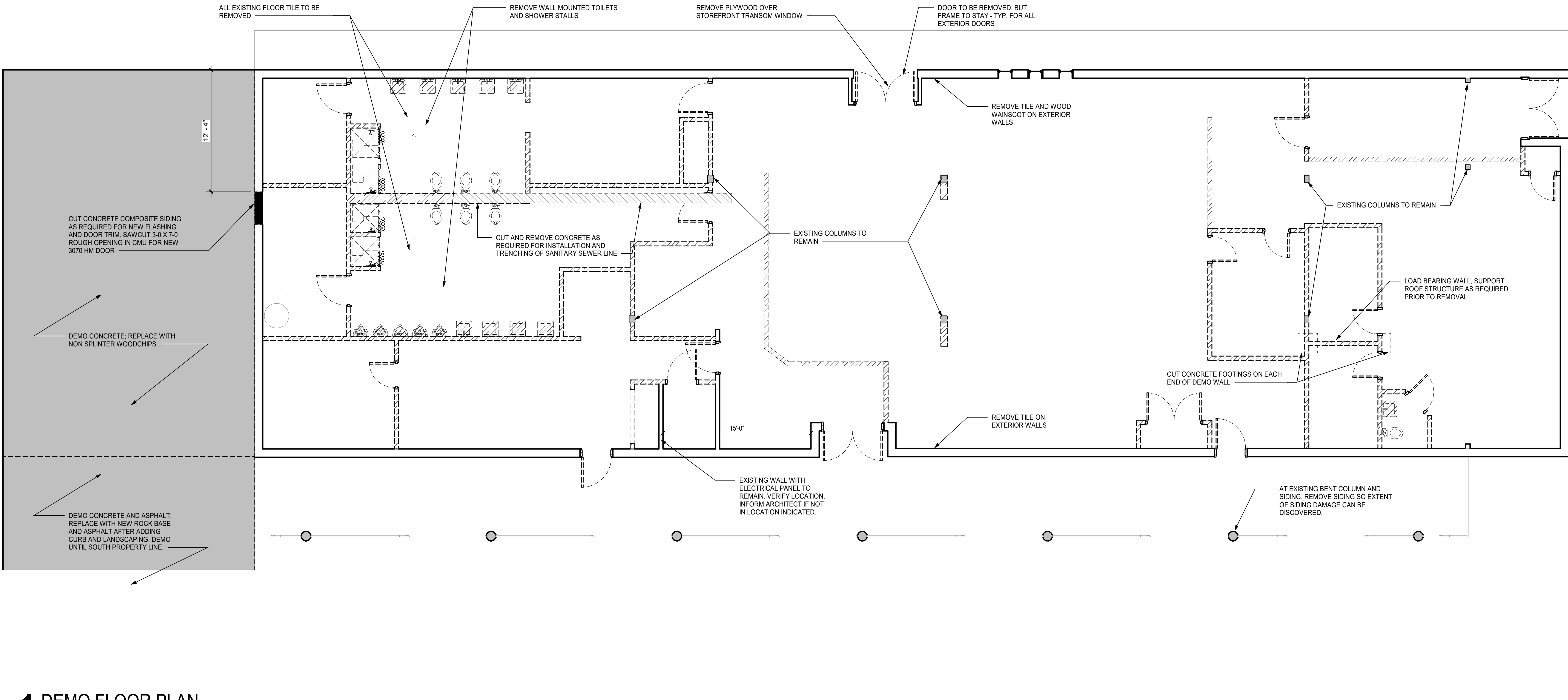


DEMO FLOOR PLAN SHEET NOTES

1. VERIFY EXTENT OF DEMOLITION WITH PROPOSED FLOOR PLANS.
2. PATCH ALL EXISTING WALLS AS REQUIRED TO PROVIDE A SMOOTH SURFACE FOR NEW FINISHES.
3. CONTRACTOR SHALL PROVIDE TEMPORARY PARTITION DUST BARRIERS IN ORDER TO MINIMIZE THE SPREAD OF DUST AND DEBRIS, AND TO PROTECT ADJACENT SPACES.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL DEMOLITION MATERIAL IN ACCORDANCE WITH BUILDING OWNER / TENANT STANDARDS.
5. PULL ANY DEMOLISHED WIRING BACK TO THE NEAREST JUNCTION BOX AND CAP IN ACCORDANCE WITH CODE. IN WALLS TO BE REMOVED, REMOVE WALL BOXES AND CONDUIT.
6. PULL ANY DEMOLISHED PLUMBING LINES BACK TO THE NEAREST POINT OF CIRCULATION AND CAP IN ACCORDANCE WITH CODE.
7. REFER TO NON-ARCHITECTURAL SHEETS FOR ADDITIONAL DEMOLITION SCOPE.
8. REMOVE ALL WALLS & DOORS INDICATED BY DASHED LINES.
9. REMOVE ALL FLOOR FINISHES ABOVE SUBFLOOR.
10. REMOVE EXISTING PLUMBING FIXTURES AND ASSOCIATED APPURTENANCES. ALSO REMOVE ALL UNUSED PIPING TO A POINT BEHIND OR BELOW FINISHED SURFACES AND CAP IN PLACE. MAINTAIN EXISTING PIPING WHERE NECESSARY FOR EXTENSION TO NEW FIXTURE LOCATIONS. REMOVE ALL EXISTING VENT PIPING THAT IS BELOW ROOF. MAINTAIN VTR LOCATIONS FOR NEW FIXTURE CONNECTION. PROTECT CLOSET BENDS WHERE NEW TOILETS WILL BE INSTALLED IN SAME LOCATIONS.
11. REMOVE WATER SUPPLY PIPING IN WALLS THAT ARE REMOVED.
12. REMOVE ALL MIRRORS.

LEGEND

- WALL TO BE DEMOLISHED
- PORTION OF CONCRETE TO BE DEMOLISHED
- EXISTING WALL TO REMAIN
- EXISTING COLUMN TO REMAIN
- DEMO ASPHALT AND CONCRETE



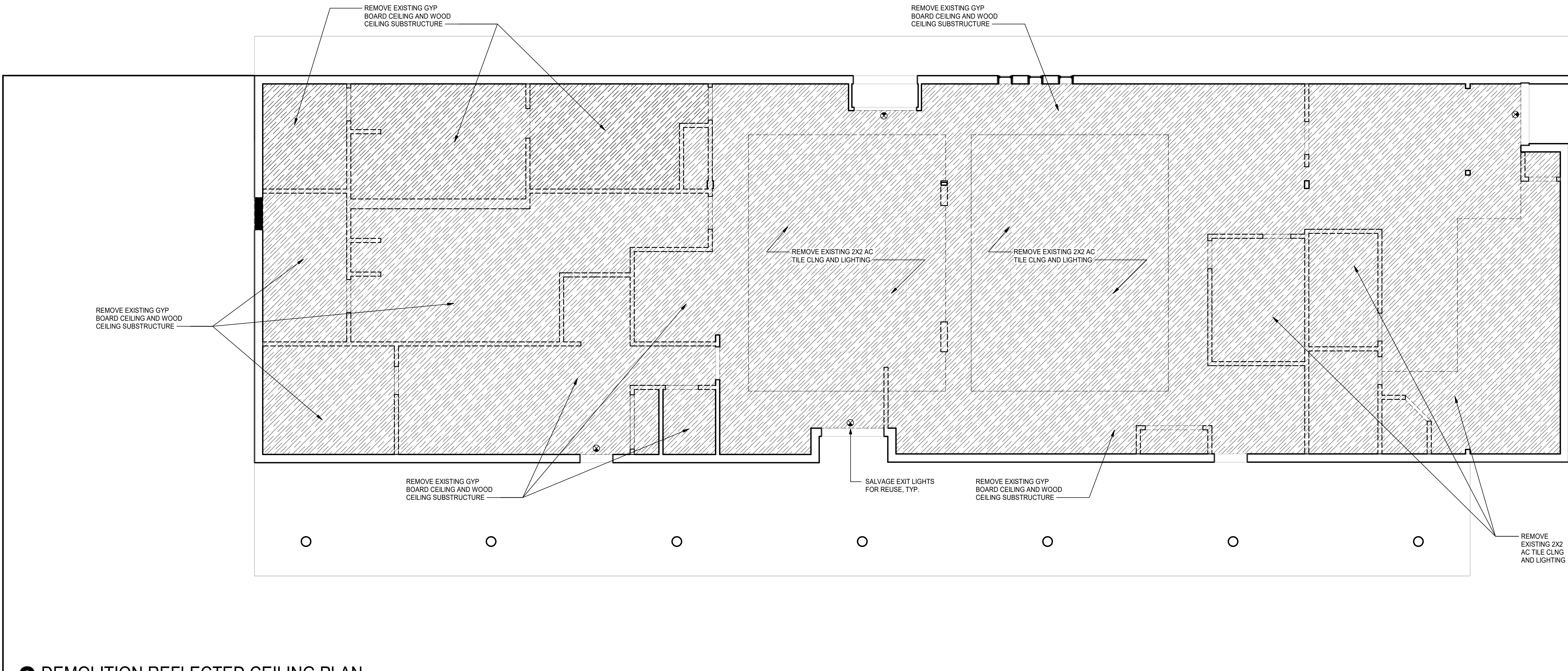
1 DEMO FLOOR PLAN  
A201 ( 3/16" = 1'-0" )

DEMO RCP SHEET NOTES

1. REMOVE ALL CEILINGS AND SOFFITS EXCEPT FOR THOSE SHOWN.
2. REMOVE ALL BULKHEADS.
3. REMOVE EXISTING LIGHTING AND HVAC GRILLES IN CEILINGS.
4. REMOVE ALL EXISTING MECHANICAL GRILLES AND LIGHT FIXTURES IN CEILINGS TO BE DEMOED.

LEGEND

- WALL TO BE DEMOLISHED
- EXISTING WALL TO REMAIN
- GYP BD CEILING / SOFFIT / WOOD SUBSTRUCTURE TO BE DEMOLISHED
- ACOUSTIC CEILING TILE (ACT) TO BE DEMOLISHED

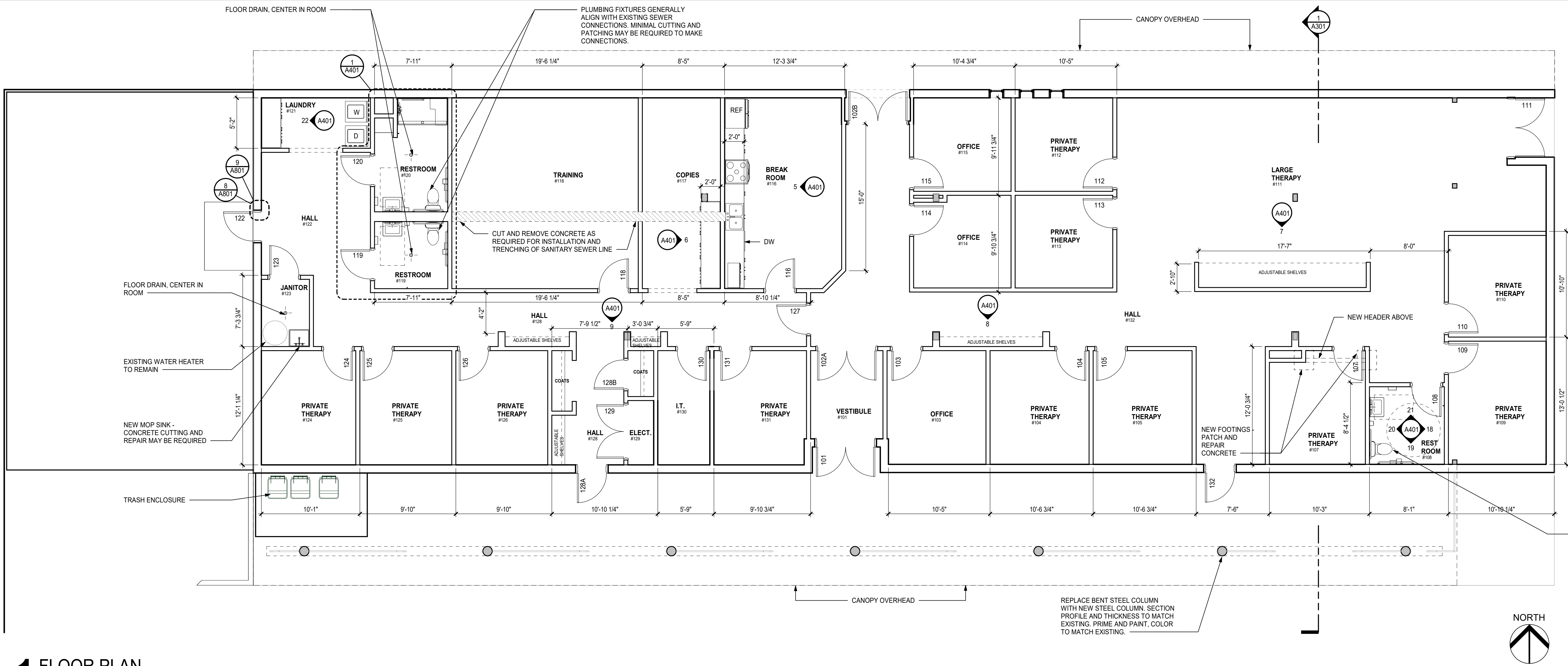


2 DEMOLITION REFLECTED CEILING PLAN  
A201 ( 3/16" = 1'-0" )



## FLOOR PLAN SHEET NOTES

- ANY INTERIOR WALL NOT LABELED WITH A WALL TAG SHALL BE WALL TYPE: W01.
- REFER TO SHEET A100 FOR INTERIOR PARTITION TYPES AND KEY.
- REFER TO DIMENSIONAL STANDARDS ON C101.
- ALL ACOUSTIC WALL SEPARATIONS MUST BE SEALED FOR SOUND TRANSMISSION.
- ALL EXISTING COLUMNS TO REMAIN.



## 1 FLOOR PLAN

A202 (3/16" = 1'-0")

## RCP SHEET NOTES

- REFER TO ENGINEER'S DRAWINGS FOR LIGHT SWITCHING AND SPECIFICATION, EXIT SIGN LOCATIONS, AND ELECTRICAL AND MECHANICAL SYSTEMS.
- REPORT TO ARCHITECT ANY CONFLICTS BETWEEN ELECTRICAL, MECHANICAL, OR STRUCTURAL DRAWINGS AND THIS LAYOUT.
- ALL VISIBLE STRUCTURE, DUCTWORK, PIPES, CONDUITS, AND OTHER ASSOCIATED COMPONENTS NOT FULLY CONCEALED BEHIND A CONTINUOUS CEILING TO BE PAINTED.
- ALL LIGHTS AND GRIDS ARE TO BE CENTERED IN ROOM, U.O.N.
- CONTRACTOR RESPONSIBLE FOR WOOD STRUCTURE FOR GYPSUM CEILINGS PER PRESCRIPTIVE CODE METHODS.

## LEGEND

- CEILING SPOT HEIGHT
- FINISH CEILING HEIGHT ABOVE FINISH FLOOR
- 2X4 LIGHT FIXTURE
- 2X2 LIGHT FIXTURE
- EXIT LIGHT
- RECESSED CAN LIGHT
- SURFACE MOUNTED DOWNLIGHT
- SA GRILLE
- RA GRILLE
- EXHAUST FAN GRILLE

### CEILING FINISHES

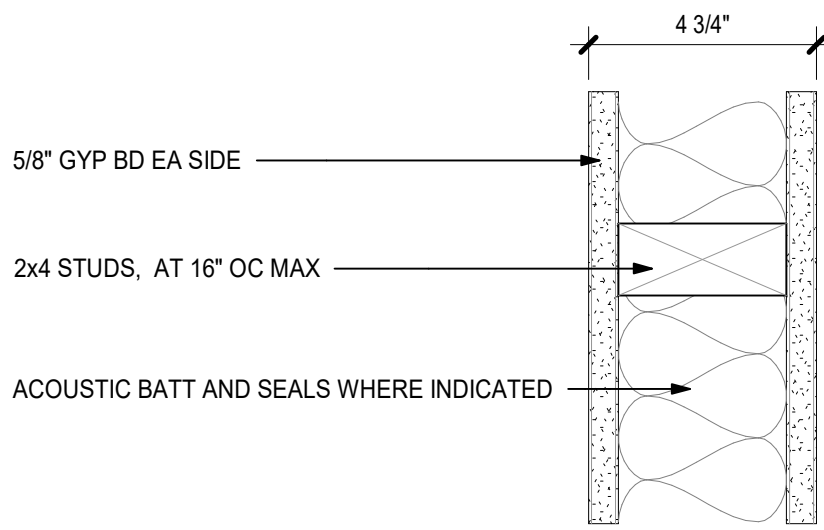
- SUSPENDED 24x48 ACOUSTIC CEILING TILE (ACT)
- SUSPENDED 24x24 ACOUSTIC CEILING TILE (ACT)
- EXISTING CEILING TO STAY
- GYPSUM BOARD ON 2X, PAINTED



## 2 REFLECTED CEILING PLAN

A202 (3/16" = 1'-0")





## W01 TYPICAL INTERIOR PARTITION

A301 ( 3" = 1'-0" )

LEVEL 2  
14'-0"

LEVEL 1  
0"

NOTE: SEE TABLES IN SECTION 2306.7.1 IN 2022 OSSC, "CEILING JOIST SPANS  
FOR COMMON LUMBER SPECIES" FOR CEILING JOISTS AND SPACING.

## 1 CROSS SECTION AT LARGE THERAPY ROOM

A301 ( 1/4" = 1'-0" )

### ROOM FINISH SCHEDULE

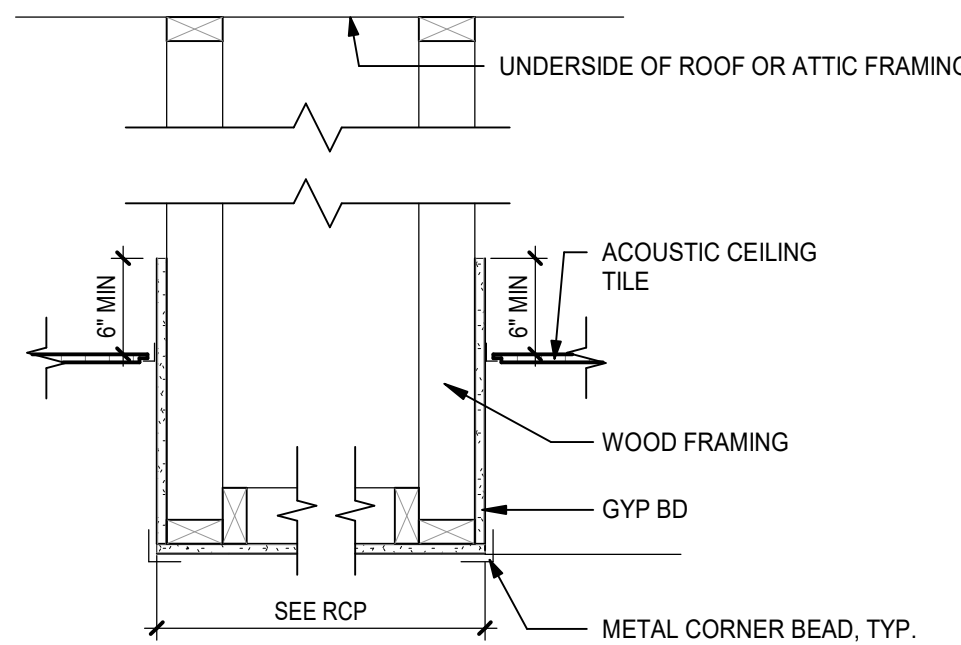
ROOM #	ROOM NAME	FLOOR	BASE	WALLS				CEILING	CASEWORK	OTHER
				NORTH	EAST	SOUTH	WEST			
101	VESTIBULE	WOM	RB-1	GYP-1, PT	GYP-1, PT	EXST	GYP-1, PT	ACT		
103	OFFICE	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	GYP-1, PT	ACT		
104	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	GYP-1, PT	ACT		
105	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	GYP-1, PT	ACT		
107	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	GYP-1, PT	ACT		
108	REST ROOM	VSF	RB-2	GYP-2, PT	GYP-2, PT	FRP-2, EXST	FRP-2, PT	ACT		
109	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	EXST	EXST	GYP-1, PT	ACT		
110	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	EXST	GYP-1, PT	GYP-1, PT	ACT		
111	LARGE THERAPY	VSF	RB-1	EXST	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
112	PRIVATE THERAPY	VSF	RB-1	EXST	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
113	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
114	OFFICE	VSF	RB-1	GYP-1, PT	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
115	OFFICE	VSF	RB-1	EXST	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
116	BREAK ROOM	VSF	RB-2	EXST	GYP-1, PT	GYP-1, PT	GYP-2, PT	ACT	PL-3	
117	COPIES	VSF	RB-1	EXST	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT	PL-3	
118	TRAINING	VSF	RB-1	EXST	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
119	RESTROOM	VSF	RB-2	FRP-2, GYP-2, PT	FRP-2, GYP-2, PT	GYP-2, PT	GYP-2, PT	GYP-3		
120	RESTROOM	VSF	RB-2	EXST	FRP-2, GYP-2, PT	FRP-2, GYP-2, PT	GYP-2, PT	GYP-3		
121	LAUNDRY	VSF	RB-2	EXST	GYP-2, PT	GYP-2, PT	EXST	ACT	PL-3	
122	HALL	VSF	RB-1	GYP-1, PT	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
123	JANITOR	EXST	RB-2	FRP-1, GYP-2, PT	FRP-1, GYP-2, PT	FRP-1, GYP-2, PT	EXST, FRP-1	OTS		
124	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	EXST	ACT		
125	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	GYP-1, PT	ACT		
126	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	GYP-1, PT	ACT		
128	HALL	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	GYP-1, PT	ACT		
129	ELECT.	EXST	RB-1	EXST	GYP-1, PT	OTS	GYP-1, PT	ACT		
130	IT	VSF	GYP-1, PT	EXST	EXST	GYP-1, PT	GYP-1, PT	ACT		
131	PRIVATE THERAPY	VSF	RB-1	GYP-1, PT	GYP-1, PT	EXST	EXST	ACT		
132	HALL	VSF	RB-1	GYP-1, PT	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
133	COATS	VSF	RB-1	GYP-1, PT	GYP-1, PT	GYP-1, PT	GYP-1, PT	ACT		
134	COATS	VSF	RB-1	GYP-1, PT	GYP-1, PT	GYP-1, PT	GYP-1, PT	GYP-3		

### LEGEND

#### FINISH ABBREVIATIONS

ACT	ACOUSTIC CEILING TILE
EXST	EXISTING TO REMAIN
FRP-1, FRP-2	FIBERGLASS REINFORCED PLASTIC
GYP-1	GYPSUM BOARD
GYP-2	MOISTURE RESISTANT GYPSUM BOARD
GYP-3	CEILING GYPSUM BOARD
OTS	OPEN TO STRUCTURE
PL-1	PLASTIC LAMINATE COUNTERTOP FINISH
PL-2	PLASTIC LAMINATE SHELVING FINISH
PL-3	PLASTIC LAMINATE CASEWORK FINISH
PT-1, PT-2, PT-3	PAINT
RB-1	RUBBER BASE
RB-2	MOISTURE RESISTANT RUBBER BASE
VSF	VINYL SHEET FLOORING
WOM	WALK OFF MAT

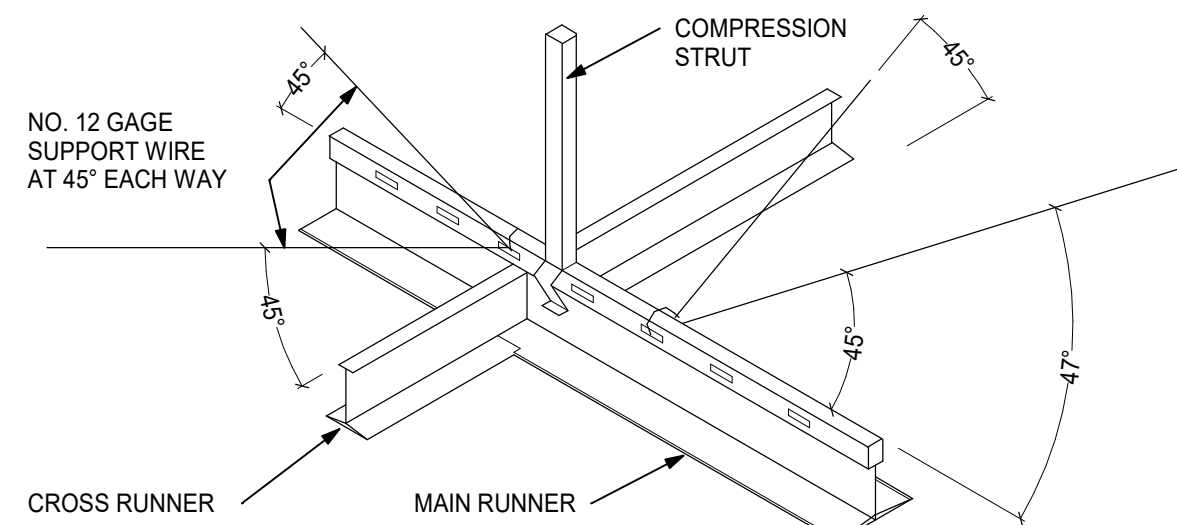
NOTE: SEE SPECIFICATIONS AND FINISH SUMMARY MATRIX FOR MORE INFORMATION



## 2 SOFFIT SECTION

A301 ( 1" = 1'-0" )

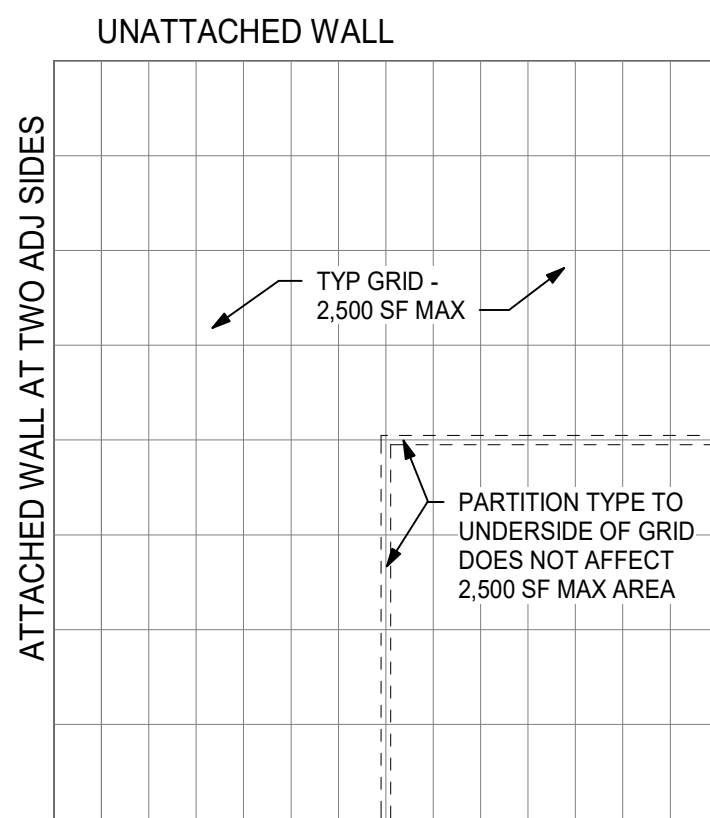
ACT : ACT (WITH SOFFIT)



MAXIMUM RECOMMENDED LENGTHS FOR VERTICAL STRUTS	
EMT CONDUIT	
1/2" EMT CONDUIT	UP TO 5'-10"
3/4" EMT CONDUIT	UP TO 7'-8"
1" EMT CONDUIT	UP TO 9'-9"
METAL STUD	
SINGLE 1 5/8" METAL STUD (20 GAUGE)	UP TO 12'
BACK TO BACK 1 5/8" METAL STUD (20 GAUGE)	UP TO 15'
SINGLE 2 1/2" METAL STUD (20 GAUGE)	UP TO 13'-6"
BACK TO BACK 2 1/2" METAL STUD (25 GAUGE)	UP TO 15'

## 3 ACT LATERAL FORCE BRACING

A301 ( 12" = 1'-0" )

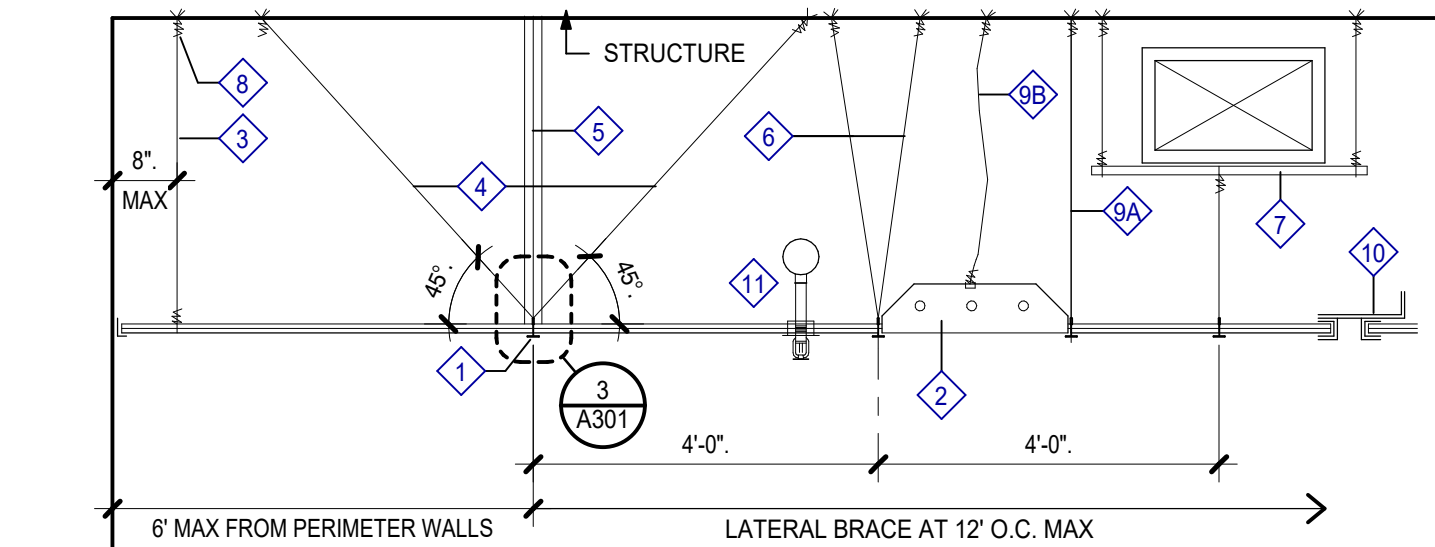


ATTACHED WALL AT TWO ADJ SIDES

SUSPENDED CEILINGS WITH AREAS LESS THAN OR EQUAL TO 144 SF THAT ARE SURROUNDED BY WALLS OR SOFFITS THAT ARE Laterally BRACED TO THE STRUCTURE MAY BE ATTACHED TO THE CLOSURE STRIP AT ALL FOUR SIDES.

## 4 ACT TYP SUSP CLG SYSTEM PLAN

A301 ( 1" = 1'-0" )



#### GRID SYSTEM REQUIREMENTS:

- AS INDICATED IN SPECIFICATION.

#### INSTALLATION:

- MAIN RUNNERS: 4 FEET O.C., SUPPORTED WITH NO. 12 GA. WIRES AT 4 FEET O.C. (OR NO. 10 GA. WIRES AT 5 FEET O.C.). HANGER ATTACHMENT TO BE DESIGNED TO SUPPORT NOT LESS THAN 200 POUNDS.
- CROSS RUNNERS: RUNNERS SUPPORTED BY MAIN RUNNERS AND CAPABLE OF CARRYING DESING LOAD WITH DEFLECTION EQUAL TO 1/360 OF ITS SPAN OR LESS.
- HANGER WIRE SYSTEM TO BEGIN WITHIN 8 INCHES OF PERIMETER WALL.
- WHERE CEILINGS EXCEED 1000 SF, GRID LATERAL FORCE BRACING IS REQUIRED. GRID LATERAL FORCE BRACING AT 12'-0" O.C. EACH WAY. BEGIN WITHIN 6 FEET OF PERIMETER AND WITHIN 2 INCHES OF CROSS RUNNER INTERSECTION. PROVIDE FOUR (4) - NO. 12 GA. WIRES SECURED TO MAIN RUNNER AND PLAYED 80 DEGREES FROM EACH OTHER AT AN ANGLE NOT EXCEEDING 45 DEGREES FROM CEILING PLANE.
- COMPRESSION STRUT AT EACH LATERAL GRID BRACING LOCATION. STRUT TO BE ADEQUATE TO RESIST VERTICAL FORCE COMPONENT INDUCED BY BRACING WIRES. SPACED 12 FEET ON CENTER IN BOTH DIRECTIONS. STRUT TO BE COMPATIBLE WITH SUSPENSION SYSTEM.
- SYSTEM HANGERS MORE THAN 1:6 OUT OF PLUMB, PROVIDE COUNTER SLOPE HANGERS.
- WHERE HANGER WIRES ARE NOT POSSIBLE DUE TO OBSTRUCTIONS, PROVIDE TRAPEZE OR EQUIVALENT DEVICE. TRAPEZE SUSPENSION FOR SPANS EXCEEDING 48 INCHES TO BE MINIMUM OF BACK-TO-BACK 1-1/4 INCH COLD ROLLED CHANNELS.
- HANGER WIRE ATTACHMENT TO CONCRETE, STEEL OR CONCRETE OVER METAL DECK MAY BE ATTACHED WITH THE FOLLOWING PAF HILTI XU1 EMBED 3/4" (ESR-2269) OR SIMPSON PDP EMBED 3/4" (ESR-2138) ANCHOR LOAD HANGER WIRE SHALL NOT EXCEED 80 LBS. PAFs MAY NOT BE USED FOR ANY COMPONENT OF LATERAL FORCE BRACING DETAIL. FOLLOW MANUFACTURER'S DIRECTION FOR EMBEDMENT INTO STEEL.
- LIGHT FIXTURE SUPPORT.
  - WITH SUSPENSION SYSTEM, NO. 12 GA. HANGERS TO BE ATTACHED TO GRID. MEMBERS WITHIN 3 INCHES OF EACH CORNER OF EACH FIXTURE - TANDEM FIXTURES MAY USE COMMON WIRES.
  - LIGHT FIXTURES WEIGHING LESS THAN 50 LBS. REQUIRE (2)-NO. 12 GA. SLACK WIRES FROM FIXTURE HOUSING TO STRUCTURE ABOVE.
  - LIGHT FIXTURES IN EXCESS OF 50 LBS. TO BE SUPPORTED DIRECTLY FROM STRUCTURE ABOVE. WIRES MUST BE TAUT.
  - LIGHT FIXTURES TO BE POSITIVELY ATTACHED TO GRID SYSTEM. ATTACHMENT DEVICE TO CARRY 100 PERCENT OF LIGHT FIXTURE WEIGHT ACTING IN ANY DIRECTION.
- PROVIDE SEISMIC JOINTS WHERE CEILING AREA EXCEEDS 2,500 SQ. FT. OR PROVIDE FULL HEIGHT PARTITION.
- WHERE SPRINKLER HEADS AND OTHER PENETRATIONS OCCUR, PROVIDE 2 INCH OVERSIZED ESCUTCHEON OR ADAPTER TO ALLOW AT LEAST 1 INCH MOVEMENT IN ALL HORIZONTAL DIRECTIONS, OR PROVIDE STANDARD ESCUTCHEON AND PENETRATIONS WITH FLEXIBLE HEAD CONNECTIONS.

## 5 ACT SUSPENDED CEILING NOTES

A301 ( 3/4" = 1'-0" )

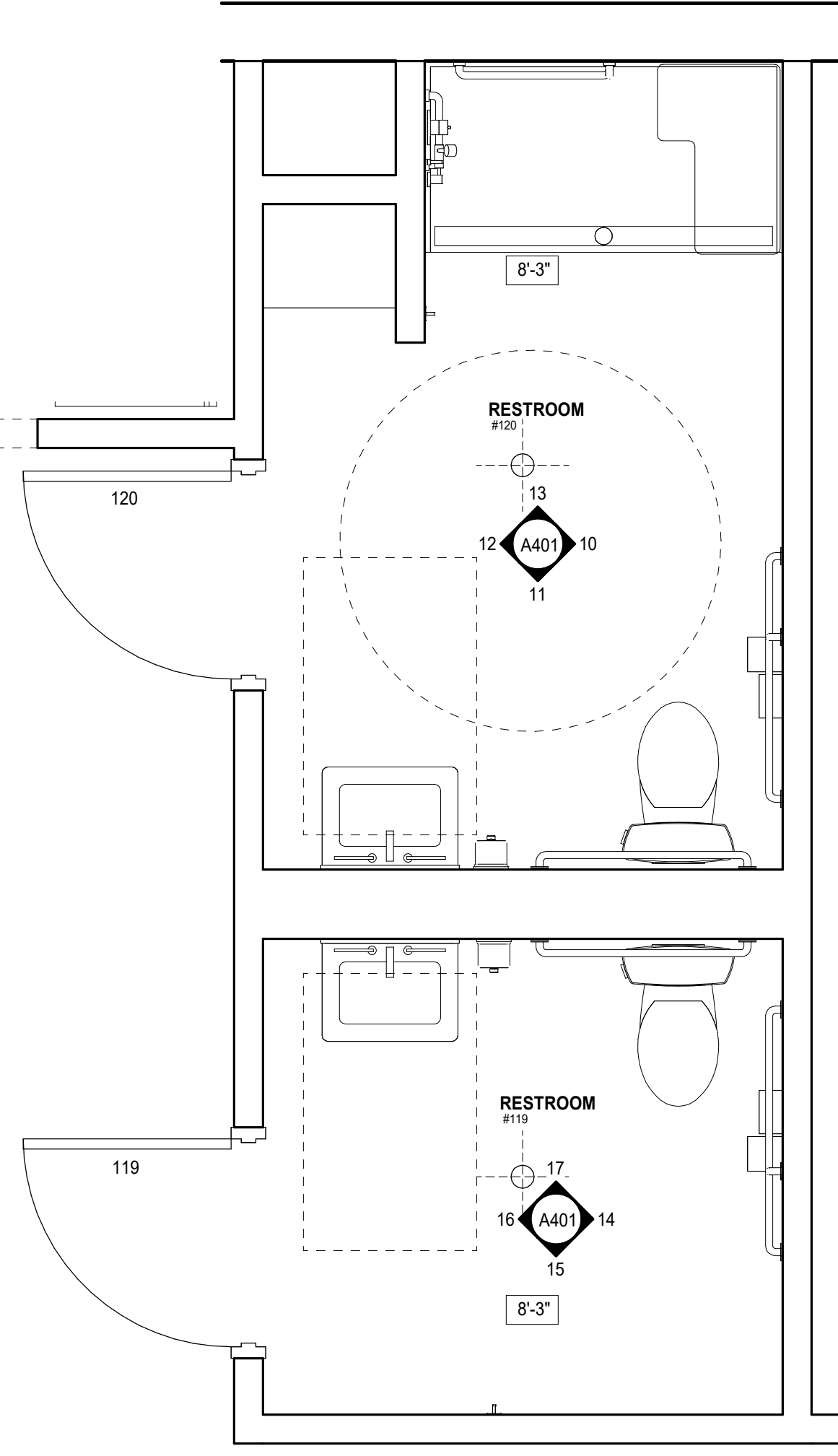


SHEET NOTES

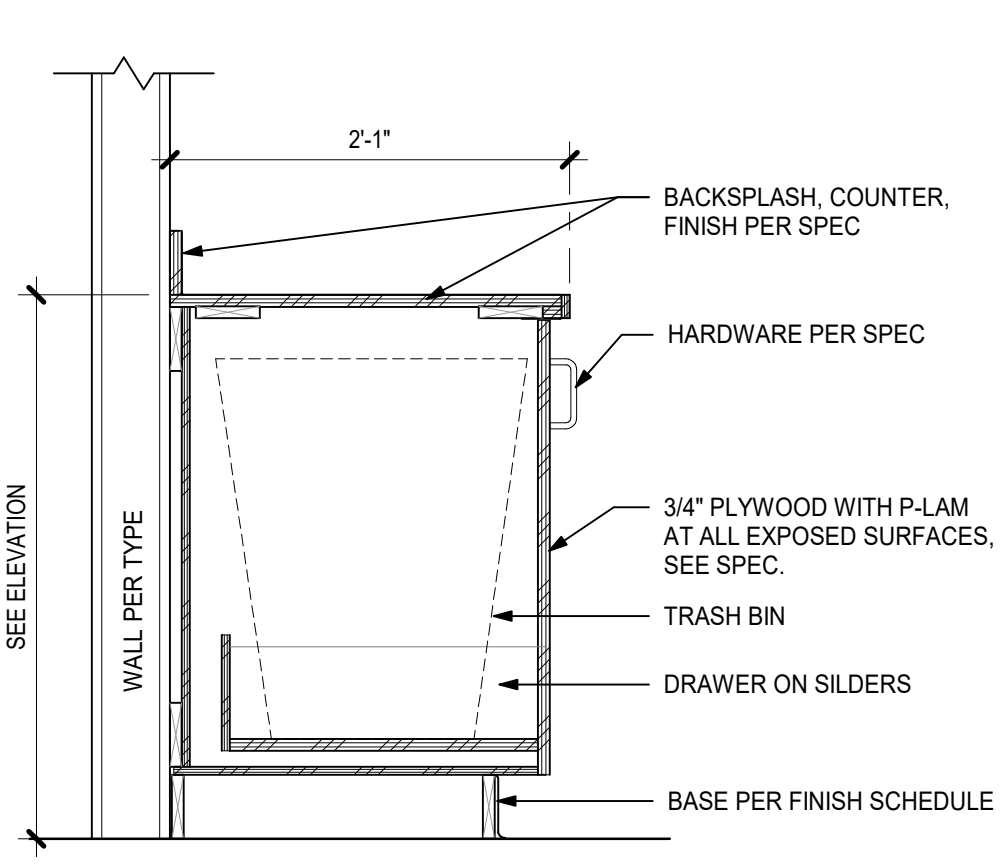
1. REFER TO TYPICAL MOUNTING HEIGHTS AND ADA DIMENSIONAL STANDARDS ON G0.XX
2. SEE FFE RESPONSIBILITY MATRIX ON E2.XX FOR WHO IS PROVIDING OR INSTALLING CERTAIN ITEMS.
3. PROVIDE IN-WALL BACKING FOR ALL WALL-MOUNTED ITEMS.
4. VERIFY ALL FIRE EXTINGUISHER LOCATIONS WITH FIRE CODE OFFICIAL PRIOR TO INSTALL.
5. SEE CASEWORK LEGEND ON A8.XX
6. SEE HM FRAME AND STOREFRONT TYPES IN A8.XX

ACCESSORY SCHEDULE

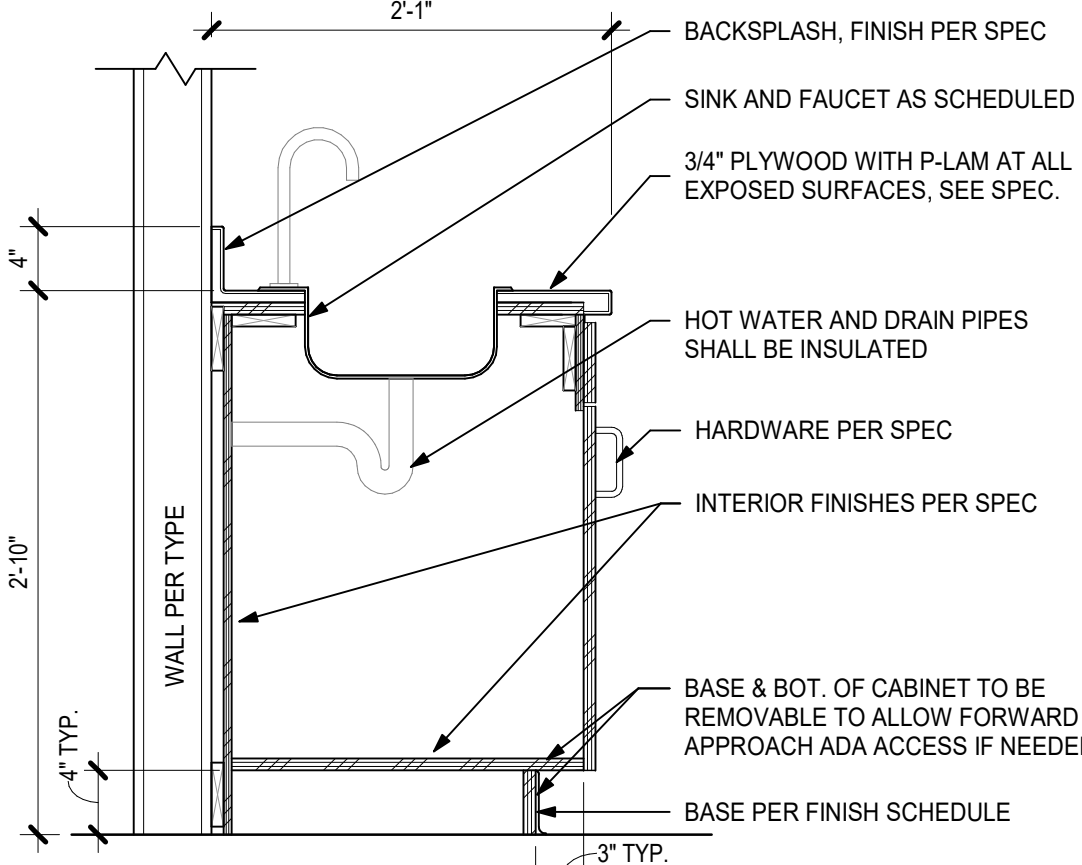
TYPE	NAME	COUNT
GB-1	GRAB BAR 42 INCH	3
GB-2	GRAB BAR 36 INCH	3
GB-4	GRAB BAR 18 INCH	3
MR	MIRROR - 2'0" X 3'4"	3
NP	SANITARY NAPKIN RECEPTACLE	3
PTD	PAPER TOWEL DISPENSER	3
SD	SOAP DISPENSER - WALL MOUNTED	3
SS	FOLDING SHOWER SEAT	5
TH	TOWEL GARMENT HOOK	6
TPD	TOILET PAPER DISPENSER	3



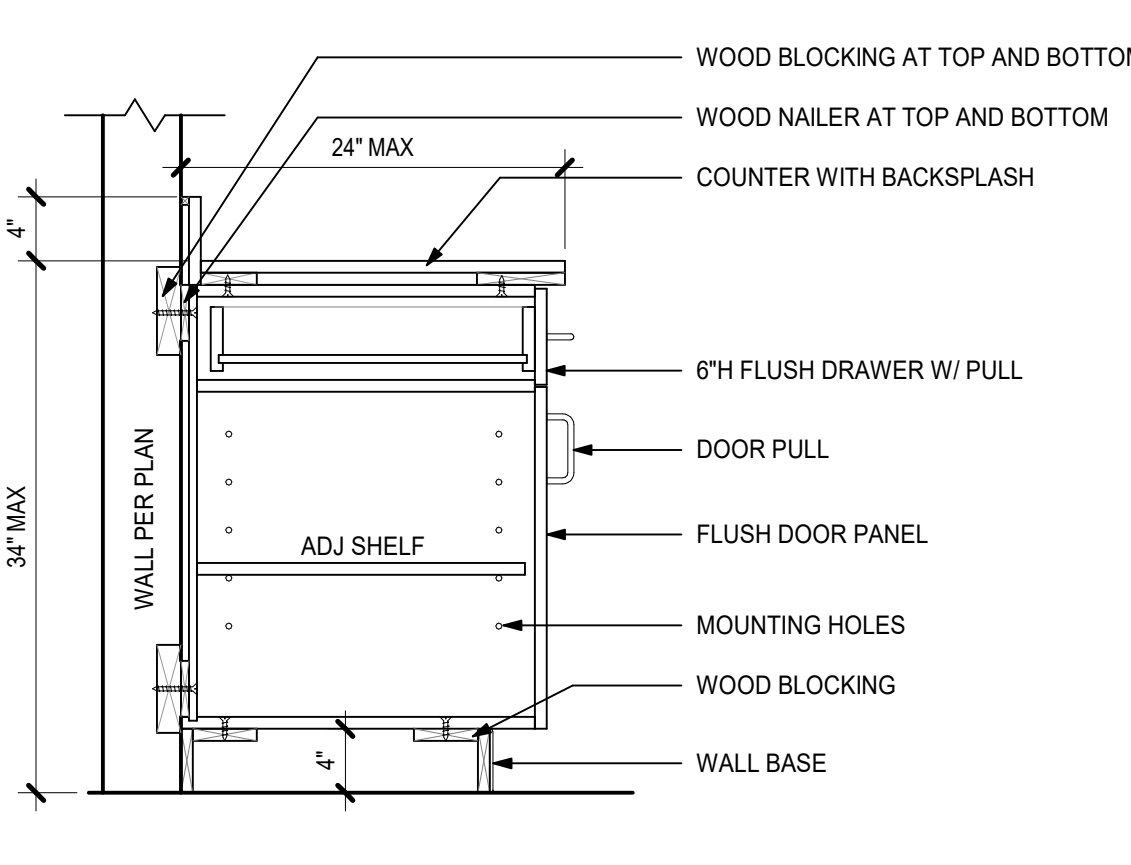
1 ENLARGED PLAN - RESTROOMS  
A401 ( 1/2" = 1'-0" )



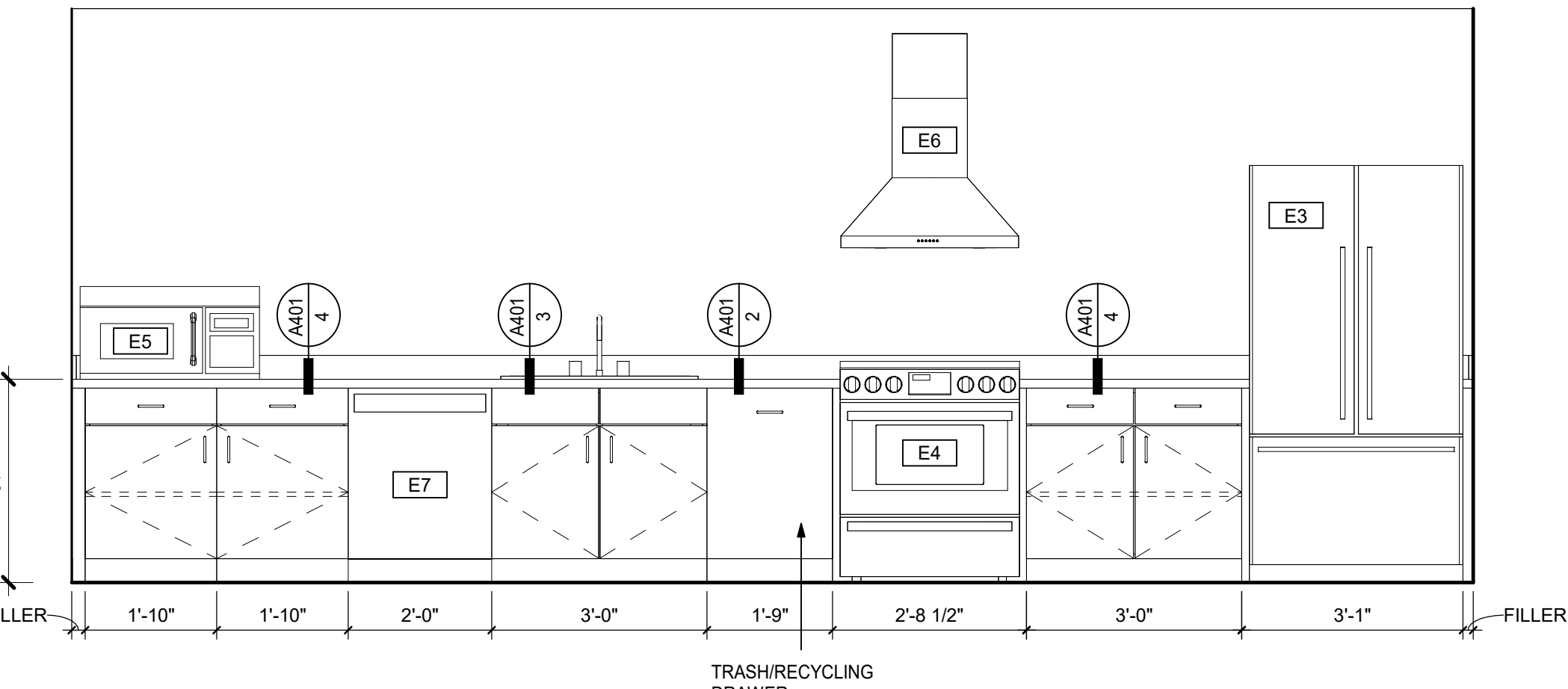
2 BASE CABINET - TRASH/RECYCLE DRAWER  
A401 ( 1" = 1'-0" )



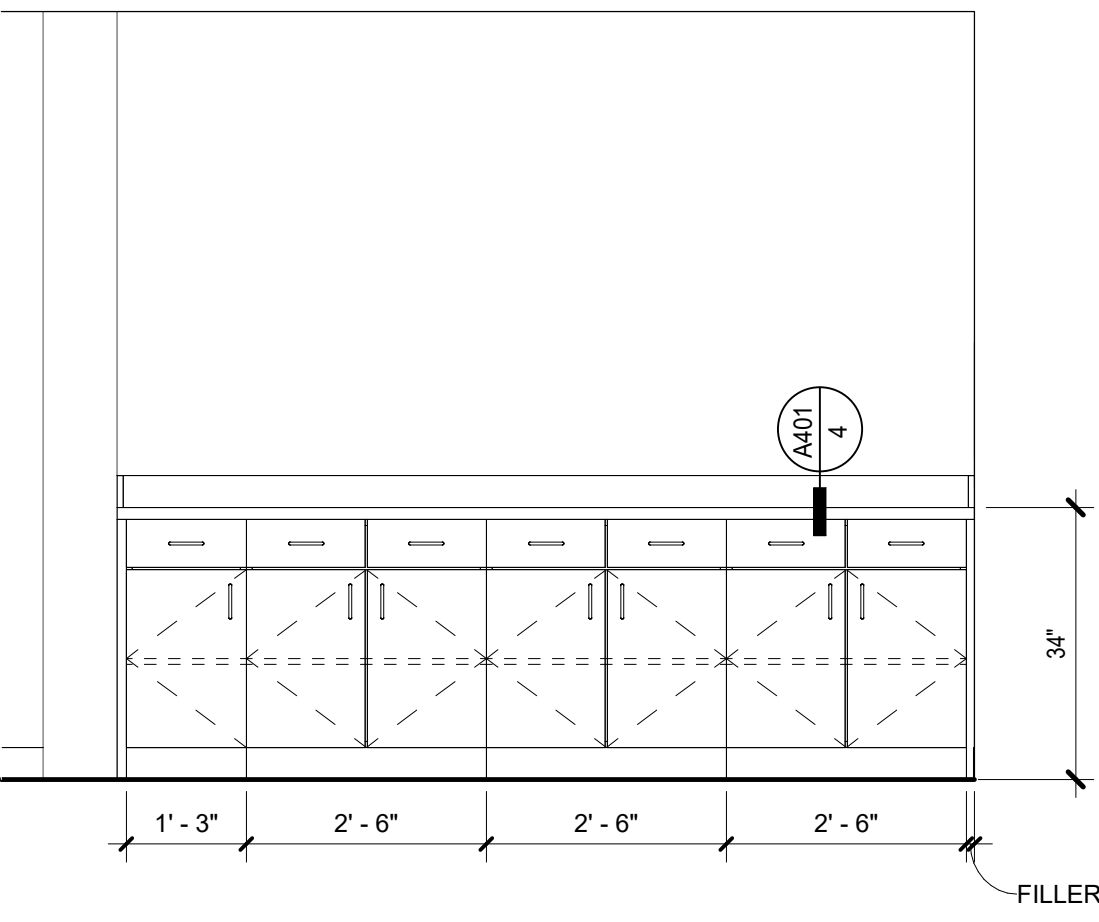
3 BASE CABINET ACCESSIBLE SINK  
A401 ( 1" = 1'-0" )



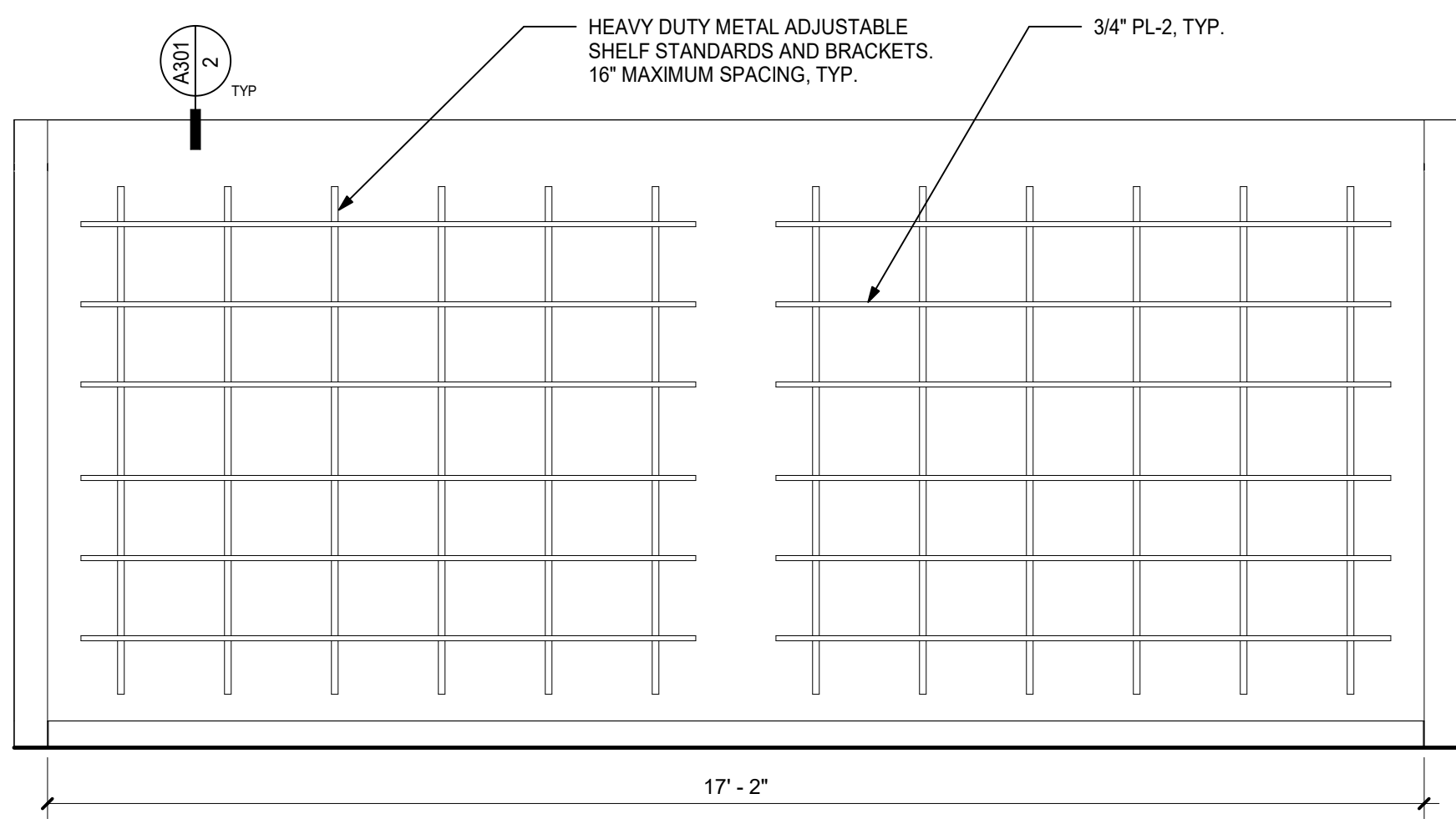
4 BASE CABINET WITH DRAWER - ADA  
A401 ( 1" = 1'-0" )



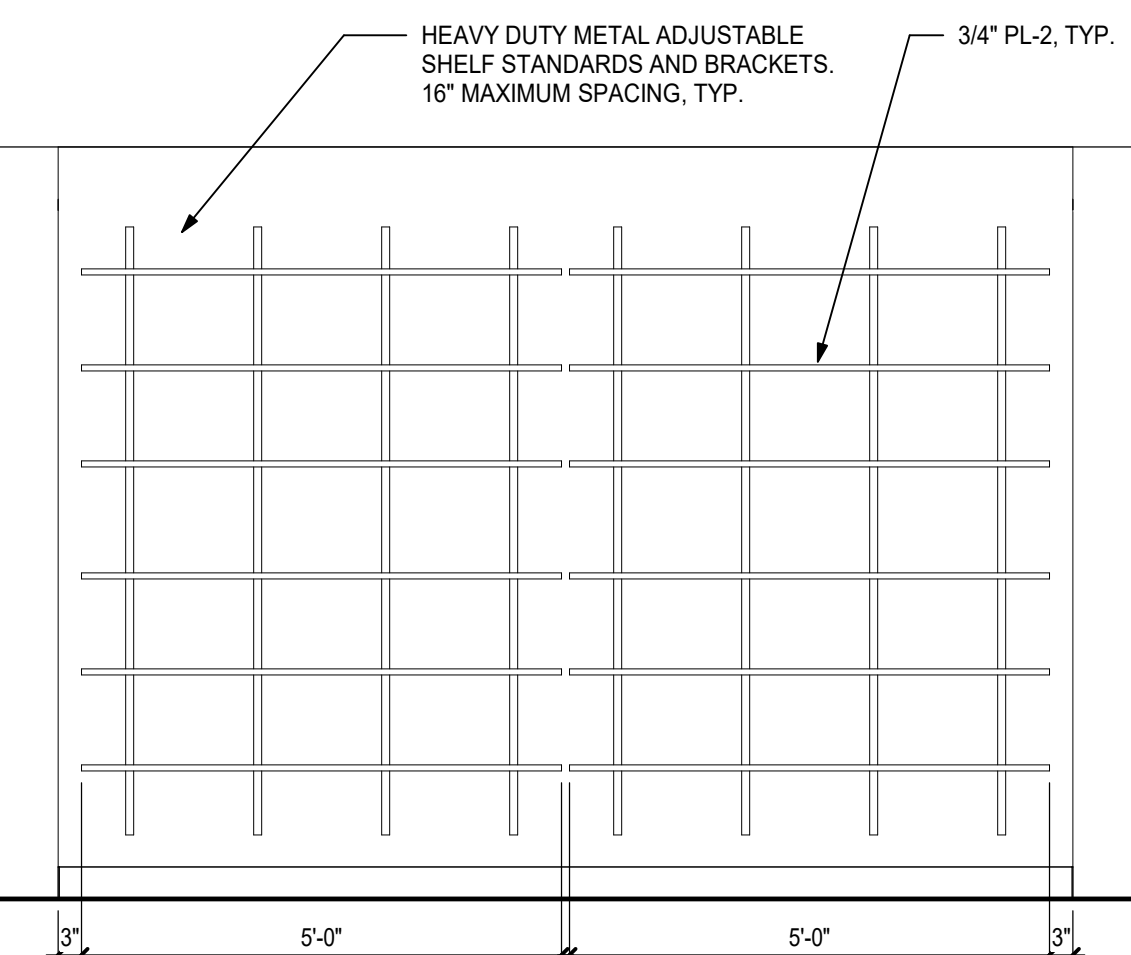
5 BREAK ROOM - CASEWORK  
A401 ( 1/2" = 1'-0" )



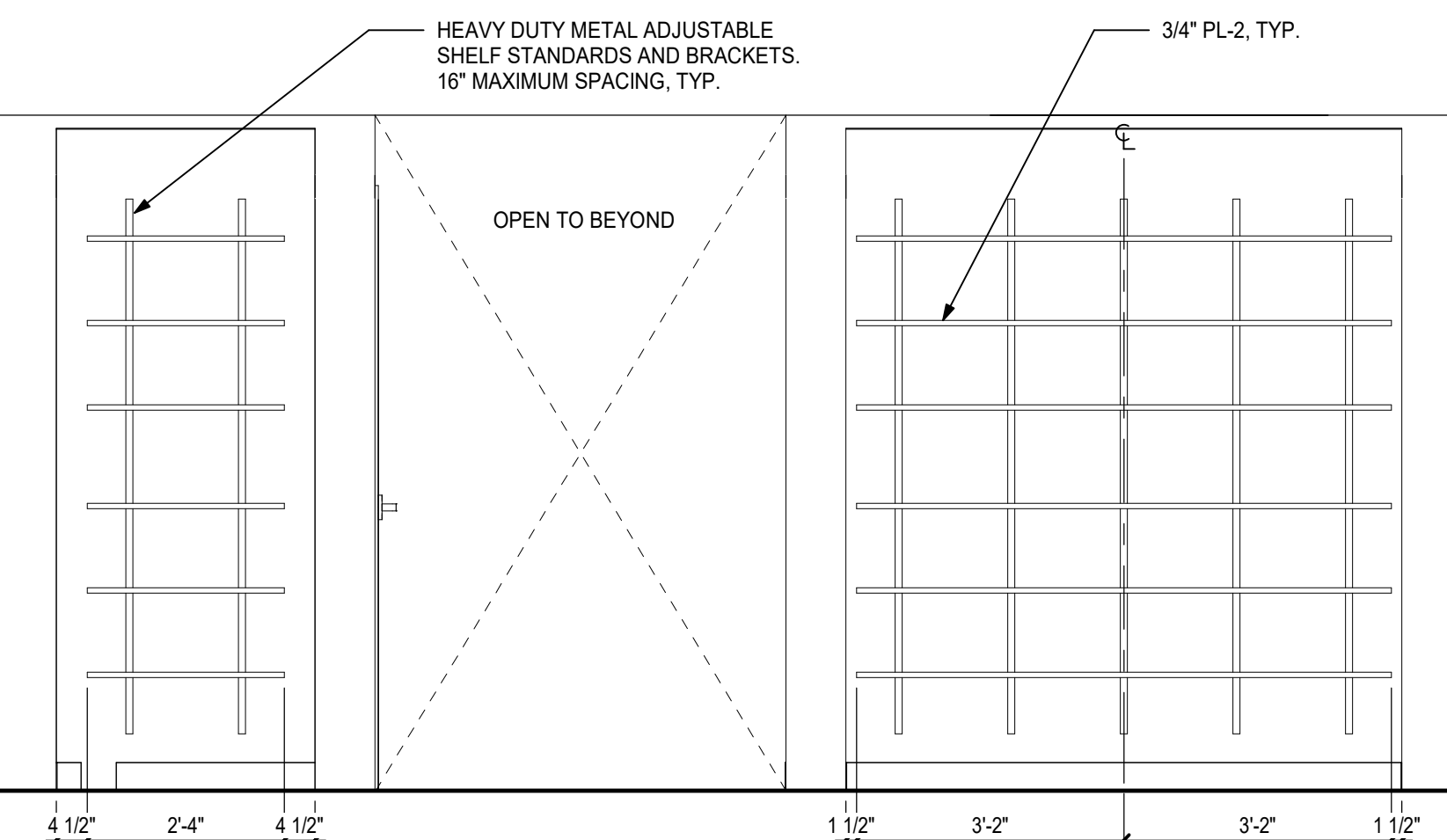
6 COPY ROOM - CASEWORK  
A401 ( 1/2" = 1'-0" )



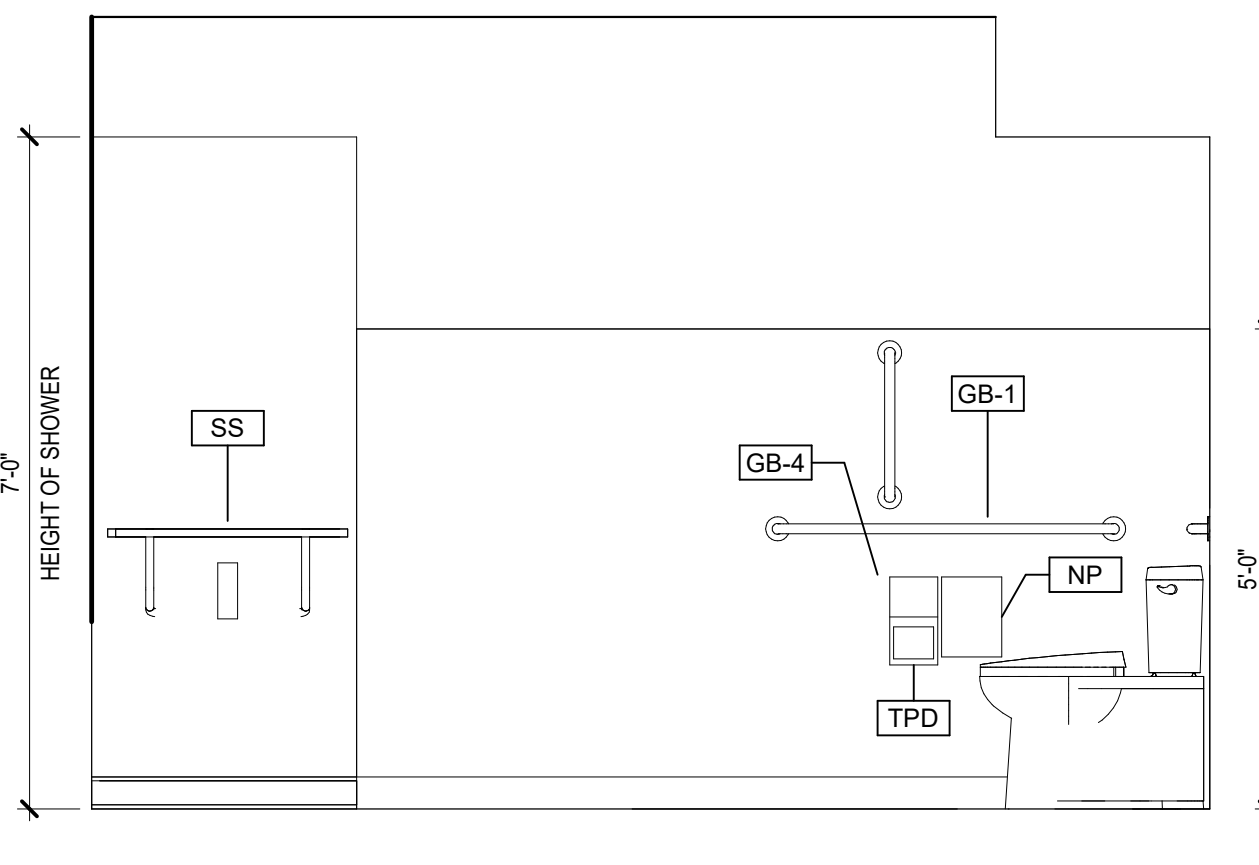
7 LARGE THERAPY ROOM - SHELVING  
A401 ( 1/2" = 1'-0" )



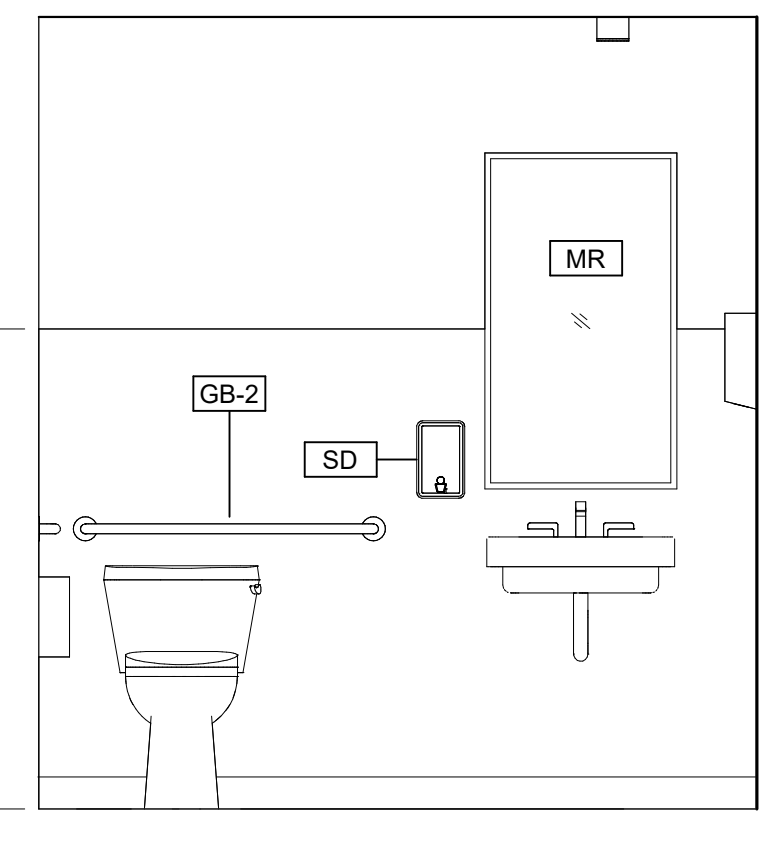
8 HALL NICHE - SHELVING  
A401 ( 1/2" = 1'-0" )



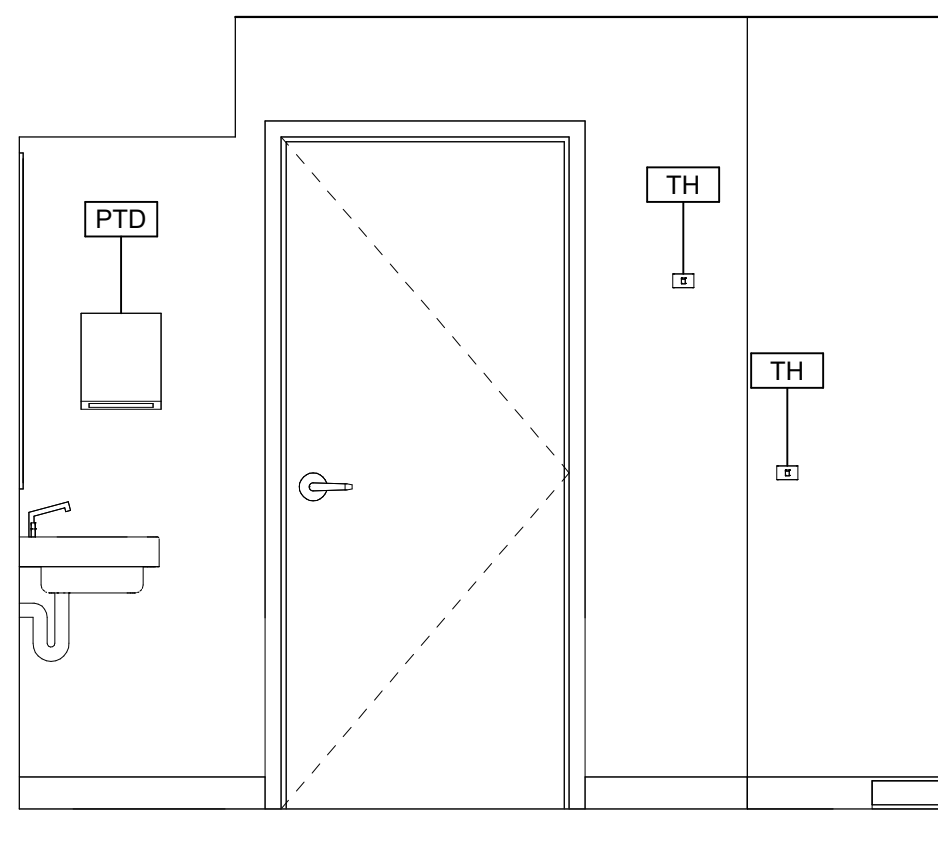
9 TWO HALL NICHES - SHELVING  
A401 ( 1/2" = 1'-0" )



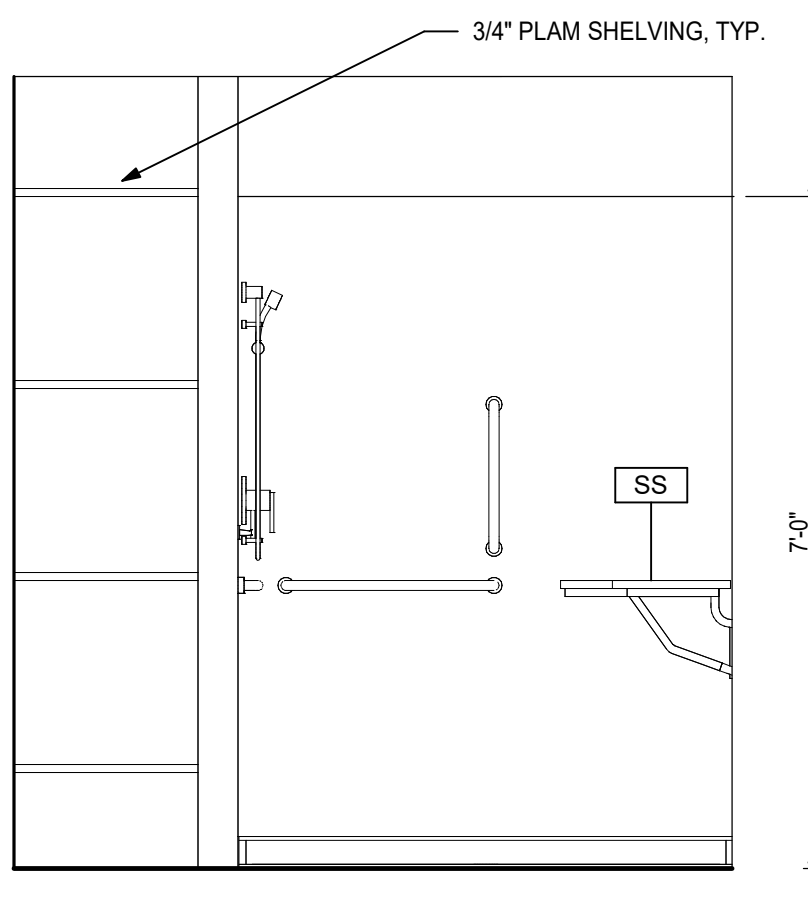
10 RESTROOM 120 - EAST  
A401 ( 1/2" = 1'-0" )



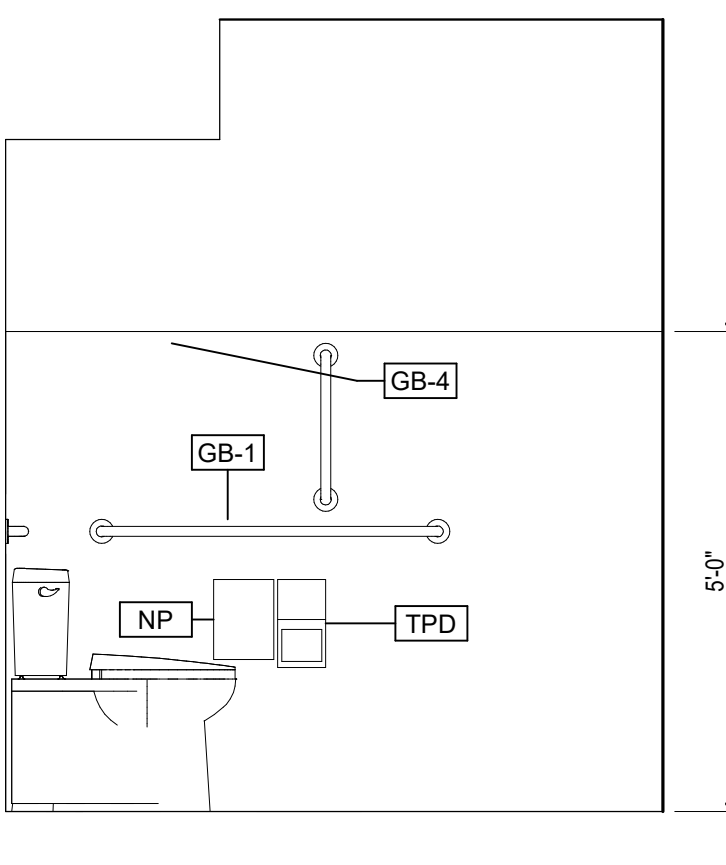
11 RESTROOM 120 - SOUTH  
A401 ( 1/2" = 1'-0" )



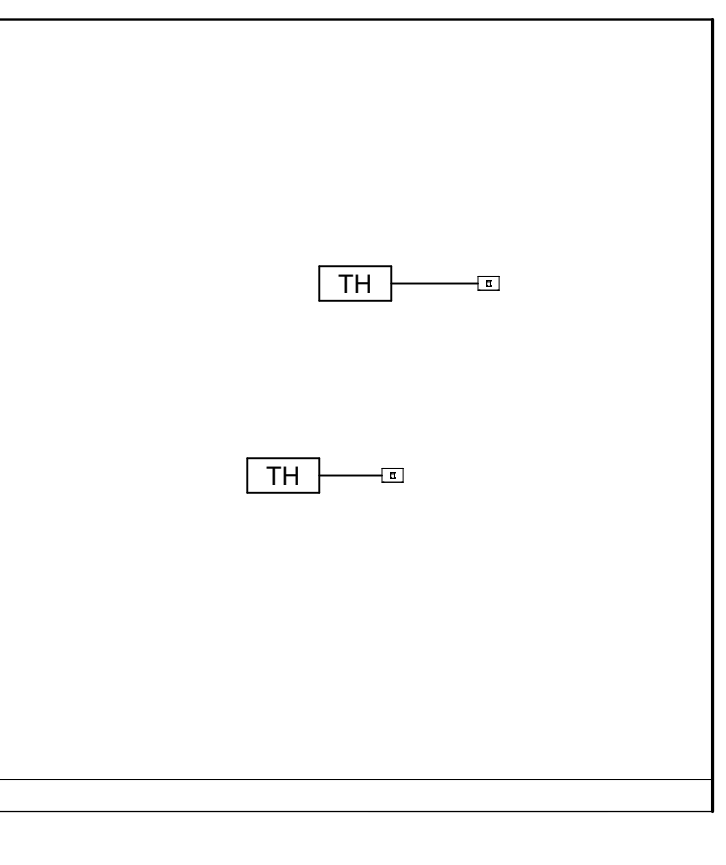
12 RESTROOM 120 - WEST  
A401 ( 1/2" = 1'-0" )



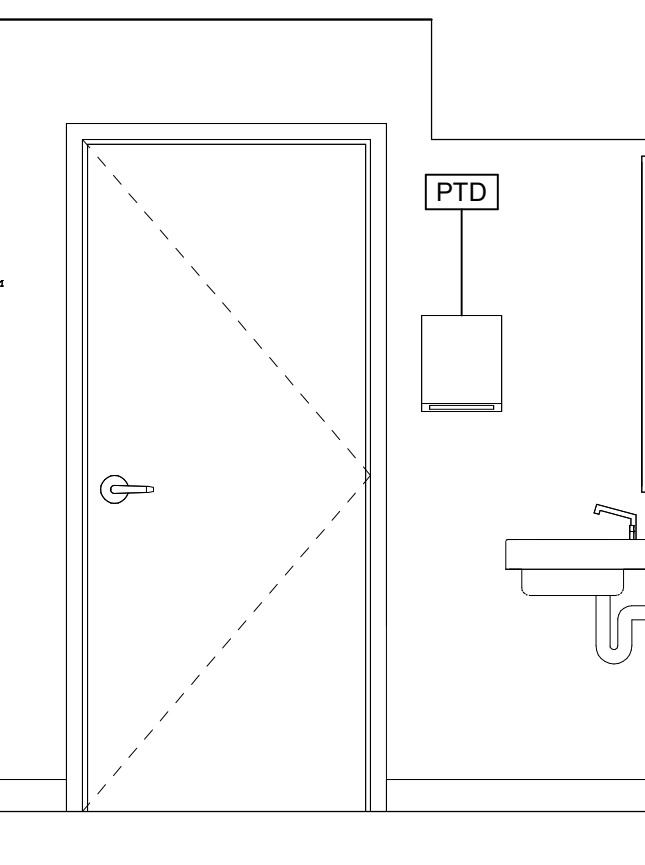
13 RESTROOM 120 - NORTH  
A401 ( 1/2" = 1'-0" )



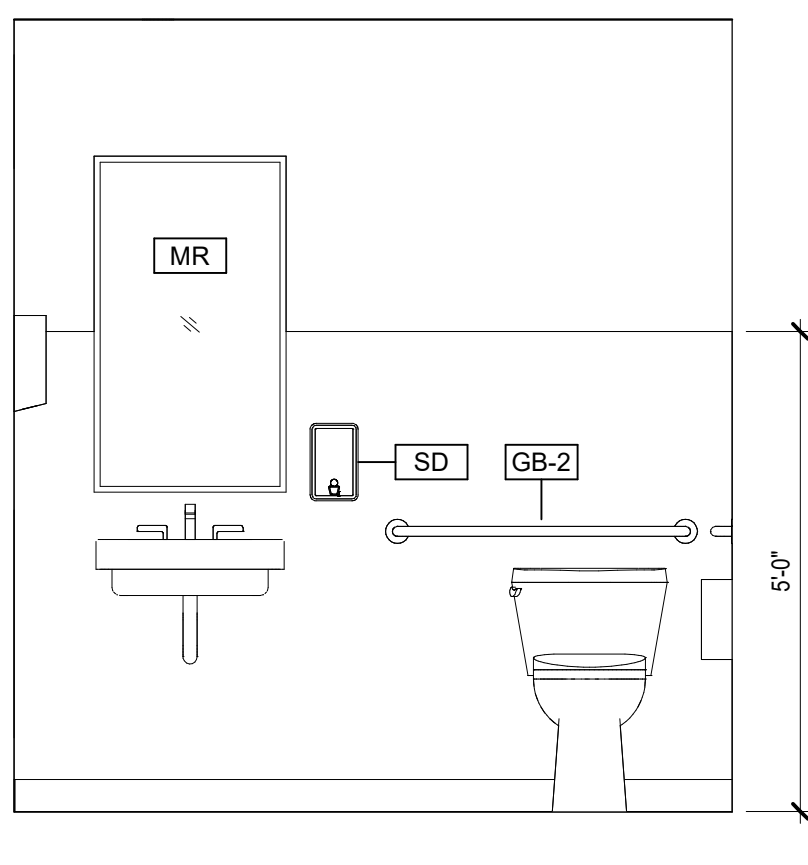
14 RESTROOM 119 - EAST  
A401 ( 1/2" = 1'-0" )



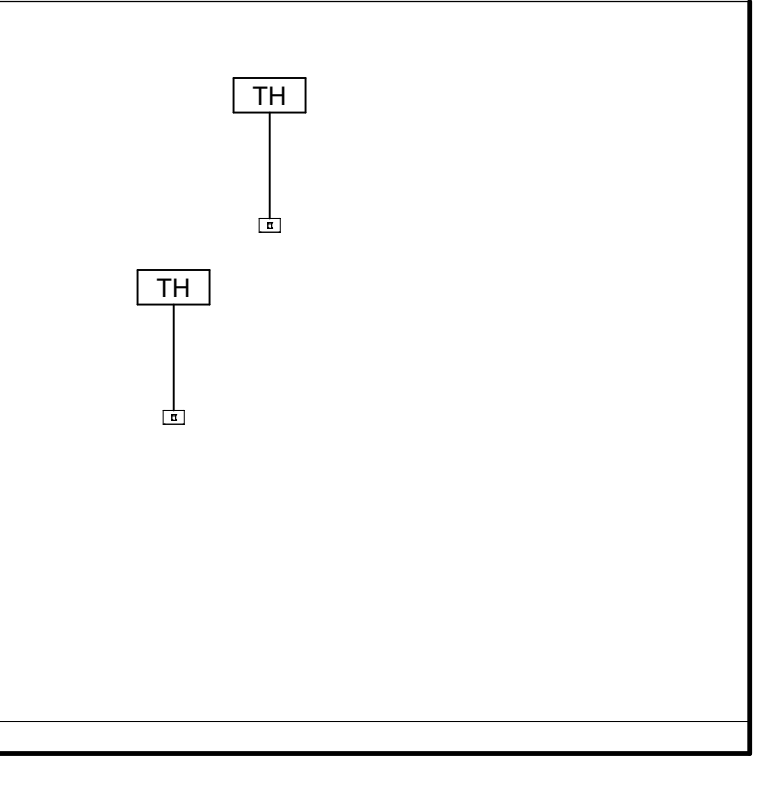
15 RESTROOM 119 - SOUTH  
A401 ( 1/2" = 1'-0" )



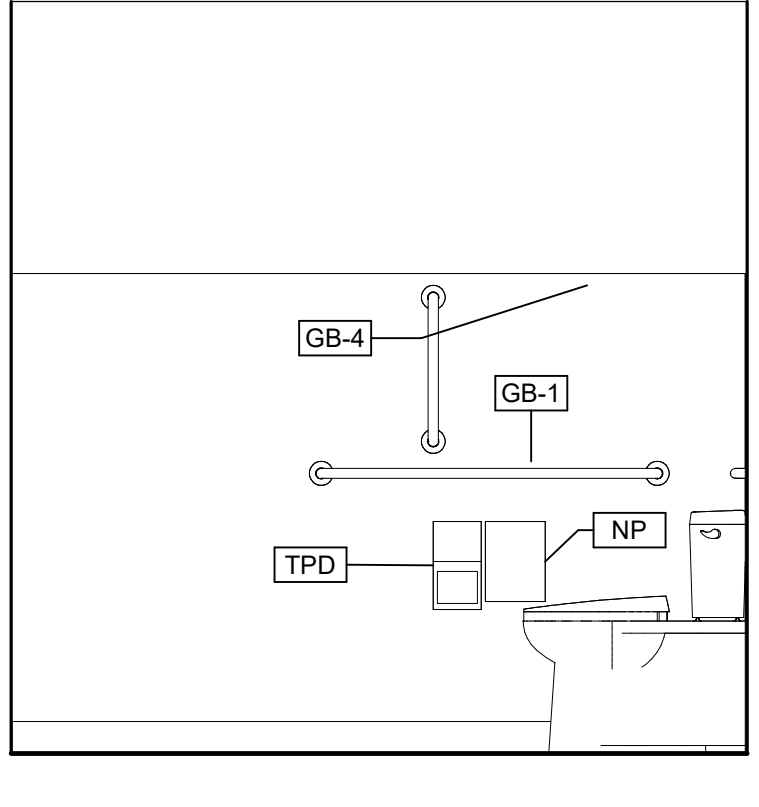
16 RESTROOM 119 - WEST  
A401 ( 1/2" = 1'-0" )



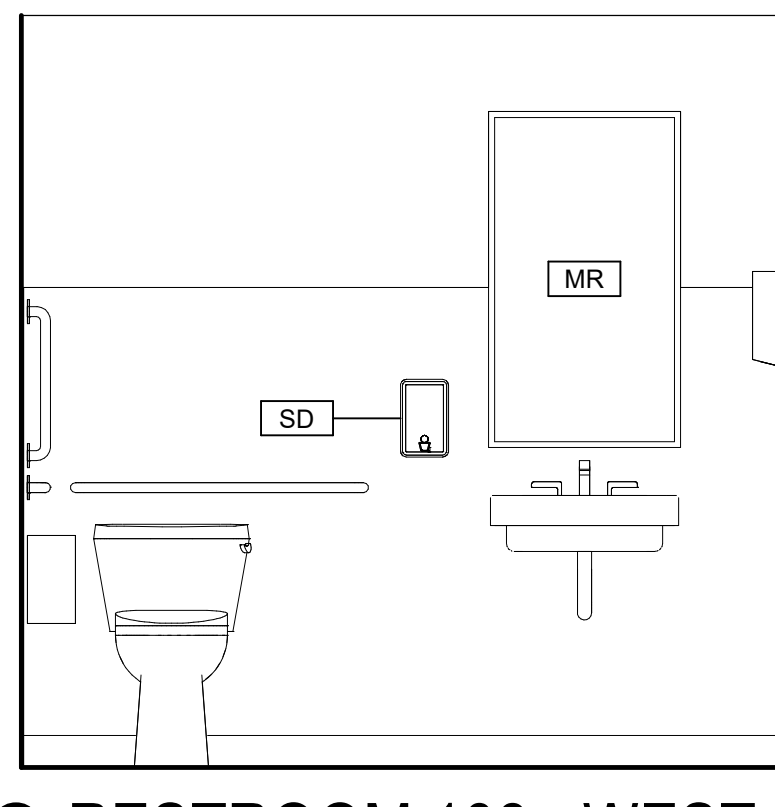
17 RESTROOM 119 - NORTH  
A401 ( 1/2" = 1'-0" )



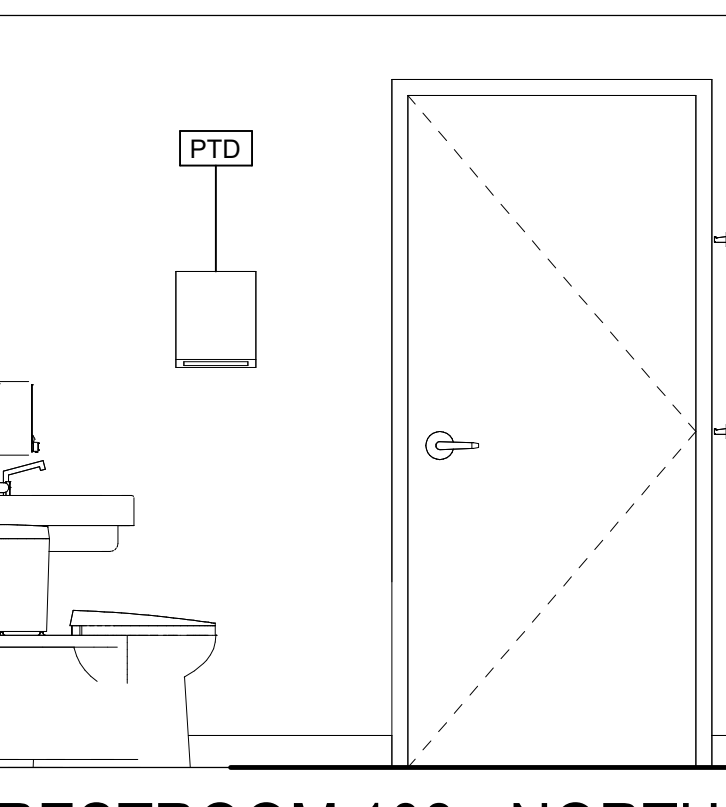
18 RESTROOM 108 - EAST  
A401 ( 1/2" = 1'-0" )



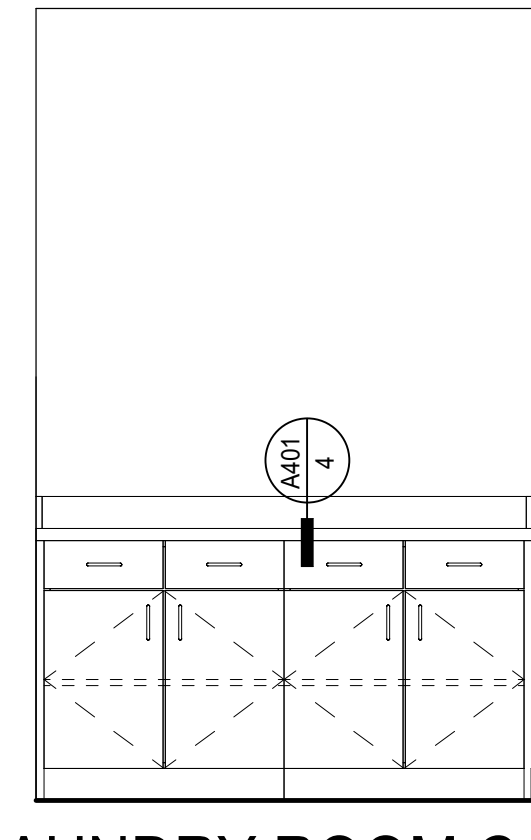
19 RESTROOM 108 - SOUTH  
A401 ( 1/2" = 1'-0" )



20 RESTROOM 108 - WEST  
A401 ( 1/2" = 1'-0" )



21 RESTROOM 108 - NORTH  
A401 ( 1/2" = 1'-0" )



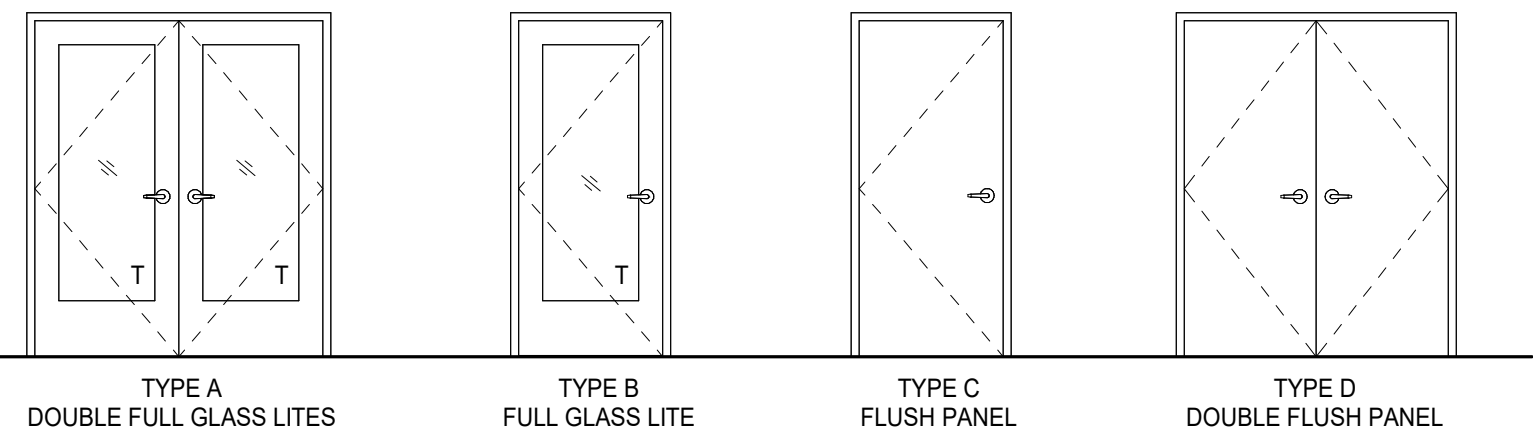
22 LAUNDRY ROOM CASEWORK  
A401 ( 1/2" = 1'-0" )

EQUIPMENT SCHEDULE

EQUIP. ID	NAME	QTY.	MANUFACTURER	MODEL	NOTES
E1	WASHING MACHINE	1	GE	ULTRAFRESH VENT SYSTEM	OFCI
E2	DRYER	1	GE	ULTRAFRESH VENT SYSTEM	OFCI
E3	REFRIGERATOR	1	FRIGIDAIRE	LFSS26121F	OFCI
E4	STOVE	1	FRIGIDAIRE	FCFE3062AB	*OFCI
E5	MICROWAVE	1			OFCI
E6	RANGE HOOD	1	WINFLO	LRW03C30	*OFCI
E7	DISHWASHER	1	WHIRLPOOL	WDF520PADM	OFCI



DOOR TYPES



DOOR AND FRAME SCHEDULE													
MARK	OPENING SIZE		DOORS				FRAMES			HARDWARE SET	FIRE RATING LABEL (MIN.)	NOTES	
	WIDTH	HGT.	TYPE	MAT	FIN		MAT	FIN					
101	6'-0"	7'-0"	A	AL	CLEAR ANODIZED	EXISTING	AL	EXISTING	CLEAR ANODIZED	1	N/A		
102A	6'-0"	7'-0"	A	AL	CLEAR ANODIZED	EXISTING	AL	EXISTING	CLEAR ANODIZED	1	N/A		
102B	6'-0"	7'-0"	A	AL	CLEAR ANODIZED	EXISTING	EXISTING	EXISTING	1	N/A			
103	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	2	N/A				
104	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
105	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
107	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
108	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	4	N/A				
109	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
110	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
111	6'-0"	7'-0"	A	AL	CLEAR ANODIZED	EXISTING	EXISTING	1	N/A				
112	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
113	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
114	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	2	N/A				
115	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	2	N/A				
116	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	2	N/A				
118	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	2	N/A				
119	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	4	N/A				
120	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	4	N/A				
122	3'-0"	7'-0"	B	HM	PAINTED	HM	PAINTED	1	N/A				
123	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	6	N/A				
124	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
125	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
126	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
127	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	5	N/A				
128A	3'-0"	7'-0"	B	AL	CLEAR ANODIZED	EXISTING	EXISTING	1	N/A				
128B	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	6	N/A				
129	3'-0"	7'-0"	D	WD	STAINED	HM	PAINTED	6	N/A				
130	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	5	N/A				
131	3'-0"	7'-0"	C	WD	STAINED	HM	PAINTED	3	N/A				
132	3'-0"	7'-0"	B	HM	PAINTED	HM	PAINTED	1	N/A				

HARDWARE GROUPS

- HARDWARE NOTES
- FINAL LOCK SETS TO BE COORDINATED WITH OREGON TECH PREFERRED DOOR HARDWARE PROVIDER
  - CONTRACTOR TO CONFIRM ACCESS AND LOCK SETS PRIOR TO ORDERING
  - OREGON TECH WILL PROVIDE CORES FOR ANY DOOR THAT IS LOCKABLE. ALL DOORS WITH LOCKS TO COORDINATE KEYING WITH OREGON TECH.
  - ALL EXTERIOR DOORS NEED HARDWARE SEALS AND THRESHOLDS AS REQUIRED.

OUTSIDE KEYED ACCESS WHEN LOCKED. INSIDE TURN/PUSH BUTTON.

SET - 1  
EXTERIOR

QTY	DESCRIPTION
3 EACH	HINGE
1 EACH	CLOSER
1 EACH	LOCK SET
1 EACH	WALL STOP
1 EACH	WEATHER STRIPPING
1 EACH	THRESHOLD

OUTSIDE KEYED ACCESS WHEN LOCKED. INSIDE TURN/PUSH BUTTON.

SET - 2  
OFFICE

QTY	DESCRIPTION
3 EACH	HINGE
1 EACH	LOCK SET
1 EACH	WALL STOP
1 EACH	SILENCER

BOTH LEVERS ALWAYS UNLOCKED.

SET - 3  
THERAPY

QTY	DESCRIPTION
3 EACH	HINGE
1 EACH	LOCK SET
1 EACH	WALL STOP
1 EACH	SILENCER
1 EACH	SOUND GASKETS

INSIDE THUMB TURN LATCH WITH OCCUPANCY INDICATOR.

SET - 4  
RESTROOM

QTY	DESCRIPTION
3 EACH	HINGE
1 EACH	CLOSER
1 EACH	LOCK SET
1 EACH	WALL STOP
1 EACH	OCCUPANCY INDICATOR
1 EACH	SILENCER

BOTH LEVERS ALWAYS UNLOCKED.

SET - 5  
CORRIDOR

QTY	DESCRIPTION
3 EACH	HINGE
1 EACH	PASSAGE LOCK SET
1 EACH	WALL STOP
1 EACH	CLOSER

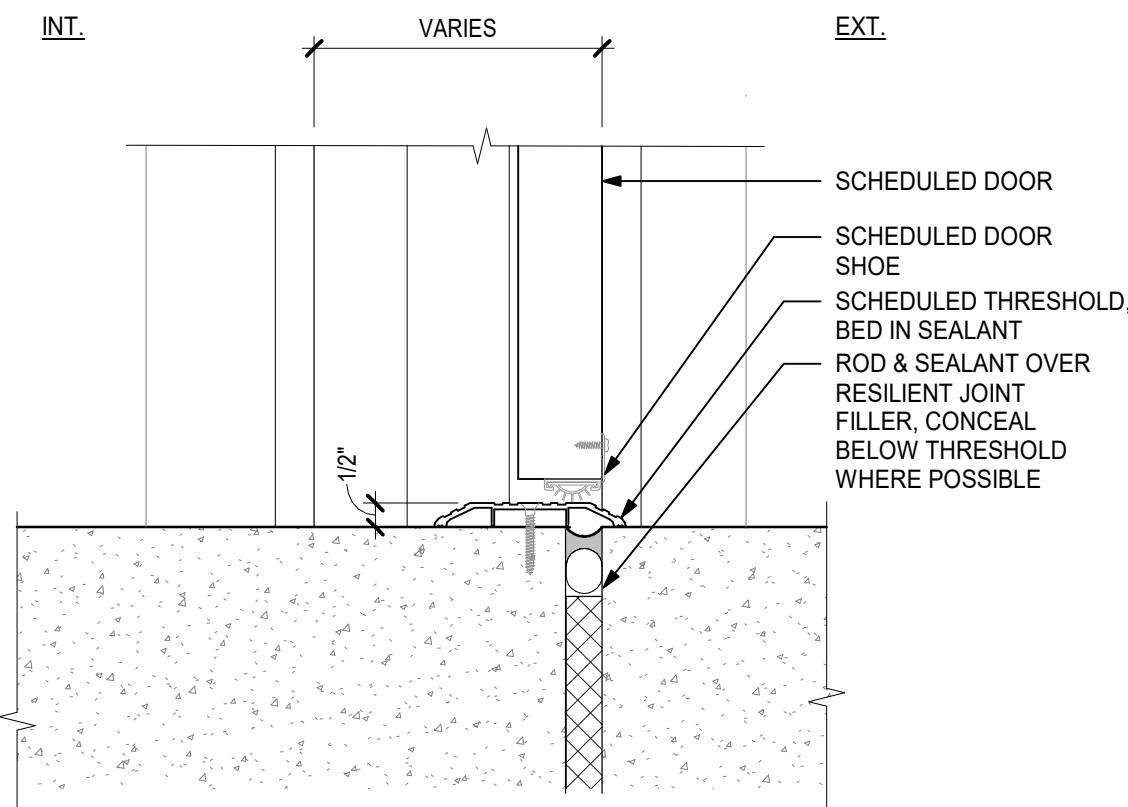
OUTSIDE KEYED ACCESS WHEN LOCKED. INSIDE ALWAYS UNLOCKED.

SET - 6  
STOREROOM

QTY	DESCRIPTION
3 EACH	HINGE
1 EACH	STOREROOM LOCKSET
1 EACH	WALL STOP
1 EACH	SILENCER

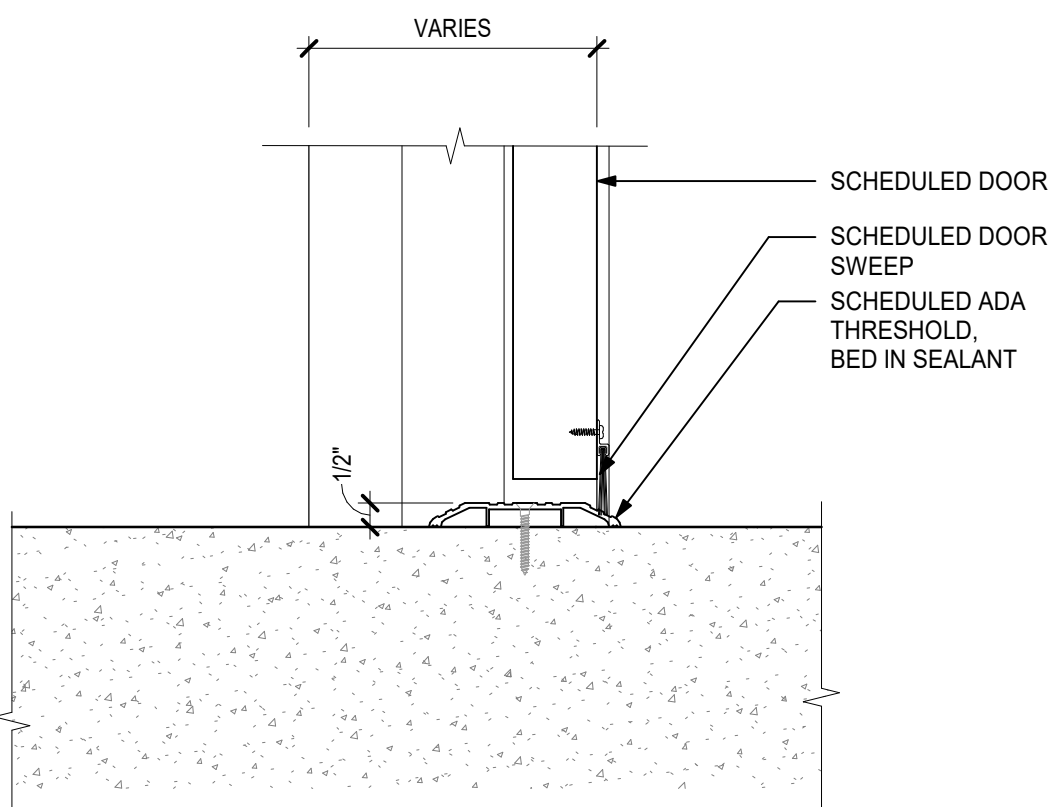
1 EXTERIOR DOOR THRESHOLD

A801 ( 3" = 1'-0" )



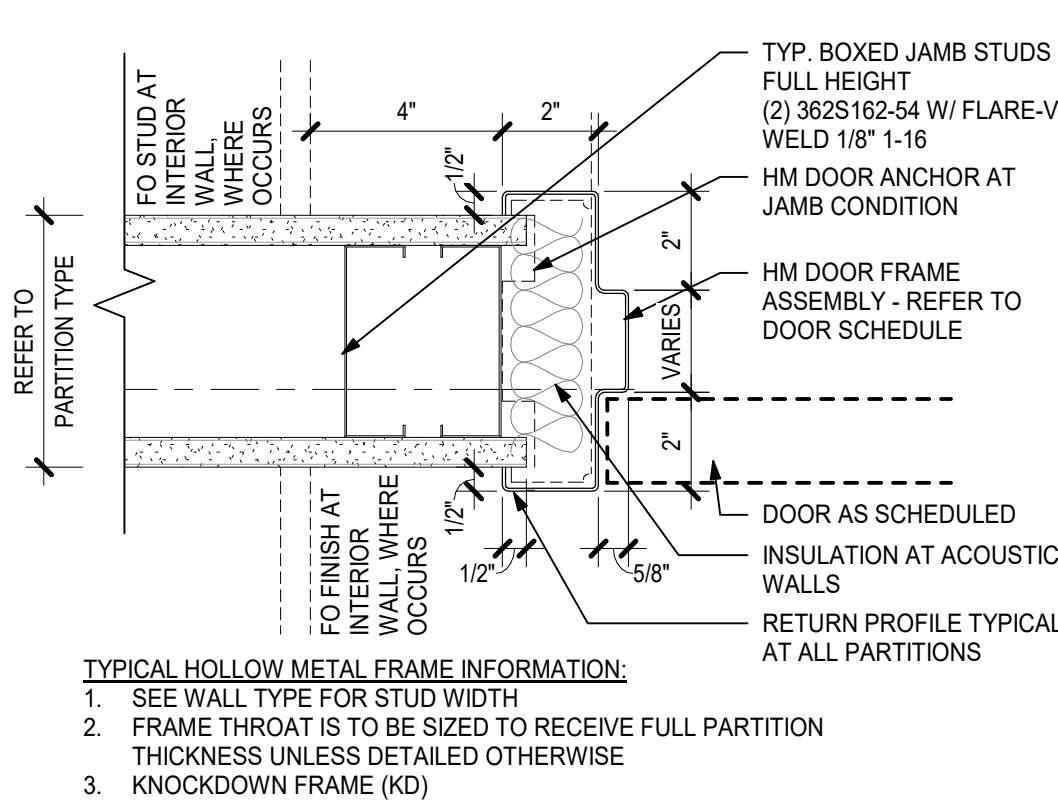
2 INTERIOR DOOR THRESHOLD

A801 ( 3" = 1'-0" )



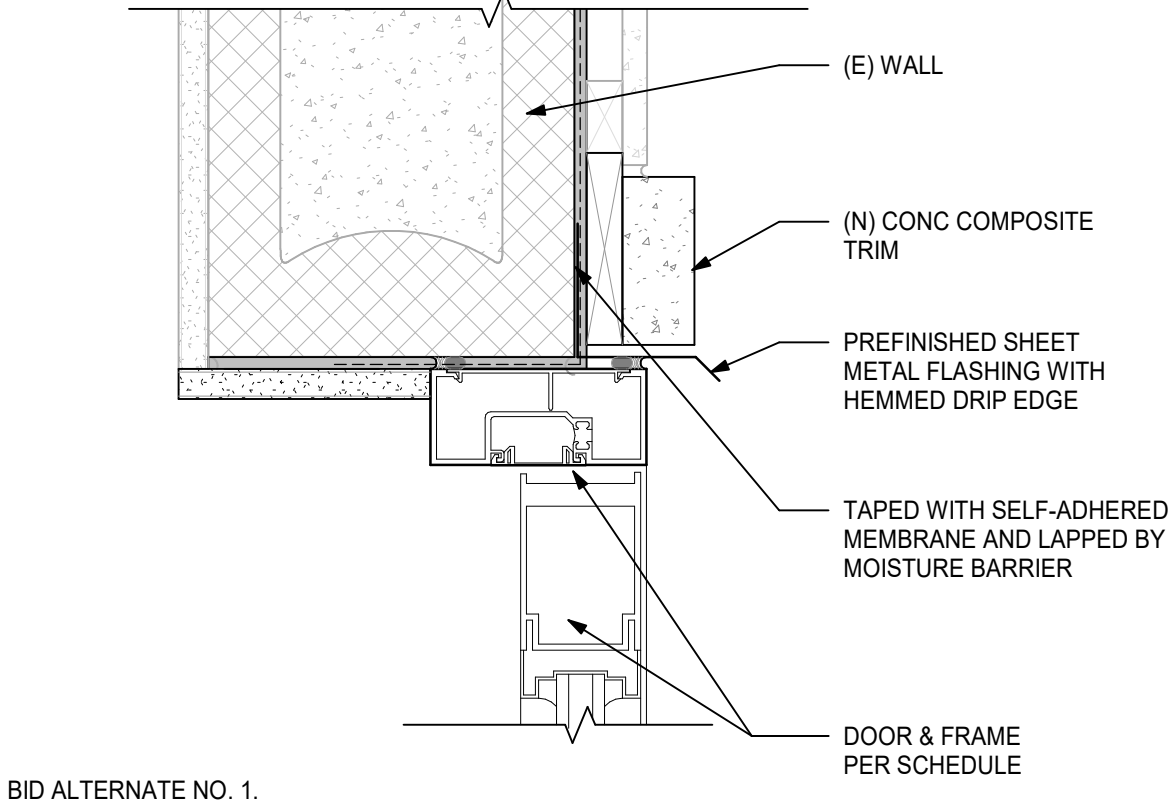
3 INTERIOR HM DOOR FRAME JAMB, HEAD SIM

A801 ( 3" = 1'-0" )



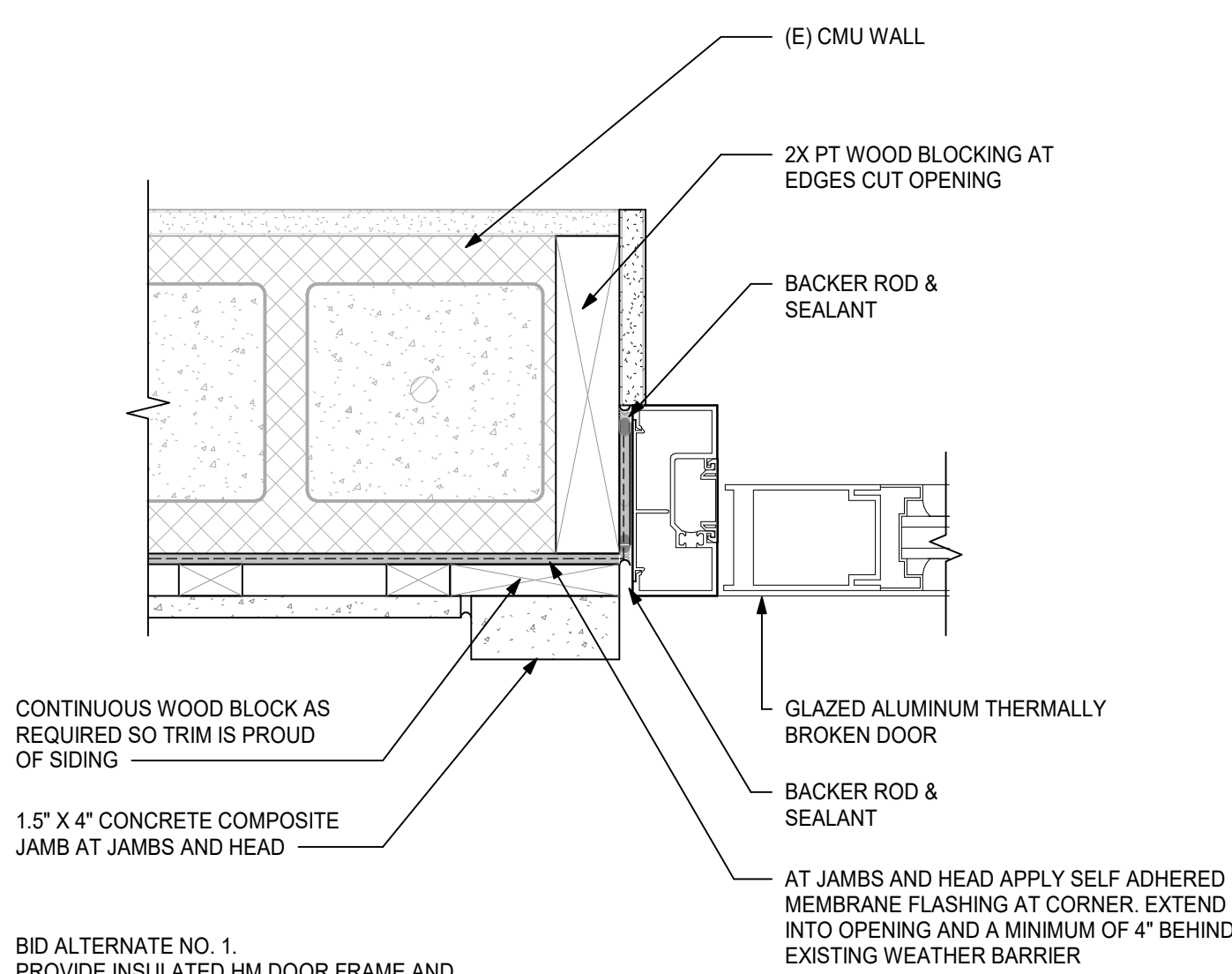
5 EXTERIOR DOOR WITH GLASS LITE - HEAD

A801 ( 3" = 1'-0" )



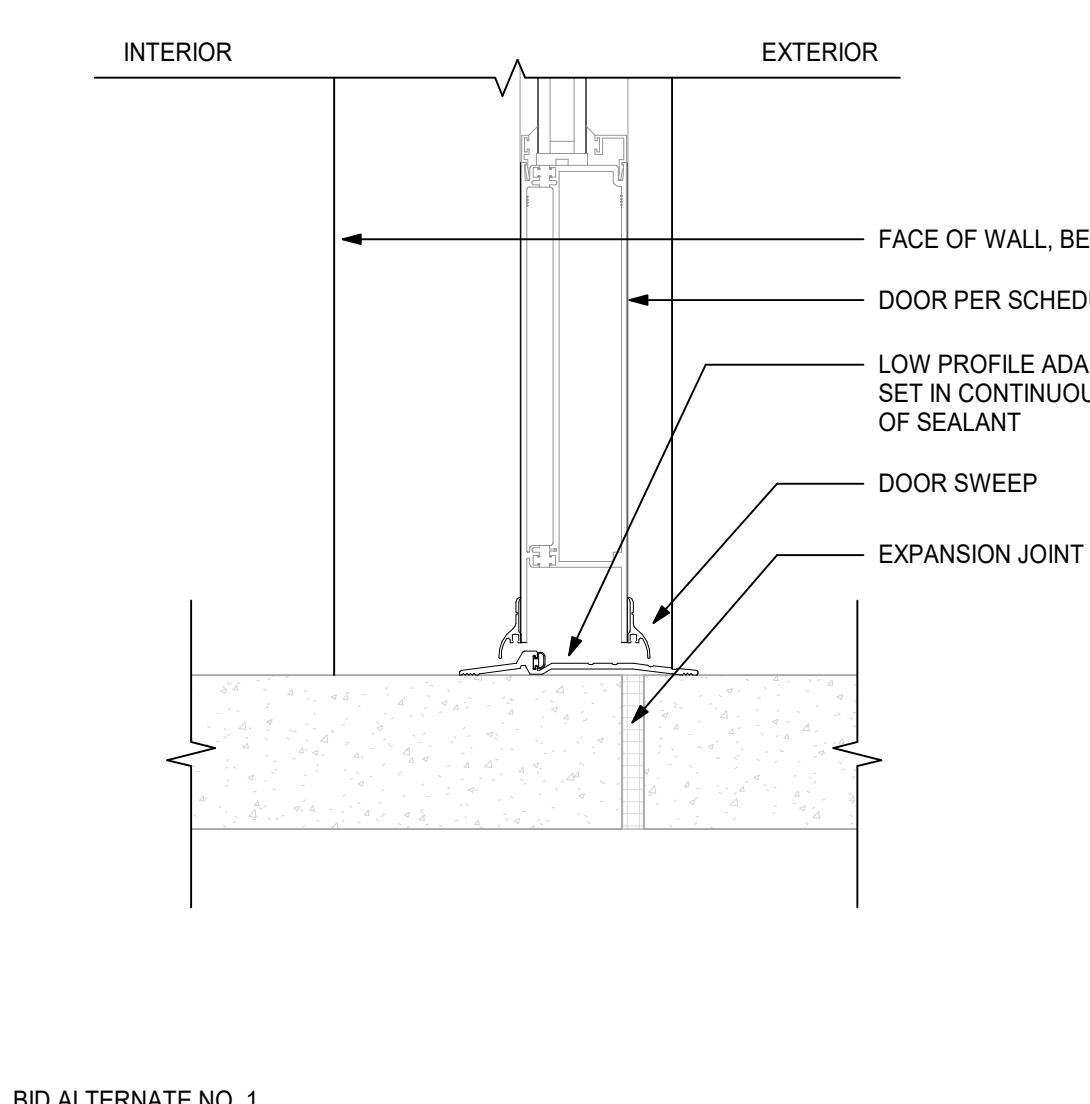
6 EXTERIOR DOOR WITH GLASS LITE - JAMB

A801 ( 3" = 1'-0" )



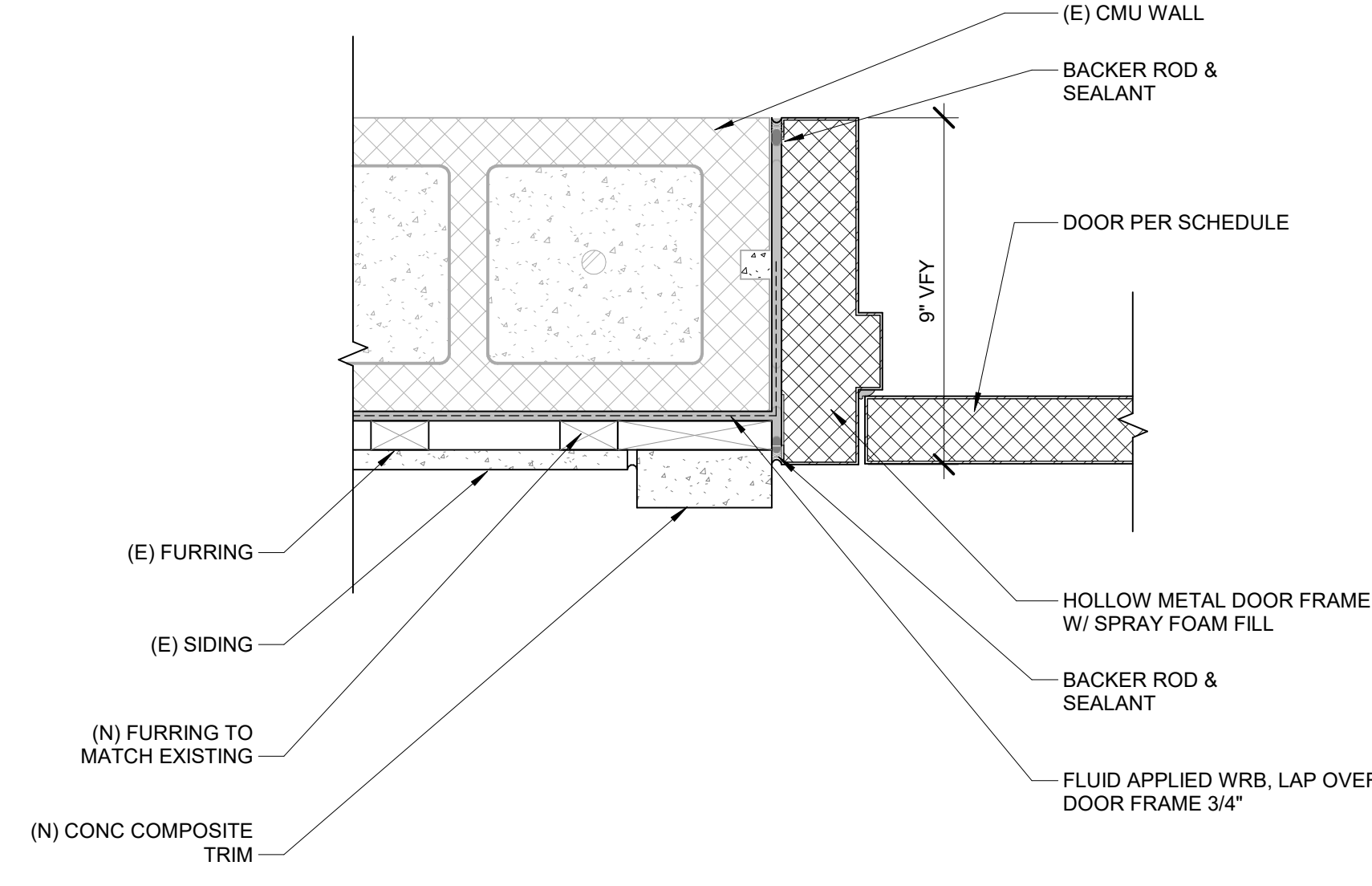
7 EXTERIOR DOOR WITH GLASS LITE - SILL

A801 ( 3" = 1'-0" )



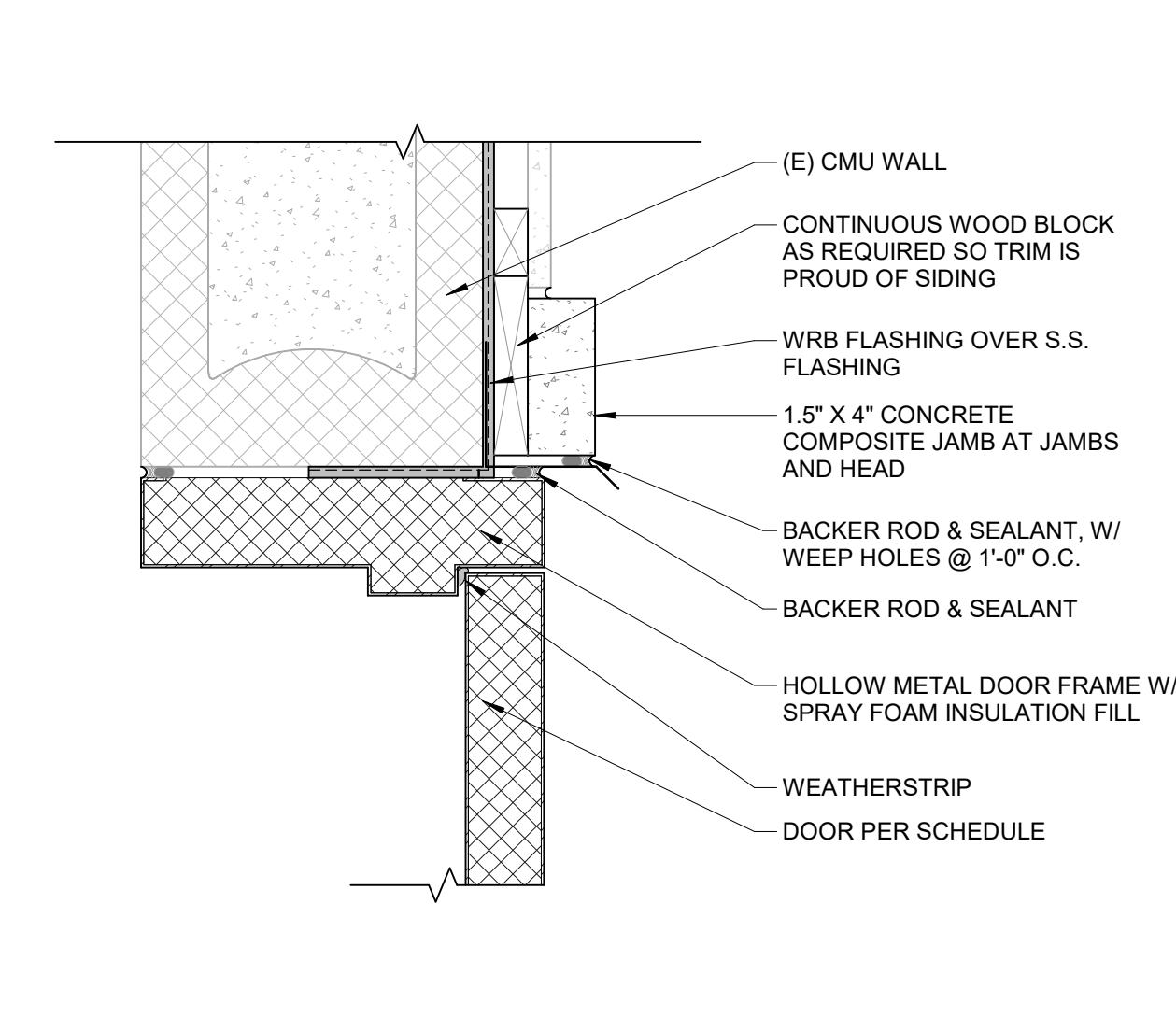
8 DOOR 122 JAMB

A801 ( 3" = 1'-0" )



9 DOOR 122 HEAD

A801 ( 3" = 1'-0" )
















## ELECTRICAL SYMBOL LIST

NOTE: This is a standard symbol list and not all items listed may be used.

### Abbreviations

AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
AWG	AMERICAN WIRE GAUGE
A	AMPERES, AMBER
AHJ	AUTHORITY HAVING JURISDICTION
AIC	AVAILABLE INTERRUPTING CAPACITY
BAS	BUILDING AUTOMATION SYSTEM
CA	CABLE
CAT	CATEGORY
CLG	CEILING
C	CONDUIT, CLOSE, CONTROL
COORD	COORDINATE
CJ	COPPER
dB	DECIBEL
(X)	DEMOLISH
DTL	DETAIL
DA	DIAMETER
DIM	DIMENSION
DIV	DIVISION
DN	DOWN
DWG	DRAWING
EA	EACH
EMT	ELECTRICAL METALLIC TUBING
EL	ELEVATION
E	EMERGENCY
EF	EXHAUST FAN
(E)	EXISTING
FF	FINISH FLOOR
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FMC	FLEXIBLE METAL CONDUIT
FT	FOOT, FEET
FBO	FURNISHED BY OTHERS
G, GND	GROUND
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFI	GROUND FAULT INTERRUPTER
GFP	GROUND FAULT PROTECTION
HH	HANDHOLE
HT	HEIGHT
ID	IDENTIFICATION
IN	INCH, INCHES
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
IMC	INTERMEDIATE METAL CONDUIT
IG	ISOLATED GROUND
KV	KILOVOLT
KVA	KILOVOLT AMPERES
KW	KILOWATT
LED	LIGHT EMITTING DIODE
LFMC	LIQUIDTIGHT FLEXIBLE METAL CONDUIT
LV	LOW VOLTAGE
MOCP	MAXIMUM OVERCURRENT PROTECTION
mA	MILLIAMPERES
MIN	MINIMUM
MCA	MINIMUM CIRCUIT AMPS
MISC	MISCELLANEOUS
MCC	MOTOR CONTROL CENTER
MT, MTD	MOUNT, MOUNTED
NEC	NATIONAL ELECTRIC CODE
NESC	NATIONAL ELECTRIC SAFETY CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
N	NEUTRAL
(N)	NEW
N/A	NOT APPLICABLE
N.I.C.	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
PNL	PANEL
PH	PHASE
PVC	POLY-VINYL-CHLORIDE
PWR	POWER
QTY	QUANTITY
REF	REFERENCE
(R)	RELOCATE
RFI	REQUEST FOR INFORMATION
REQD	REQUIRED
RMC	RIGID METAL CONDUIT
RM	ROOM
SHT	SHEET
SIM	SIMILAR
STD	STANDARD
SPD	SURGE PROTECTION DEVICE
SWBD	SWITCHBOARD
TBD	TO BE DETERMINED
XFMR	TRANSFORMER
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
UPS	UNINTERRUPTIBLE POWER SUPPLY
UON	UNLESS OTHERWISE NOTED
VFD	VARIABLE FREQUENCY DRIVE
V	VOLTS, VOLTAGE
WP	WEATHERPROOF
WG	WIRE GUARD
W/	WITH
W/O	WITHOUT




### Connections / Equipment


	COMBINATION ADJUSTABLE FREQUENCY DRIVE WITH SAFETY DISCONNECT SWITCH, FURNISHED BY DIVISION 23 AND INSTALLED BY DIVISION 28.
	COMBINATION MOTOR STARTER/FUSED DISCONNECT SWITCH
	HEAVY DUTY FUSED DISCONNECT SWITCH
	MOTOR CONNECTION
	NON-FUSED DISCONNECT SWITCH
	TRANSFORMER
	FIRE SMOKE DAMPER
	SMOKE DAMPER
	CEILING MOUNTED JUNCTION BOX
	FLOOR MOUNTED JUNCTION BOX
	WALL-MOUNTED JUNCTION BOX



### Fire Alarm

	FIRE ALARM CONTROL PANEL
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### General

	DETAIL NUMBER AND SHEET LOCATION
	EQUIPMENT IDENTIFICATION LOCATION
	KEYED NOTE








	DEMOLISH
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	EXISTING WORK
	NEW WORK





### Lighting

	EXIT SIGN CEILING MOUNTED, ARROW(S) INDICATES DIRECTION IF SHOWN
	EXIT SIGN WALL MOUNTED, ARROW(S) INDICATES DIRECTION IF SHOWN
	RECESSED 1' X 4' LUMINAIRE
	RECESSED 1' X 4' LUMINAIRE CONNECTED TO EMERGENCY/LIFE SAFETY CIRCUIT OR WITH INTEGRAL EMERGENCY BATTERY CONNECTED TO UNSWITCHED CIRCUIT
	RECESSED 2' X 2' LUMINAIRE
	RECESSED 2' X 2' LUMINAIRE CONNECTED TO EMERGENCY/LIFE SAFETY CIRCUIT OR WITH INTEGRAL EMERGENCY BATTERY CONNECTED TO UNSWITCHED CIRCUIT
	RECESSED 2' X 4' LUMINAIRE
	RECESSED 2' X 4' LUMINAIRE CONNECTED TO EMERGENCY/LIFE SAFETY CIRCUIT OR WITH INTEGRAL EMERGENCY BATTERY CONNECTED TO UNSWITCHED CIRCUIT
	RECESSED LUMINAIRE
	RECESSED LUMINAIRE CONNECTED TO EMERGENCY/LIFE SAFETY CIRCUIT
	WALL MOUNTED LUMINAIRE
	WALL MOUNTED LUMINAIRE CONNECTED TO EMERGENCY/LIFE SAFETY CIRCUIT OR WITH INTEGRAL EMERGENCY BATTERY CONNECTED TO UNSWITCHED CIRCUIT


### Miscellaneous

	BRANCH CIRCUIT WIRING. ARROW INDICATES HOME RUN TO PANEL WITH CIRCUITS AS NOTED. WIRE SIZE IS #12 AWG MINIMUM UNLESS NOTED OTHERWISE. SHORT TICK MARKS INDICATE PHASE CONDUCTORS. LONG TICK MARKS INDICATE NEUTRAL CONDUCTORS. A SINGLE CURVED TICK MARK INDICATES INSULATED GREEN GROUND CONDUCTOR. SECOND CURVED TICK MARK INDICATES "ISOLATED GROUND" (GREEN INSULATION WITH YELLOW STRIPE) CONDUCTOR.
	BRANCH PANEL
	CIRCUIT BREAKER
	DRY TYPE TRANSFORMER
	FLUSH WALL MOUNTED BRANCH PANEL
	GROUND BAR
	MAIN DISTRIBUTION PANEL / SUB DISTRIBUTION PANEL

### Raceways






	CONDUIT CONCEALED IN WALL OR CEILING SPACE
	CONDUIT ROUTED BELOW FLOOR / GRADE
	CONDUIT ELLED DOWN
	CONDUIT ELLED UP




	CONDUIT/WIRING CONTINUATION
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	CONDUIT/WIRING STUBBED OUT WITH END CAP OR INSULATED PLASTIC BUSHING
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	FLEXIBLE CONDUIT
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### Switches and Receptacles

	DUPLEX RECEPTACLE (MULTIPLE LETTERS INDICATE MULTIPLE OPTIONS) A = ABOVE COUNTER B = CLOCK HANGER C = FLUSH CEILING MOUNTED E = EMERGENCY F = ARC FAULT PROTECTED BY BREAKER IN PANEL G = GROUND FAULT CIRCUIT INTERRUPTER H = HOSPITAL GRADE K = CHILD RESISTANT COVER L = ISOLATED GROUND P = PENDANT MOUNTED WITH CORD GRIPS. VERIFY PENDANT LENGTH R1 = HALF SWITCHED BY OCCUPANCY SENSOR RELAY R2 = FULLY SWITCHED BY OCCUPANCY SENSOR RELAY S = SPLIT WIRED T = TAMPER RESISTANT SHUTTERED RECEPTACLE U = USB PORT(S) W = WEATHERPROOF CONTINUOUS USE COVER, GFCI PROTECTED, WITH WEATHER-RESISTANT RECEPTACLE
	DUPLEX RECEPTACLE, FLUSH FLOOR
	DOUBLE DUPLEX RECEPTACLE, FLUSH FLOOR
	DOUBLE DUPLEX RECEPTACLE. SEE LETTER CODE LIST AT DUPLEX RECEPTACLE FOR OPTIONS
	EQUIPMENT ELECTRICAL CONNECTION

	SPECIAL PURPOSE RECEPTACLE. LETTER CODE DENOTES RECEPTACLE CONFIGURATION LX.XXR = NEMA CONFIGURATION TWIST-LOCK RECEPTACLE X.XXR = NEMA CONFIGURATION STRAIGHT BLADE RECEPTACLE P = PENDANT MOUNT WITH CORD GRIPS. VERIFY PENDANT LENGTH X = COORDINATE RECEPTACLE CONFIGURATION WITH EQUIPMENT BEING SUPPLIED CEILING MOUNTED OCCUPANCY SENSOR P = PASSIVE INFRARED D = DUAL TECHNOLOGY U = ULTRASONIC, 360 DEG RANGE H = ULTRASONIC, HALLWAY PATTERN v (LOWERCASE) = VACANCY CONTROL DESIGNATION WALL MOUNTED OCCUPANCY SENSOR P = PASSIVE INFRARED D = DUAL TECHNOLOGY v (LOWERCASE) = VACANCY CONTROL DESIGNATION WALL MOUNTED OCCUPANCY SENSOR/ SWITCH S = PASSIVE INFRARED WITH INTEGRAL "OFF" SWITCH T = DUAL RELAY PASSIVE INFRARED WITH TWO INTEGRAL "OFF" SWITCHES D = PASSIVE INFRARED WITH INTEGRAL DIMMER TO OFF. v (LOWERCASE) = VACANCY CONTROL DESIGNATION MULTIPLE CHANNEL SURFACE METAL RECEPTACLE RACEWAY WITH LOW VOLTAGE DIVIDERS, LENGTH AND RECEPTACLES AS INDICATED
	PHOTO ELECTRIC SWITCH D = CONTINUOUS DIMMING PHOTOCCELL S = SWITCHED PHOTOCCELL SINGLE POLE SWITCH 2 = DOUBLE POLE SWITCH 3 = THREE-WAY SWITCH 4 = FOUR-WAY SWITCH a THRU z (LOWERCASE) = LUMINAIRE CONTROL DESIGNATION D = DIMMER F = FAN SPEED CONTROL K = KEY OPERATED SWITCH L = LIGHTED HANDLE M = MANUAL MOTOR STARTER WITH THERMAL OVERLOAD P = SWITCH WITH PILOT LIGHT S = SENTRY SWITCH T = INTERVAL TIMER W = WEATHERPROOF SWITCH V = LOW VOLTAGE SWITCH
	RACEWAY ONLY DATA/TELEPHONE OUTLET. PROVIDE DOUBLE GANG BACK BOX AND SINGLE GANG ADAPTER PLATE WITH 1" C. AND PULLSTRING TO ACCESSIBLE CEILING SPACE. (MULTIPLE LETTERS INDICATE MULTIPLE OPTIONS) A = ABOVE COUNTER C = CEILING MOUNTED ABOVE ACCESSIBLE CEILING F = FLUSH CEILING MOUNTED R = SURFACE MOUNTED ON RACEWAY RACEWAY ONLY TELEPHONE OUTLET. PROVIDE DOUBLE GANG BACK BOX AND SINGLE GANG ADAPTER PLATE WITH 3/4" C. AND PULLSTRING TO ACCESSIBLE CEILING SPACE. SEE LETTER CODE LIST AT DATA/TELEPHONE OUTLET FOR OPTIONS.

### Telecommunications

	RACEWAY ONLY DATA/TELEPHONE OUTLET. PROVIDE DOUBLE GANG BACK BOX AND SINGLE GANG ADAPTER PLATE WITH 1" C. AND PULLSTRING TO ACCESSIBLE CEILING SPACE. (MULTIPLE LETTERS INDICATE MULTIPLE OPTIONS) A = ABOVE COUNTER C = CEILING MOUNTED ABOVE ACCESSIBLE CEILING F = FLUSH CEILING MOUNTED R = SURFACE MOUNTED ON RACEWAY RACEWAY ONLY TELEPHONE OUTLET. PROVIDE DOUBLE GANG BACK BOX AND SINGLE GANG ADAPTER PLATE WITH 3/4" C. AND PULLSTRING TO ACCESSIBLE CEILING SPACE. SEE LETTER CODE LIST AT DATA/TELEPHONE OUTLET FOR OPTIONS.
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## GENERAL ELECTRICAL NOTES

- ALL ELECTRICAL MATERIAL AND INSTALLATIONS SHOWN AND/OR SPECIFIED TO BE INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS AND IN ACCORDANCE WITH THE LATEST EDITION OF THE NEC 2023.
- REFER TO ARCHITECTURAL DRAWINGS TO COORDINATE LOCATION AND MOUNTING HEIGHT OF ALL ELECTRICAL DEVICES.
- REFER TO MECHANICAL AND PLUMBING DRAWINGS FOR EXACT LOCATION OF ALL MECHANICAL AND PLUMBING EQUIPMENT.
- MAXIMUM VOLTAGE DROP OF BRANCH CIRCUITS TO BE 3%. ELECTRICAL CONTRACTOR TO SIZE WIRING TO SUIT.
- NO WIRE SMALLER THAN #12 AWG SHALL BE USED FOR BRANCH CIRCUIT WIRING.
- IN FINISHED INTERIOR AREAS RUN ALL CONDUITS CONCEALED UNLESS OTHERWISE NOTED. PAINT ALL EXPOSED CONDUITS AND ELECTRICAL EQUIPMENT. REFER TO ARCHITECTURAL PAINTING SPECIFICATIONS FOR REQUIREMENTS.
- ALL EXPOSED CONDUIT TO BE RUN PARALLEL TO BUILDING LINES.
- PROVIDE DEDICATED NEUTRALS FOR ALL BRANCH CIRCUITS UNLESS OTHERWISE NOTED.
- ALL IN-SLAB OR BURIED CONDUIT TO BE COMPLETE WITH EQUIPMENT GROUNDING CONDUCTOR.
- ALL EMPTY CONDUITS TO BE COMPLETE WITH PULL WIRE.
- MC CABLE SHALL NOT BE USED WITHOUT PERMISSION FROM THE ENGINEER.
- ALL CONDUIT ROUTED IN AREAS SUBJECT TO MECHANICAL DAMAGE TO BE RIGID.

## GENERAL LIGHTING NOTES

- COORDINATE LIGHTING WITH ARCHITECTURAL DRAWINGS PRIOR TO ORDERING TO CONFIRM LUMINAIRES WILL FIT IN INTENDED ARCHITECTURAL FEATURES, CEILING GRIDS, COVES, ETC.
- COORDINATE LIGHTING INSTALLATION REQUIREMENTS WITH SPRINKLER CONTRACTOR PRIOR TO SPRINKLER LINE INSTALLATION.
- ALL LIGHT SWITCHES, DIMMERS AND MOTION SENSORS TO CONTROL LIGHTING WITHIN THE ROOM THEY ARE LOCATED IN UNLESS OTHERWISE NOTED.
- ALL ROOM WALL SWITCHES, DIMMERS AND MOTION SENSORS TO BE SUBORDINATE TO THE LOW VOLTAGE SWITCHING ZONE THEY ARE LOCATED IN.
- ALL PHOTOCELLS TO CONTROL THE LUMINAIRES WITHIN DAYLIGHT ZONE THEY ARE LOCATED WITHIN.
- ALL MOTION SENSORS TO BE MOUNTED AT LEAST 3' AWAY FROM MECHANICAL DIFFUSERS.

## GENERAL POWER NOTES

- USE #10 AWG FOR 20A, 120V CIRCUITS LONGER THAN 70'.
- USE #8 AWG FOR 20A, 120V CIRCUITS LONGER THAN 100'.

## SHEET INDEX

E001	SYMBOL LIST AND GENERAL NOTES - ELECTRICAL
E002	LUMINAIRE SCHEDULE & SEQUENCE OF OP.
E201	CEILING PLAN - LIGHTING
E301	FLOOR PLAN - POWER
E501	ONE LINE DIAGRAMS & SCHEDULES - ELECTRICAL
E700	DETAILS - ELECTRICAL
E800	SPECIFICATIONS - ELECTRICAL



Project

Consultant



Revisions

No.	Description	Date
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Stamp



Issuance

Permit Set

Date

Mar 22nd, 2024

Project Number

2023-1255

Drawing Title

SYMBOL LIST AND  
GENERAL NOTES -  
ELECTRICAL

Sheet No

E001





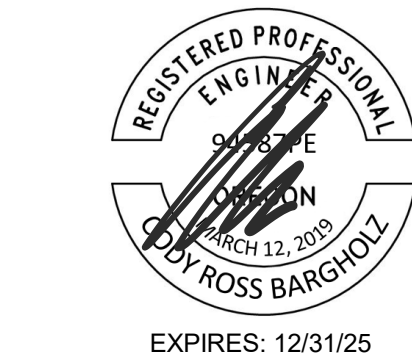
Consultant



Revisions

No.	Description	Date
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Stamp



Issuance  
**Permit Set**

Date  
**Mar 22nd, 2024**

Project Number  
**2023-1255**

Drawing Title  
**LUMINAIRE  
SCHEDULE &  
SEQUENCE OF OP.**

Sheet No  
**E002**

LUMINAIRE SCHEDULE

TYPE	DESCRIPTION	HOUSING	OPTICS	MOUNTING	FINISH	UL/IP RATING	DRIVER LOCATION	DIMMING CONTROL	INITIAL DELIVERED LUMENS	CCT	CRI	RATED LIFE	LM/W	WATTAGE	VOLTAGE	MANUFACTURER	PRE-APPROVED PRODUCTS	REMARKS
'A2'	RECESSED LED LUMINAIRE; 2'L x 2'W x NOMINAL DIMENSIONS	ALUMINUM	WHITE FROST LENS	RECESSED	WHITE	DAMP	INTEGRAL	0-10V	3307	3500K	90	60,000 (L73)	130	29.2	120	METALUX	22FP3235C	
'A2-E'	RECESSED LED LUMINAIRE; 2'L x 2'W x NOMINAL DIMENSIONS	ALUMINUM	WHITE FROST LENS	RECESSED	WHITE	DAMP	INTEGRAL	0-10V	3307	3500K	90	60,000 (L73)	130	29.2	120	METALUX	22FP3235CEL10W	PROVIDE EM BATTERY
'A4'	RECESSED LED LUMINAIRE; 4'L x 2'W x NOMINAL DIMENSIONS	ALUMINUM	WHITE FROST LENS	RECESSED	WHITE	DAMP	INTEGRAL	0-10V	4591	3500K	90	60,000 (L73)	111	41.4	120	METALUX	24FP4735C	
'A4-E'	RECESSED LED LUMINAIRE; 4'L x 2'W x NOMINAL DIMENSIONS	ALUMINUM	WHITE FROST LENS	RECESSED	WHITE	DAMP	INTEGRAL	0-10V	4591	3500K	90	60,000 (L73)	111	41.4	120	METALUX	24FP4735CEL10W	PROVIDE EM BATTERY
'B'	RECESSED LED DOWNLIGHT LUMINAIRE; 5.66"DIA x 14.14"L x 13.08"W NOMINAL DIMENSIONS	ALUMINUM	HIGH REFLECTANCE UPPER REFLECTOR	RECESSED	WHITE	DAMP	INTEGRAL	0-10V	1000	3500K	90	50,000 (L70)	100	10.0	120	PORTFOLIO	LDSQ4C15D010 EU4C10209035 4LBCSSQ1MW	
'C'	SURFACE LINEAR LED LUMINAIRE; 4' NOMINAL DIMENSIONS	STEEL	ACRYLIC LENS	SURFACE	WHITE	DAMP	INTEGRAL	0-10V	3150	3500K	90	100,000 (L70)	105	30.0	120	CREE LIGHTING	LS4-40L-35K-10V-FD	
'SA'	SITE/AREA WALL MOUNTED LED LUMINAIRE; 11.5"W x 7"L x 9"H NOMINAL DIMENSIONS	DIE CAST ALUMINUM	CLEAR SAFETY GLASS	WALL MOUNTED AT 7'-0" A.F.G.	BLACK	WET	INTEGRAL	0-10V	1200	3000K	90	50,000 (L95)	126	10.0	120	LITHONIA LIGHTING WDGE2	WDGE2 LED P1-30K-90CRI-VW-MVOLT-DMG-DBLXD	
'SA-E'	SITE/AREA WALL MOUNTED LED LUMINAIRE; 11.5"W x 7"L x 9"H NOMINAL DIMENSIONS	DIE CAST ALUMINUM	CLEAR SAFETY GLASS	WALL MOUNTED AT 7'-0" A.F.G.	BLACK	WET	INTEGRAL	0-10V	1200	3000K	90	50,000 (L95)	126	10.0	120	LITHONIA LIGHTING WDGE2	WDGE2 LED P1-30K-90CRI-VW-MVOLT-E10WH-DMG-DBLXD	PROVIDE EM BATTERY
'X'	EXIT SIGNS	THERMOPLASTIC	RED LENS	REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING CONDITIONS	BRUSHED ALUMINUM	UL DAMP	INTEGRAL	N/A	N/A	N/A	N/A	N/A	N/A	2.0	120	EVENLITE RAZOR SERIES; ISOLITE, PATHWAY, SURE-LITES TPK, BARRON LIGHTING, OR APPROVED	RZR3-EM-R-U-BA-CN-SD	

- NOTES
- THIS LUMINAIRE SCHEDULE IS NOT COMPLETE WITHOUT A COPY OF THE PROJECT MANUAL CONTAINING THE ELECTRICAL SPECIFICATIONS.
  - DIMMING CONTROL PROTOCOL (0-10VDC, LINE VOLTAGE, DALI, ETC.) COMPATIBLE WITH LIGHTING CONTROL SYSTEM AS SPECIFIED AND SHOWN ON DRAWINGS.
  - PROVIDE +/- 12 INCH ADJUSTABILITY IN AIRCRAFT CABLE LENGTH WHERE USED.
  - COORDINATE ALL CEILING TYPES WITH LUMINAIRE LOCATIONS PRIOR TO ORDERING LUMINAIRES. COORDINATE INSTALLATION WITH REFLECTED CEILING PLAN.
  - SPECIFIED MANUFACTURERS ARE BASIS OF DESIGN. SUBMIT ALTERNATES FOR APPROVAL PRIOR TO BID CLOSE.
  - PROVIDE SUBMITTALS THAT INCLUDE THE LUMINAIRE, LAMP AND DRIVER INFORMATION OF EACH LUMINAIRE, WITH APPLICABLE OPTIONS CLEARLY CHECKED OR HIGHLIGHTED. SUBMITTALS NOT INCLUDING THIS INFORMATION WILL BE RETURNED AS REJECTED BY THE ENGINEER OF RECORD.
  - REMOTE BALLASTS/DRIVERS: UL LISTED FOR THEIR APPLICATION. BALLASTS/DRIVERS MARKED AS UL RECOGNIZED COMPONENT BUT NOT UL LISTED ARE SUBJECT TO REMOVAL AND REPLACEMENT AT NO COST TO OWNER.
  - LABEL ALL REMOTE DRIVERS TO SHOW LUMINAIRE TYPE IDENTIFICATION AND SOURCE CIRCUIT. PROVIDE WIRING BETWEEN REMOTE DRIVER AND LUMINAIRE AS RECOMMENDED BY MANUFACTURER. DO NOT EXCEED MAXIMUM DISTANCE RECOMMENDED BY MANUFACTURER BETWEEN DRIVER AND FURTHEST LUMINAIRE.

LIGHTING AND RECEPTACLE CONTROL SEQUENCE OF OPERATIONS: SPACE BY SPACE

ROOM NAME	OCCUPANCY SENSOR TYPE	LIGHTING CONTROL NETWORK CONNECTED	PHOTOSENSOR CONTROL	RECEPTACLE CONTROL	ALL LUMINAIRES CONFIGURED FOR CONTINUOUS DIMMING	CONTROL FUNCTIONS	PRODUCT BASIS OF DESIGN	REMARKS
VESTIBULES, HALLWAYS, AND COMMONS	PASSIVE INFRARED	NO	NO	NO	YES	AUTO ON/OFF WITH OCCUPANCY SENSOR. NORMAL POWER LOSS WITHIN ZONE TRIGGERS EMERGENCY LUMINAIRES TO GO TO FULL BRIGHTNESS.	ALC, ALCS, IR	
EXTERIOR BUILDING	NONE	NO	NO	NO	YES	AUTO ON/OFF WITH LUTRON TIME CLOCK. NORMAL POWER LOSS WITHIN ZONE TRIGGERS EMERGENCY LUMINAIRES TO GO TO FULL BRIGHTNESS, WHERE APPLICABLE.	ALC, ALCS,	
RESTROOMS, JANITOR, AND LAUNDRY	PASSIVE INFRARED	NO	NO	NO	YES	AUTO ON/OFF WITH OCCUPANCY SENSOR. NORMAL POWER LOSS WITHIN ZONE TRIGGERS EMERGENCY LUMINAIRES TO GO TO FULL BRIGHTNESS.	ALC, ALCS, IR	
OFFICE, PRIVATE THERAPY, TRAINING ROOM, AND COPIES	PASSIVE INFRARED	NO	NO	YES	YES	MANUAL ON/OFF AND DIMMING WITH WALL DIMMER. AUTO OFF WITH OCCUPANCY SENSOR. AUTO DIMMING WITHIN DAYLIGHT ZONES WITH PHOTOCELL WHERE INDICATED.	ALC, ALCS(x2), DM, IR, R	
BREAK ROOM	PASSIVE INFRARED	NO	NO	YES	YES	MANUAL ON/OFF AND DIMMING WITH WALL DIMMER. AUTO OFF WITH OCCUPANCY SENSOR. AUTO DIMMING WITHIN DAYLIGHT ZONES WITH PHOTOCELL WHERE INDICATED. NORMAL POWER LOSS WITHIN ZONE TRIGGERS EMERGENCY LUMINAIRES TO GO TO FULL BRIGHTNESS.	ALC, ALCS(x2), DM, IR, R	
ALL OTHER ROOMS	PASSIVE INFRARED	NO	NO	NO	YES	MANUAL ON/OFF AND DIMMING WITH WALL DIMMER. AUTO OFF WITH OCCUPANCY SENSOR. AUTO DIMMING WITHIN DAYLIGHT ZONES WITH PHOTOCELL WHERE INDICATED.	ALC, ALCS, DM, IR	

PRODUCT BASIS OF DESIGN LEGEND

- DM - DIMMING WALL SWITCH - LUTRON PICO 3 BUTTON WITH RAISE LOWER AND PRESET WITH WALL MOUNT KIT - UPJ2-3BRL-xx-L01
- IR - CEILING MOUNTED PASSIVE INFRARED OCCUPANCY SENSOR - ULRF2-OCR2B-P-WH
- PC - WIRELESS DAYLIGHT SENSOR - LRF2-DCRB-WH
- SC - SCENE SELECTION WALL STATION LUTRON PICO 4 BUTTON CONTROLLER WITH WALL MOUNT KIT - PJ2-4B-WH-xx
- EM - EMERGENCY AREA LIGHTING CONTROLLER - LUTRON VIVE EMERGENCY POWERPACK WITH 0-10V DIMMING - RMJS-8T-DV-B-EM
- R - HUBBELL HEAVY DUTY CONTROL UNIT - CU300HDU-CPN6814
- ALC - AREA LIGHTING CONTROLLER - LUTRON VIVE POWERPACK WITH 0-10V DIMMING - URMJS-8T-DV-B
- ELV - VIVE POWPAK PHASE SELECT DIMMING - RMJS-PNE-DV
- ALCS - VIVE POWPAK 24V CONTACT CLOSURE - URMJS-CCO1-24B

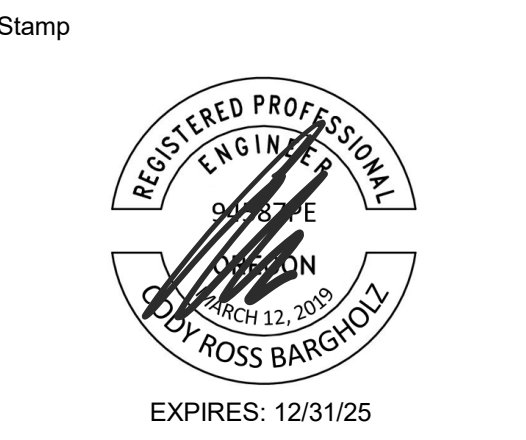
GENERAL NOTES:

- EMERGENCY LIGHTING DIMS/ON-OFF WITH NORMAL LIGHTING UNLESS NORMAL POWER IS LOST THEN EMERGENCY LUMINAIRES ARE TO TURN ON AND GO TO FULL BRIGHTNESS.
- EXIT SIGNS TO BE UNSWITCHED.
- CONTRACTOR TO SUPPLY AND INSTALL LUTRON VIVE WIRELESS HUBS TO CONTROL ALL LIGHTING INTERIOR AND EXTERIOR TO THE BUILDING. LOCATIONS ARE TO BE DETERMINED BY MANUFACTURER.
- ALL LUMINAIRE CONTROL MODULES AND AREA CONTROL MODULES ARE TO BE HARDWIRE AND INSTALLED WITHIN CONCEALED ACCESSIBLE LOCATIONS SUCH AS ABOVE T-BAR CEILINGS OR WITHIN SERVICE ROOMS.
- CUSTOM SCENE BUTTONS ARE TO BE SELECTED BY OWNER PRIOR TO ORDERING.





Revisions	No.	Description	Date
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Issuance  
**Permit Set**

Date  
**Mar 22nd, 2024**

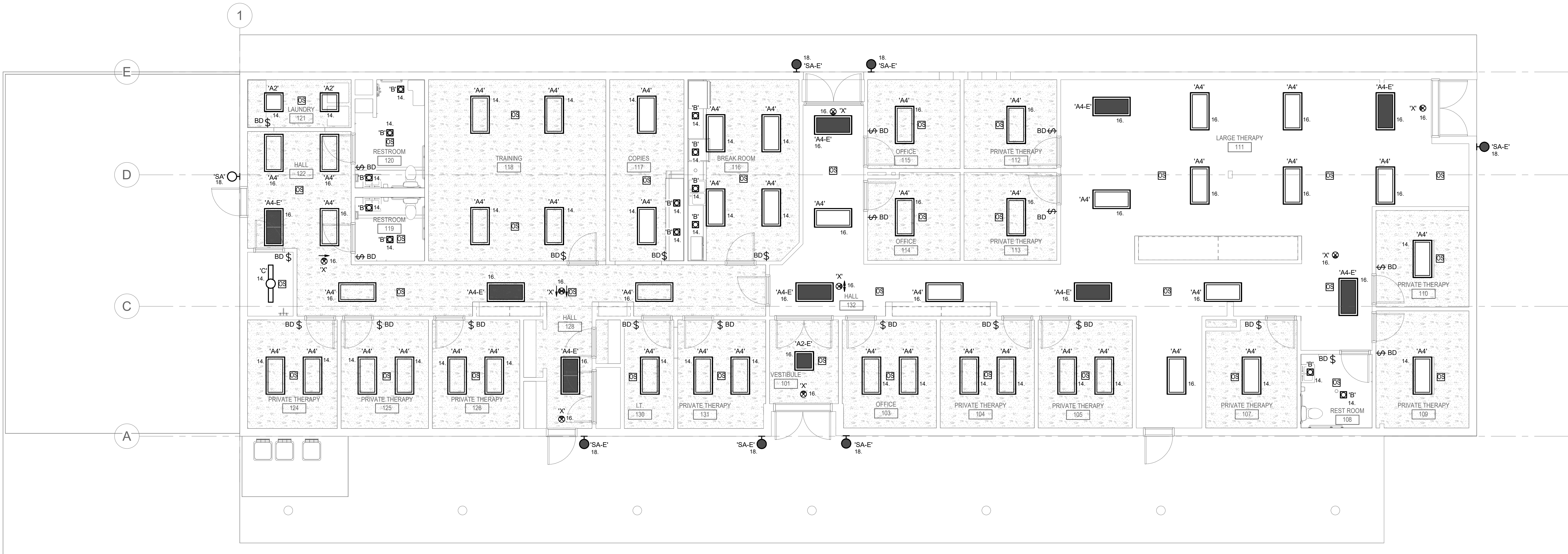
Project Number  
**2023-1255**

Drawing Title  
**CEILING PLAN -  
LIGHTING**

Sheet No.  
**E201**

**GENERAL SHEET NOTES**

- A. CONNECT NEW LUMNAIRES TO EXISTING NORMAL LIGHTING CIRCUIT MADE AVAILABLE BY DEMOLITION OF EXISTING NORMAL LIGHTS, UNLESS OTHERWISE NOTED.
- B. PROVIDE BOTH SWITCHED AND UNSWITCHED CIRCUIT LEGS FOR EMERGENCY LIGHTING LUMNAIRES DESIGNATED WITH THE SUBSCRIPT 'EM'.

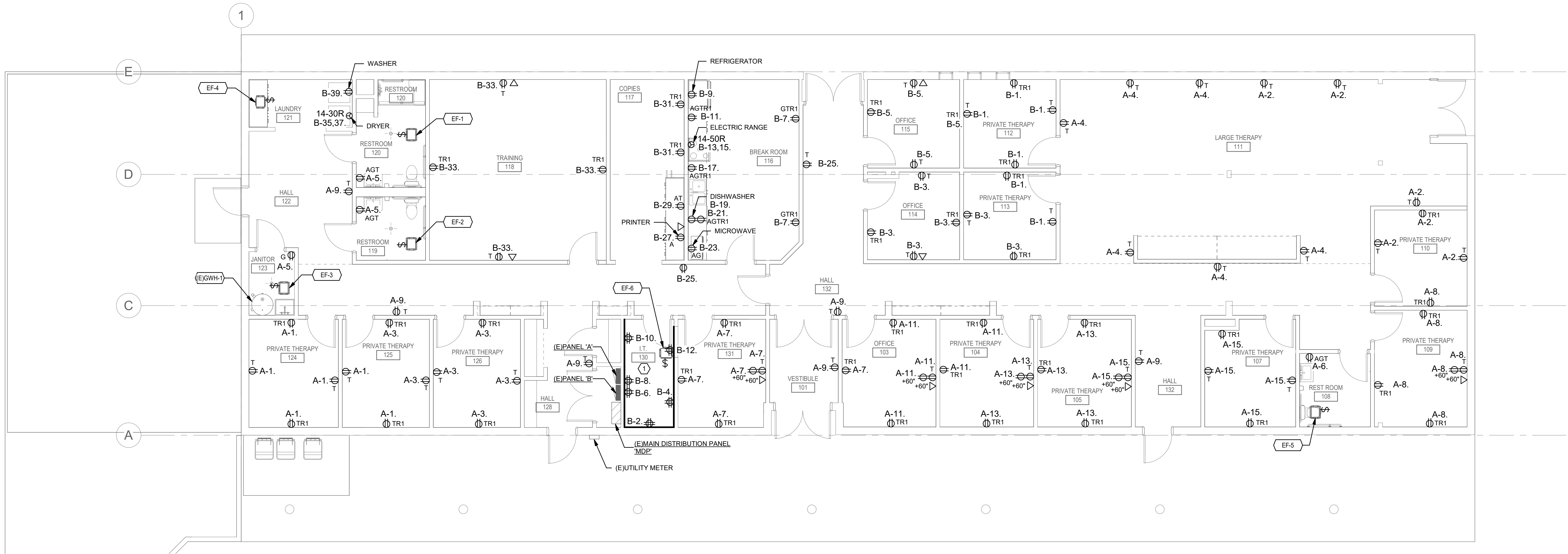


**1 LEVEL 1 LIGHTING PLAN - OVERALL**

0' 4' 8' 16'  
3/16" = 1'-0"



SHEET KEYNOTES  
1. BOND OFF OF DATA RACK USING ONE #6 INSULATED  
BOUNDING CONDUCTOR BETWEEN TWO POSTS DATA  
RACK AND MAIN GROUND BAR AT ELECTRICAL CLOSET.



1 LEVEL 1 POWER PLAN - OVERALL



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DISTRIBUTION PANELBOARD: MDP							
MAIN LUG ONLY				MOUNTING			
BUS AMPACITY: 400 A				ENCLOSURE:			
SERVICE: 120/240 V, 1PH, 3 WIRE				LOCATION:			
AIC RATING: SEE ONE-LINE DIAGRAM				SUPPLY FROM:			
Load (VA)							
CKT	LOAD DESCRIPTION	Number of Poles	FRAME SIZE	TRIP RATING	A	B	NOTES
1,2	PANEL 'A'	2	225 A	150 A	15387.6	16620.0	
3,4	PANEL 'B'	2	400 A	250 A	18217.6	20334.4	
5,6	(E)MECHANICAL EQUIPMENT	2	100 A	20 A	5760.0	5760.0	
Load Type Definitions:							
Motor (125% largest Motor + 100% remaining motor)							W=Water Heater (125%)
R= Receptacles (to 10kVA 100%, over 10kVA 50%)							X = X-Rays (Demand per NEC 660.6)
E= Existing Load 30-day metered (125%)							H=Heating (100%)
EL= Elevator (Demand as per NEC Table 620.14)							EV = Electric Vehicle Charging
Load Type	Connected Load	NEC Demand Factor	NEC Demand Load	Panel Totals			
L	2652.0	125.00%	3315.0				
Motor	11667.6	124.68%	14547.6	Total Connected Load:			82079.6
R	17100.0	79.24%	13550.0	Total NEC Demand:			82072.6
G	18980.0	100.00%	18980.0	Total Connected Current:			342 A
Spare	31680.0	100.00%	31680.0	Total NEC Demand Current:			342 A

PANELBOARD: A																			
MAIN LUG ONLY						MOUNTING: SURFACE													
BUS AMPACITY: 150 A						ENCLOSURE: TYPE 1													
EQUIPMENT RATING: 120/240 V, 1PH, 3 WIRE						LOCATION:													
FOR AIC RATING SEE ONE-LINE DIAGRAM						SUPPLIED FROM: MDP													
Accessories:																			
Load (VA)																			
CKT	Description/Location	Type	C.B.	Pole	Note	A	B	A	B	Note	Pole	C.B.	Type	Description/Location	CKT				
1	R PRIVATE THERAPY 124,125	R	20 A	1		1,080		1,080			1	20 A	R	R R PRIVATE THERAPY 110, 111	2				
3	R PRIVATE THERAPY 125,126	R	20 A	1			1,080		1,080		1	20 A	R	R R PRIVATE THERAPY 111	4				
5	R RESTROOM 129, 120, JANITOR...	R	20 A	1		720		180		1	1	20 A	R	R RR 108	6				
7	R PRIVATE THER 131,OFFICE 103	R	20 A	1			1,080	1,080	1	1	20 A	R	R PRIVATE THERAPY 109, 110	8					
9	R HALL122, 132, VEST 101	R	20 A	1		1,080		0			1	20 A	--	(E)SPARE BREAKER	10				
11	R PRIVATE THER. 104,OFFICE 103	R	20 A	1		1,080		0		1	20 A	--	(E)SPARE BREAKER	12					
13	R PRIVATE THERAPY 104,105	R	20 A	1	1	1,080		0		1	20 A	--	(E)SPARE BREAKER	14					
15	R PRIVATE THERAPY 105,107	R	20 A	1			1,080	0		1	20 A	--	(E)SPARE BREAKER	16					
17	(E)FURNACE	--	60 A	2		5,040		5,040		2	60 A	--	(E)FURNACE	18					
19	--	--	--	--	--	--	5,040	--	--	--	--	--	--	--	20				
21	(E)BUSSED SPACE	--	--	--	--	--	5,040	88		1	15 A	Motor	EF-1,2,4	22					
23	(E)BUSSED SPACE	--	--	1		--	--	60		1	15 A	Motor	EF-3,5,6	24					
Total Connected load Ph. A						128 A	Panel...		32.0 kVA	133.4 A									
Total Connected load Ph. B						139 A	Total Demand...		31.2 kVA	129.9 A									
0 A																			
Notes:																			
1. PROVIDE NEW BREAKER AT EXISTING PANEL.																			
Load Type Definitions:																			
Motor (125% largest Motor + 100% remaining motors)				K = Kitchen (Demand as per NEC Table...				C = Continuous Load (125%)				X = X-Rays (Demand per NEC 660.6)							
R = Receptacles (to 10kVA/100%, over 10 kVA 50%)				G = General Load (Non-continuous)(100%)				L = Lighting (125%)				H = Heating (100%)							
E = Existing Load 30-day metered (125%)				EL = Elevator (Demand as per NEC Table...				W = Water Heater (125%)				EV = Electric Vehicle Changer							
Load Type	Connected Load	NEC Demand Factor	NEC Demand Load	Panel Totals															
Motor	147.6	108.74%	160.5																
R	11700.0	92.74%	10850.0	Total Connected Load: 32007.6 VA															
Spare	20160.0	100.00%	20160.0	Total NEC Demand: 31170.5 VA															
				Total Connected Current: 133.4 A															
				Total NEC Demand Current: 129.9 A															









Project

Consultant



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Revisions

No.	Description	Date
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Stamp



Issuance

Permit Set

Date

Mar 22nd, 2024

Project Number

2023-1255

Drawing Title

SPECIFICATIONS -  
ELECTRICAL

Sheet No

E800

## 1 GENERAL

1.1 The general requirements, instructions to bidders, this specification and any addenda hereto form part of the contract documents and shall be read in conjunction with them. Work is to include the furnishing of all labor and materials unless specifically noted otherwise to complete and put into operating condition all electrical systems as indicated on the drawings and specified herein.

## 2 STANDARD OF MATERIAL AND WORKMANSHIP

2.1 All materials are to be new and of the quality specified and are to be UL listed or CSA approved. Where equipment or materials are specified by technical description only, they shall be of the best commercial quality obtainable for the purpose.

2.2 Qualified tradesmen shall execute all work in a neat and workmanlike manner. Electrical trade shall keep a competent foreman and necessary assistants all satisfactory to the engineer on the job during the progress of the work.

## 3 FIRE PROTECTION AND SMOKE SEALING

3.1 Where cables, conduits, bus ducts or similar electrical equipment pass through fire rated assemblies such as floors, walls and ceilings, the fire rating of these assemblies shall be maintained by using engineer approved and UL listed firestop materials. Provide manufacturer literature showing that the proposed firestop system is a UL listed system for the proposed application.

3.2 Where cables, conduits, bus ducts or similar electrical equipment pass through smoke rated assemblies such as floors, walls and ceilings, the smoke rating of these assemblies shall be maintained by using engineer approved and UL listed materials. Provide manufacturer literature showing that the proposed system is a UL listed system for the proposed application.

3.3 The systems used to comply with the smoke sealing and fire protection requirements shall be installed as per the manufacturer recommendations. The manufacturer representative shall witness and confirm that the system has been installed in compliance with manufacturer recommendations and the UL listing for the specific installation.

3.4 This contractor shall provide two letters to the engineer at the completion of the job as follows:

- 1 A letter on the company official letterhead signed by an official of the contracting company with signing authority stating that the systems have been installed as per the manufacturer recommendations.
- 2 A letter on the company official letterhead signed by an official of the manufacturer representative company with signing authority stating they have inspected the systems and that the systems have been installed as per manufacturer recommendations and the UL listing for the specific installations.

3.5 This contractor shall allow for all costs relating to the installation of sealing and fire protection materials for electrical installations, witnessing by the manufacturer representatives and preparation of the letters.

## 4 FLAME RATING OF CABLES

4.1 Cables not installed in enclosed conduit shall be minimum CMP/FT6 rated. Typical examples are: cables in cable tray and cables used for grounding cable trays.

## 5 UNIFORMITY OF EQUIPMENT

5.1 Unless otherwise specifically called for in the specifications, uniformity of manufacture shall be maintained for any particular item throughout the building.

## 6 DRAWINGS AND SPECIFICATION

6.1 The drawings and specifications are complementary each to the other and what is called for by one shall be binding as if called for by both.

6.2 Should any discrepancy appear between the drawings and specifications which leaves the electrical trade in doubt as to the true intent and meaning of the plans and specifications, a ruling shall be obtained from the Engineer. If this is not done, it will be assumed that the most expensive alternate has been allowed for.

## 7 CODES, PERMITS AND INSPECTION

7.1 The installation shall comply with the requirements of the currently adopted edition of the National Electrical Code and the regulations of the Authority Having Jurisdiction.

7.2 The electrical trade shall obtain all permits required and display them in the electrical room.

## 8 EXAMINATION OF THE SITE

8.1 Prior to submitting this bid, the electrical trade is to carefully examine the site and ascertain all conditions, which will affect the electrical trade. No extras will be allowed for work resulting from conditions that would have been evident upon a thorough examination of the site.

## 9 CLEAN UP

9.1 The electrical trade and subtrades are to at all times during construction, keep the site free of all debris, boxes, packing, etc., resulting from work of this trade.

9.2 At the completion of the work, the electrical installation shall be left in a clean finished condition to the satisfaction of the engineer.

9.3 All luminaires and electrical devices are to be washed, cleaned of grease, dirt and lint as required.

## 10 SETTING OUT OF THE WORK

10.1 The electrical trade is responsible for correcting all work-completed contrary to the intent of the drawings and specifications and bear all cost for same. Where the intent of the drawings and specifications is not clear, the electrical contractor is to obtain the clarification of the engineer before proceeding with the work.

10.2 The electrical trade is to give the work personal supervision, lay out their own work, do all necessary leveling and measuring or employ a competent engineer to do so. Figures, full size and detail drawings shall take precedence over scale measurements.

10.3 Where any equipment supplied by the electrical trade must be built in with the work of other contractors, this contractor is responsible for the supplying of the equipment to be built in or measurements to allow necessary openings to be left so as not to hold up the work.

10.4 Electrical trade is responsible for any damage caused the owner or any of the other trades by improper location or carrying out of his work.

## 11 LOCATION OF OUTLETS

11.1 Engineer reserves the right to change location of outlets to within ten (10) feet of points indicated on plans without extra charge providing electrical trade is advised prior to installation.

## 12 CUTTING AND PATCHING

12.1 The Contractor is responsible for all cutting and patching required for the electrical installation. Structural members are not be cut without the consent of the structural engineer.

12.2 Where work by the electrical trade damages work of other trades, the electrical trade shall repair and make good such damage to the satisfaction of the trade concerned and the Engineer.

## 13 ACCESS DOORS

13.1 Number of access doors to be kept to an absolute minimum and to be used only with the permission of the Engineer.

13.2 Where access is required to pullboxes and junction boxes, these boxes are to be located in removable type ceiling areas where possible or adjacent to recessed luminaires.

13.3 Where it is absolutely impossible to service certain equipment through removable type ceilings or recessed luminaires and where special permission has been obtained from the Engineer, Division 26 to supply and install access doors of such work. Access doors to be complete with necessary frames and hinged doors held closed with captive type studs. Access panels to be of not less than 14 gauge MDF, prime coated and painted on the job to match the wall or ceiling finish or as requested by the Architect.

## 14 PAINTING AND FINISHES

14.1 All electrical fittings, supports, hanger rods, pullboxes, channel frames, conduit racks, outlet boxes, brackets, clamps, etc., are to have galvanized finish or paint finish over corrosion-resistant primer.

14.2 All panelboards are to be factory finished with spray on air dry enamel. All enamel shall be applied over corrosion resistant primer. Matte or flat type finish paint will not be accepted. All panels or similar factory finished units that are scratched or marked during installations are to be touched up with matching spray on dry lacquer and if required to provide satisfactory job are to be completely refinished.

## 15 SHOP DRAWINGS

15.1 Electrical trade is to submit to the Engineer for approval, shop drawings of electrical components as requested in relevant specification sections.

15.2 All drawings are to be submitted electronically in PDF format.

15.3 The Engineer's review of shop drawings is for general design only and does not relieve the electrical trade or suppliers from their responsibility for errors, proper fitting, construction of the work and furnishing of materials. The review is not to be construed as approving departures from the contract document requirements if such departures are not specifically noted in a covering letter accompanying such drawings. Electrical trade is responsible for verifying all dimensions.

## 16 RECORD PLANS

16.1 Maintain at site at least one set of drawings for recording "As-constructed" conditions. Electrical trade is to accurately record on this set of plans, day by day, all outlets, conduit, luminaires, equipment as actually installed on the job. Any changes to the contract work are to be similarly recorded.

16.2 As-built drawings shall be clearly marked in red including all changes to the original bid drawings covered by addenda, change orders, field changes, Job conditions, etc.

16.3 At completion of project, input changes to original project on CAD Drawings or within the Revit model and make one set of black-line drawings in version/release equal to contract drawings. Submit CAD Files or Revit Model and drawings upon substantial completion.

## 17 TESTS

17.1 All portions of the electrical work are to be tested and checked for satisfactory operation.

17.2 Before energizing any portion of the electrical system, perform megger tests on all feeders and branch circuits. Results of such tests shall conform to the requirements of the National Electrical Code and are to be to the satisfaction of the authorized inspection agency and the Engineer.

17.3 Upon completion of the work and immediately prior to final inspection and takeover, check the load balance on all feeders and at distribution center, panels, etc. Turning on all possible loads in the tenant and checking load current balance shall carry out the tests. If load unbalance exceeds 15 per cent, reconnect circuits to balance the load.

## 18 GUARANTEE/WARRANTY

18.1 That all work executed under this contract will be free from defects of material and workmanship for a period of one (1) year from the date of final acceptance of this work, unless noted otherwise.

18.2 The above parties further agree to, at their own expense, repair and replace all such defective work and other work damaged thereby which fails or becomes defective during the term of the warranty provided that such failure is not due to improper usage.

18.3 The period of the warranty specified shall in no way supplant any other guarantee of a longer period but shall be binding on work not otherwise covered.

18.4 All Category 6 data cables and connectors will carry a 25-year manufacturer's warranty for bandwidth to 2.4Gbps.

## 19 BUILDING WIRING

19.1 All wiring shall be copper with THHN/THWN-2 insulation in rigid galvanized steel conduit or electrical metallic tubing. No wire smaller than No. 12 AWG gauge is to be used for branch circuit wiring. MC cable may be used only as follows:

- 1 Above removable ceilings from EMT junction boxes down to new duplex receptacles mounted in existing drywall partitions. In this case, the EMT junction box must be mounted on the slab immediately above the partition wall.
- 2 Within new drywall partitions to interconnect electrical devices, except that the connection from the junction box above the suspended ceiling down to the first electrical device in the drywall shall be wire in EMT conduit or empty EMT conduit for low voltage devices.
- 3 With the above exceptions, all 120-volt branch circuit wiring must be installed in rigid conduit or EMT. MC cable shall be complete with anti-short bushings. Wiring shall be color coded to match existing installation. Rigid threaded galvanized steel conduit is to be used for stub-ups from concrete slabs and for exposed runs below seven (7) feet from the floor.

19.2 Conduit to be sized in accordance with the National Electrical Code.

19.3 Where the floor slab is drilled for conduit installation to wall junction boxes or to floor fittings the floor shall be DRY CORE DRILLED. After conduit installation the opening shall be caulked and sealed. Conduit after installation of conductors shall be sealed with heavy density fiberglass, to maintain the integrity of the fire rating for the structure. Electrical trade to pay for all associated X-ray costs.

## 20 DEMOLITION

### 20.1 General

20.1.1 All unused conduit, wire, hangers, etc. is to be removed from the ceiling space. The intent is to keep the ceiling space clean.

20.1.2 The Contractor is to record as-built information showing luminaire type, junction boxes, conduit routes, and circuit numbers. The contractor shall provide as-built drawings to the Owner at the completion of the project.

20.1.3 The Contractor is to turn over equipment being removed to building management. Equipment not required by building management is to be removed from site by the Contractor.

20.1.4 The Contractor is to seal all unused openings due to electrical demolition to ensure that fire-resistance rating is maintained.

20.1.5 Provide decora blank coverplates at all unused outlets.

### 20.2 Lighting & Lighting Controls

20.2.1 Existing base building luminaires are to remain unless noted otherwise.

20.2.2 Luminaires to be removed as indicated on the drawings.

20.2.3 Switches on walls being demolished shall be removed.

20.2.4 Unused conduit and wire are to be removed.

20.2.5 Provide blank coverplates at all unused outlets.

20.2.6 Dimming stations associated with dimming system are to be removed. All conduit/wire to be removed in its entirety.

### 20.3 Power

20.3.1 All circuits originating from panel boards located in electrical room which are not being re-used shall be pulled back to the source. Show information on as-built drawings. The electrical contractor is to inform the owner of any deficiency that is encountered during the demolition.

20.3.2 Power connections and outlets are to be removed from walls to be demolished.

20.3.3 All power associated with the existing Audio/Visual systems, including A/V racks & cabinets and panels & associated conduit/wire shall be removed back to the source in Electrical Room. Dimming Cabinets in the Electrical Riser Room shall also be removed.

20.3.4 All electrical devices affected by demolition not shown on existing walls and columns are to be removed.

20.3.5 Ensure that all existing receptacles left isolated by the removal of outlets in the same run shall be re-fed to become fully functional to the satisfaction of the engineer.

### 20.4 Communications

20.4.1 Conduits are to be removed back in their entirety.

20.4.2 All communication outlets with cabling, coverplates and connectors are to be removed where indicated.

20.4.3 Data cabling interconnecting floors that is supplemental to base building riser systems shall be removed.

20.4.4 Remove existing fiber and copper backbone between each floor and Floor Data Room.

20.4.5 Existing communications cabling and connectors not shown on existing walls and columns are to be removed. Communications outlets that are not being reused shall be blanked off with coverplates.

### 20.5 Systems

20.5.1 Fire alarm detection and alarm system are to remain operational during demolition.

20.5.2 Fire alarm devices located on walls being demolished are to be removed and neatly secured to nearest building structure.

20.5.3 All security and miscellaneous systems not related to base building operations are to be removed and their conduit and wire removed back to the source.

## 21 WIRING DEVICES

21.1 Boxes, except where otherwise noted, shall be pressed sheet steel UL listed and galvanized to CSA standards. All outlets for flush wall mounting switches, receptacles, telephone and LV outlets shall be No. 52151 box with appropriate plaster cover for single, 2-gang outlets or 4-gang outlets. Flush mounting voice/data, data & telephone wall outlets shall be No 52171 series (4 inch square, 2 1/8 inches deep with appropriate plaster or extension ring.

21.2 Sectional type boxes or handy boxes shall not be used.

21.3 Receptacles on levels shall be white decora, or match existing. Where called for on the drawings, receptacles shall be orange faced indicating isolated ground receptacles. Receptacle mounting height to be at 18 inches. Special receptacles will be as shown on the drawings. Receptacles to be of specification grade and of one manufacturer throughout, e.g., Leviton.

21.4 Typical wall outlets comprising of more than two duplex receptacles or light switches shall have a common gang faceplate.

21.5 Occupancy lighting motion sensors shall be as manufactured by Wattstopper. Occupancy sensors shall be complete with power packs.

21.6 Plates for all flush mounting devices shall be white decora.

21.7 All isolated ground circuits to have separate neutral conductor per phase.

21.8 For non-isolated ground computer receptacles, provide separate neutral conductor per phase.

21.9 Kroy duratape 200 nametags to be provide on all existing and new receptacles indicating circuits and panel designation, e.g. B32. At all locations, dedicated circuits such as printers, faxes, plotters, copiers, etc. indicated on coverplate receptacle designation, i.e. computer, fax, printer, etc.

## 23 SUPPORTING DEVICES

23.1 Conduit supports: Single runs - to be galvanized conduit straps or ring bolt range 1 type hangers; multiple runs (three or more) - conduit rack; vertical runs - channel support with conduit fittings.

23.2 Install to maintain headroom, neat mechanical appearance and to support equipment loads required. Where inserts are required in concrete, expansion inserts, lead inserts or plastic inserts may be used in drilled holes. Wood or fiber plugs not permitted.

23.3 All electrical distribution including cable tray and conduit, which is mounted above the suspended ceiling, shall be supported directly and independently from the concrete slab.

23.4 The use of any part of the ceiling or ceiling suspension system as a support or foundation for the suspension of cable tray, conduit or flexible conduit (where permitted) is forbidden.

23.5 The use of any drywall or wall partition as a support or foundation for cable tray or conduit routed horizontally through the ceiling space is forbidden.

23.6 Support hangers and other trades to support non-electrical services or devices shall not use trays installed by the electrical trade.

## 24 PULLBOXES

24.1 Supply and install pullboxes as shown on the drawings and as required suiting job conditions. Pullboxes shall conform to National Electrical Code requirements and shall be finished in enamel over corrosion-resistant primer with screw on or hinged cover. In removable ceiling areas, pullboxes are to be installed above the ceiling. Pullboxes in finished walls and plaster or non-removable ceilings shall have overlapping type trim with covers prime coated and painted on job to match wall or ceiling finish.

24.2 Surface mounted pullboxes or pullboxes above ceiling shall be finished in colors matching existing building.

## 25 GROUNDING

25.1 Supply and install a complete grounding system. The grounding/earthing system must meet the following criteria:

- 1 Local electrical codes must be adhered to.
- 2 The grounding/earthing system shall comply with J-STD-607-A and ANSI/TIA-942.
- 3 All grounding/earthing conductors shall be copper.
- 4 Lugs, HTAP's, grounding strips shall be made of tin plated electrolytic copper. Antioxidant shall be used while making connections in the field.
- 5 Wherever possible, two hole lugs shall be used. All lugs shall be irreversible compression and meet NEBS level 3. Lugs with inspection windows shall be used in all non-corrosive environments.
- 6 Die index numbers shall be embossed on all compression connections to allow for inspection.
- 7 Cable assemblies shall be UL listed and CSA certified. Cables shall be distinctive green or green/yellow in colour and all jackets shall be UL, VW-1 flame rated.

25.2 The Telecommunications Grounding Busbar (TGB) in the telecommunications space will be grounded/earthed to the Telecommunications Main Grounding Busbar (TMGB) located at service entrance via the telecommunications grounding riser in electrical room. The gauge of the connecting ground/earth cable, known as the Telecommunications Bonding Backbone (TBB) will follow J-STD-607-A guidelines as indicated on drawings.

25.3 Any metallic component in the same space as the TGB including racks, ladders, enclosures, equipment, surge protective devices, cable tray, TBB's, other TGB's, electrical power panels for telecommunications equipment and the Grounding Equalizer if present. Equipment and rack shall be bonded in accordance with the methods described in ANSITIA-942.

25.4 Route TBB to each TGB in as straight a path as possible. The TBB should be installed as a continuous conductor avoiding splices where possible. Plumbing and conduit shall not be used as TBB.

## 26 FIRE ALARM SYSTEM

26.1 Electrical trade is to extend existing closed circuit supervised annunciated fire alarm systems into tenant premises as indicated on drawings and specified herein. All new equipment and components shall match existing base building equipment and shall be by same manufacturer.

26.2 Connect new fire alarm system devices to the existing building fire alarm system per landlord and AHJ requirements. Expand/modify/reprogram existing fire alarm system as required to accommodate the new devices indicated. This is a performance based specification: Items shown are a minimum. Provide additional devices as required to adhere to all code requirements. Acceptable manufacturers: Match existing system manufacturer.

26.3 Actual fire alarm design is to be by a company licensed to design/install fire alarm systems in the State of Oregon. Fire Alarm submittals are to be submitted to AHJ for review and approval. Coordinate with facility personnel for possible specific fire alarm groups that should accommodate the fire alarm system updates. Obtain contact information from owner's representative and provide for all items accordingly.

26.4 All fire alarm strobes are to be minimum 110 candela and mounted 80" above finished floor.

26.5 Color code fire alarm system wiring and install in conduit. Install all wiring and products per manufacturer's requirements.

26.6 Make conduit and wiring connections to duct mounted smoke detectors.

26.7 Test completed fire alarm system in accordance with NFPA and the local AHJ.

26.8 All smoke detectors are to feed through fire alarm control unit, including smoke detectors installed in main supply air duct of each A/C unit. See mechanical drawings for duct detector locations.

26.9 All smoke detectors are to be minimum 36" away from HVAC supply diffusers or return air grilles.

26.10 Fire alarm system is to provide direct notification to the fire department.

## 27 LIGHTING CONTROL SYSTEM

27.1 Occupancy/Vacancy sensor layout on Drawings are designed based on Lutron; Approved manufacturers listed are allowed on condition of meeting the specified conditions including complete sensor coverage of the area controlled and switching of luminaires in the area controlled. Provide additional sensors and power switch packs as needed to provide the same level of functionality as shown on Drawings or required in Specifications. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.

27.2 Occupancy sensor designation indicates sensors automatically turn lights ON when the sensor detects the presence of a person and will automatically turn lights OFF when no presence is detected for a specified amount of time (automatic-on and automatic-off).

27.3 Vacancy sensor designation requires someone to manually turn the lights ON. The sensor will then automatically turn the lights OFF when no presence is detected for a specified amount of time (manual-on and automatic-off).

27.4 Ceiling-Mounted Sensor: Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off). 360 degree sensor range; coverage: 1200 SF, unless otherwise noted on drawings. Multiple sensors can be wired in parallel to allow coverage of large areas.

27.5 Combination occupancy/vacancy wall switches ("Sensor switches") Completely self-contained sensor system that fits into standard single gang box. Passive infrared sensor technology includes advanced signal processing to reduce false triggers without increasing sensitivity. LED indicator blinks when occupant sensed. Includes neutral wire to meet NEC. Finish is to be white.

## 28 POWER DISTRIBUTION

28.1 Provide new equipment as indicated on the drawings. Branch circuit breakers and wiring to be installed under this contract. Provide typewritten directory of panel loads and affix to panelboard doors.

28.2 Panelboards shall be composed of the number of circuit breakers with poles and trip ratings as listed in the schedules. Where space only is called for, provide all mounting brackets, busbar drillings, filerplates, etc., to facilitate installation of future breakers.

28.3 New panelboards shall be of 225 amps, three phase, four wire solid neutral design composed of an assembly of bolt-in-place type molded case automatic air circuit breakers with both thermal and magnetic trip and trip free action. Each breaker shall be identified as to function and load controlled.

28.4 Panelboards shall be of corrosion-resistant finish having trim for flush or surface mounting as indicated in the schedules. Panelboard trim shall have a hinged locking door with flush type catch and lock over circuit breakers. All panelboards shall be of matching type to existing project.

28.5 Where called for provide an isolated stand-off ground bus on new or existing panelboards and connect back to the building ground with insulated #2 AWG.

28.6 Panel schedules shall be retyped to reflect existing and new circuits.

28.7 Panelboards to be subfed or double lugged as indicated. Provide double lug kits in existing and new panelboards as required. New panelboards feeding IG circuits shall be complete with IG bar. Where existing panelboards are being replaced with new, contractor shall relocate existing branch circuits to new panelboard and provide new breakers for existing and new circuits.

28.8 Label all equipment with lamacoid labels. Labels indicate equipment designations and voltage. Report to the engineer prior to installation.

28.9 Work requiring shutdown of power bus duct shall be coordinated with landlord and shall be carried out beyond normal working hours.

28.10 Allow for relocation of any equipment in electrical room which are necessary to allow for proper installation of new and relocated equipment.

28.11 Calculate arc flash incident energy (AIE) levels and flash protection boundary distances to determine required level of personal protective equipment (PPE) at applicable electrical equipment during normal conditions that could result in maximum arc flash incident energy levels. Calculations are to be stamped by a currently licensed electrical engineer registered in the State of the project scope. Provide label compliant with NFPA 70E guidelines indicating personal protective equipment (PPE) recommended for servicing of electrical equipment while energized, as well as calculated incident energy levels and arc flash protective boundary distance.

## 29 LUMINAIRES

29.1 Original installation of building standard 2/F32 watt T8 indirect basket type fluorescent luminaires does not form part of this contract.

29.2 However, supply and installation of low voltage switching equipment and wiring, over and above what presently exists, will be the responsibility of this contractor.

29.3 Luminaires shall be added, relocated or removed as indicated. Luminaires removed shall be turned over to the building owners.

29.4 Electrical trade shall be responsible for cleaning and replacing any and all damaged lens, faulty ballasts and provide touch-up paint where required. Replace burnt out lamps for fluorescent and incandescent luminaires where required.

29.5 All luminaires to be supplied complete with lamps. Incandescent lamps to be 5000 hours, 130 volt extended service type. Unless otherwise noted, all fluorescent lamps shall be standard warm white T8. Special lamps to be used where indicated with the longest life available in each category. Lamps shall be as manufactured by Phillips, Osram or SYLVANIA.

29.6 Light Emitting Diodes (LED's)

- 1 All LED products must be tested and certified using the latest IES Standards LM-79 and LM-80, as well as ANSI Standards C62.41.1 and C62.41.2
- 2 Correlated Color Temperatures to conform to latest ANSI NEMA ANSLG C78.377.
- 3 Color Rendering Index to be greater than 80 CRI.





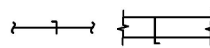
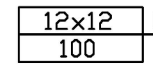
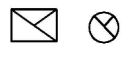
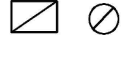

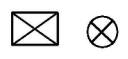

MECHANICAL SYMBOL LIST

NOTE: This is a standard symbol list and not all items listed may be used.

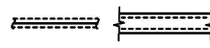
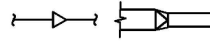
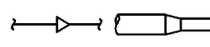
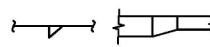
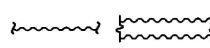

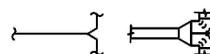
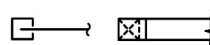

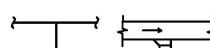
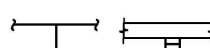
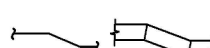
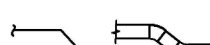
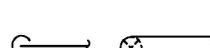

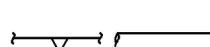
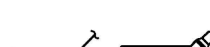
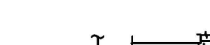
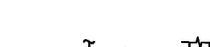

Abbreviations

AFF	ABOVE FINISHED FLOOR
A/C	AIR CONDITION(ED)
BDD	BACKDRAFT DAMPER
CD	CEILING DIFFUSER
CONT.	CONTINUATION
DB	DECIBEL
(X)	DEMOLISH
DIA	DIAMETER
DG	DOOR GRILLE
DB	DRY BULB
ELECT	ELECTRICAL
EXH	EXHAUST
EF	EXHAUST FAN
(E)	EXISTING
F	FAHRENHEIT
FT	FEET
FLA	FULL LOAD AMPS
HP	HORSEPOWER
IN	INCHES
ID	INSIDE DIAMETER
KW	KILOWATT
MAX	MAXIMUM
MIN	MINIMUM
(N)	NEW
N/A	NOT APPLICABLE
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
NO.	NUMBER
OC	ON CENTER
OBD	OPPOSED BLADE DAMPER
OA	OUTSIDE AIR
OD	OUTSIDE DIAMETER
PH	PHASE
LBS.	POUNDS
PD	PRESSURE DROP
QTY	QUANTITY
(R)	RELOCATE/RELOCATED LOCATION
RET	RETURN
RA	RETURN AIR
RPM	REVOLUTIONS PER MINUTE
R	RISE
SF	SQUARE FEET
SP	STATIC PRESSURE
SA	SUPPLY AIR
T, TEMP	TEMPERATURE
TP	TOTAL PRESSURE
UD	UNDERCUT DOOR
VEL	VELOCITY
V	VOLT
VD	VOLUME DAMPER (HAND OPERATOR)
W	WATT
W	WITH
W/O	WITHOUT

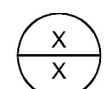
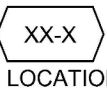

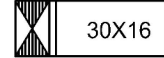

Control Symbols

	E	LINE VOLTAGE THERMOSTAT
	AC-1	SPACE TEMPERATURE SENSOR/THERMOSTAT
		VOLUME DAMPER
	12x12 CD-1	DIFFUSER OR GRILLE IDENTIFICATION
		EXHAUST AIR
		RETURN AIR
		RETURN/EXHAUST AIR FLOW
		SUPPLY AIR
		SUPPLY AIR FLOW

Ductwork Fittings

		ACOUSTICALLY LINED DUCT (SIZES SHOWN ARE NET INSIDE)
		CONCENTRIC SQUARE TO ROUND
		CONCENTRIC TRANSITION, RECTANGULAR OR ROUND
		ECCENTRIC TRANSITION, RECTANGULAR OR ROUND
		FLEX DUCT
		FLEXIBLE CONNECTION
		NON-SYMMETRICAL WYE
		RECTANGULAR DUCT DROP
		RECTANGULAR DUCT RISER
		RECTANGULAR MAIN WITH RECTANGULAR BRANCH
		RECTANGULAR MAIN WITH ROUND BRANCH
		RECTANGULAR OFFSET LESS THAN 15% $\Delta$ d
		RECTANGULAR OFFSET MORE THAN 15% $\Delta$ d
		ROUND DUCT DROP
		ROUND DUCT RISER
		ROUND DUCT WITH ROUND BRANCH
		ROUND WYE
		SYMMETRICAL WYE
		MITERED ELBOW WITH TURNING VANES
		RADIUSED ELBOW

General

		DETAIL NUMBER AND SHEET LOCATION
		EQUIPMENT IDENTIFICATION
		KEYED NOTE
	30x16	RECTANGULAR DUCT SIZING
	30"Ø	ROUND DUCT SIZING

GENERAL MECHANICAL NOTES

- PROVIDE MISCELLANEOUS METALS AND MATERIALS FOR A COMPLETE INSTALLATION OF THE HVAC SYSTEM (E. SUPPORT, BRACING, ETC.)
- PRIOR TO SUBMISSION OF BID, REVIEW A COMPLETE SET OF CONSTRUCTION DOCUMENTS (INCLUDING ALL OTHER TRADES). INCLUDE ADDITIONAL PIPE OR DUCT OFF-SETS THAT MAY BE REQUIRED TO CLEAR STRUCTURE, FINISHES OR WORK OF OTHER TRADES. FIELD VERIFY EXACT LOCATION AND SIZES OF EXISTING UTILITIES, THE PROPOSED POINT OF CONNECTIONS TO EXISTING SYSTEMS, AND NEW ROUTINGS. EXTRA PAYMENT WILL NOT BE ALLOWED FOR WORK RESULTING FROM LACK OF APPRAISAL OF ENTIRE SCOPE OF WORK PRIOR TO BID. SYSTEM LAYOUTS AS INDICATED ON DRAWINGS ARE GENERALLY DIAGRAMMATIC BUT SHALL BE FOLLOWED AS CLOSELY AS ACTUAL CONSTRUCTION WILL PERMIT.
- DUCTWORK DIMENSIONS SHOWN ON DRAWINGS ARE CLEAR INTERNAL DIMENSIONS. WHEN ACOUSTICAL DUCT LINING IS REQUIRED INCREASE DUCT SIZE AS NECESSARY TO MAINTAIN THE CLEAR INTERNAL DIMENSIONS.
- DUCT RUNOUTS TO SUPPLY, EXHAUST, AND RETURN GRD'S TO MATCH SIZE OF CONNECTED GRD, UNLESS NOTED OTHERWISE.
- PROVIDE DUCT ACCESS DOORS FOR EQUIPMENT AND DEVICES REQUIRING ACCESS OR RESETTNG (IE. FIRE AND SMOKE DAMPERS, SMOKE DAMPERS, SENSORS, ETC.) INDICATE SIZE AND LOCATION ON COORDINATED SHOP DRAWINGS.
- PROVIDE MANUAL VOLUME DAMPERS AT EACH GRILLE, REGISTER, AND DIFFUSER. DO NOT USE VOLUME DAMPERS INTEGRAL WITH GRILLES, DIFFUSERS AND REGISTERS FOR AIR BALANCING.
- PROVIDE DUCTWORK AND TRANSITIONS EQUAL TO DUCT FREE AREA SHOWN ON DRAWINGS. TO PREVENT A SPATIAL CONFLICT, AT CONTRACTOR'S OPTION AND IF SPATIAL CONSTRAINTS ALLOW, ROUND SPIRAL DUCTWORK OF EQUAL CROSS-SECTIONAL AREA OR LARGER, MAY BE USED IN LIEU OF RECTANGULAR DUCTWORK WHERE SHOWN ON PLANS.
- USE FLEXIBLE DUCTS ONLY FOR THE LAST 5 FEET MAXIMUM AT AIR OUTLETS. DO NOT USE FLEXIBLE DUCTWORK IN LIEU OF ELBOWS OR FITTINGS.
- COORDINATE EXACT LOCATIONS AND ELEVATIONS OF ALL SIDEWALL GRILLES WITH ARCHITECT.
- COORDINATE WITH DIVISION 28 FOR LOCATION OF POWER AND LOCAL DISCONNECTS FOR MECHANICAL EQUIPMENT DEVICES. PROVIDE STARTERS FOR EQUIPMENT WITHOUT VFD'S, ECM MOTORS, OR EQUIPMENT WITHOUT INTEGRAL STARTERS.
- INSTALL EQUIPMENT WITH SUFFICIENT ACCESS TO PANELS, CONTROLS, FILTERS, MOTORS, ETC. COORDINATE ACCESS TO ALL DAMPERS, VALVES, AND OTHER SERVICEABLE EQUIPMENT. REVIEW CEILING HEIGHTS AND COORDINATE ACCESS PANEL LOCATIONS.
- PROVIDE CEILING ACCESS PANELS FOR ACCESS TO CONCEALED EQUIPMENT AND OTHER DEVICES. LOCATION OF ACCESS PANELS IS THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE WITH AS-BUILT CONDITIONS. ALL CEILING PANELS MAY NOT BE INDICATED ON THE MECHANICAL DRAWINGS. SUBMIT PROPOSED ACCESS PANEL LAYOUT TO ARCHITECT DURING PRE-CONSTRUCTION COORDINATION PROCESS FOR REVIEW.
- VERIFY DIFFUSERS, GRILLES, AND REGISTER, FACTORY FINISH COLOR, MOUNTING FRAME TYPES WITH CONSTRUCTION TYPE AND CONFIGURATION.
- PAINT FLAT BLACK ALL VISIBLE INTERIOR PORTIONS OF DUCTWORK.
- PROTECT AND ISOLATE DUCTS STORED ON CONSTRUCTION SITE FROM DUST CONTAMINATION.
- PROTECT AND ISOLATE EQUIPMENT STORED ON CONSTRUCTION SITE FROM WEATHER AND DUST CONTAMINATION.
- COORDINATE LOCATION OF SENSORS AND THERMOSTATS WITH ARCHITECT AND OTHER WALL MOUNTED SWITCHES (IE LIGHTS), COMPLY WITH ADA REQUIREMENTS.
- "DEMOLISH" OR "REMOVE": REMOVE AND RETURN TO OWNER FOR ACCEPTANCE, AND DISPOSE OF ANY ITEMS NOT ACCEPTED BY THE OWNER.

SHEET INDEX

M001	SYMBOL LIST AND GENERAL NOTES - MECHANICAL
M002	SCHEDULES - MECHANICAL
M201	FLOOR PLAN - MECHANICAL
M500	DETAILS - MECHANICAL



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Revisions

No. Description Date

Stamp



Issuance

Permit Set

Date

Mar 22nd, 2024

Project Number

2023-1255

Drawing Title

SYMBOL LIST AND  
GENERAL NOTES -  
MECHANICAL

Sheet No

M001



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FAN SCHEDULE																
SYMBOL	LOCATION	AREA SERVED	BASIS OF DESIGN		TYPE	DRIVE	AIR FLOW (CFM)	ESP (IN H2O)	MAX RPM	MAX SONES	ELECTRICAL			CONTROLS REF	MAX WT (LBS)	COMMENTS
			MFR	MODEL							VOLTS	PH	WAT TS			
EF-1	RESTROOM 120	RESTROOM 120	GREENHECK	SP-A125	CEILING	DIRECT	100	0.25	1054	0.6	120	1	18	LIGHT SWITCH	18	SPEED CONTROLLER, BACKDRAFT DAMPER, WALL CAP
EF-2	RESTROOM 119	RESTROOM 119	GREENHECK	SP-A125	CEILING	DIRECT	100	0.25	1054	0.6	120	1	18	LIGHT SWITCH	18	SPEED CONTROLLER, BACKDRAFT DAMPER, WALL CAP
EF-3	JANITOR 123	JANITOR 123	GREENHECK	SP-A125	CEILING	DIRECT	100	0.25	1054	0.6	120	1	18	TIME CLOCK	18	SPEED CONTROLLER, BACKDRAFT DAMPER, WALL CAP
EF-4	LAUNDRY 121	LAUNDRY 121	GREENHECK	CSP-A125	INLINE CABINET	DIRECT	100	0.25	969	0.3	120	1	52	TIME CLOCK	17	SPEED CONTROLLER, BACKDRAFT DAMPER, WALL CAP
EF-5	RESTROOM 120	RESTROOM 120	GREENHECK	SP-A125	CEILING	DIRECT	100	0.25	1054	0.6	120	1	18	LIGHT SWITCH	18	SPEED CONTROLLER, BACKDRAFT DAMPER, WALL CAP
EF-6	STORAGE 130	STORAGE 130	GREENHECK	CSP-A390-VG	INLINE CABINET	DIRECT	350	0.25	1279	1.4	120	1	74	LINE VOLTAGE T-STAT	24	EC MOTOR, BACKDRAFT DAMPER

DIFFUSER, REGISTER AND GRILLE SCHEDULE								
SYMBOL	TYPE	FACE	FRAME	DAMPER	FINISH	BASIS OF DESIGN		COMMENTS
CD-1	CEILING SUPPLY DIFFUSER	PERFORATED	LAY-IN	NONE	WHITE	TITUS	PCS	
CD-2	CEILING SUPPLY DIFFUSER	PERFORATED	SURFACE	NONE	WHITE	TITUS	PCS	
CEG-1	CEILING EXHAUST GRILLE	PERFORATED	LAY-IN	NONE	WHITE	TITUS	PAR	
CRG-1	CEILING RETURN GRILLE	PERFORATED	LAY-IN	NONE	WHITE	TITUS	PAR	

OUTSIDE AIR VENTILATION SCHEDULE - EXISTING AC UNIT, EAST											
EQUIPMENT TAG	ROOM	Az NET OCCUPIABLE FLOOR AREA (SF)	DEFAULT OCCUPANT DENSITY (#/1000SF)	Rp PEOPLE OUTDOOR AIR RATE (CFM / PERSON)	Ra AREA OUTDOOR AIR FLOW RATE (CFM/SQ FT)	DEFAULT ZONE POPULATION	Pz ACTUAL ZONE POPULATION	Vbz BREATHING ZONE OUTDOOR AIRFLOW (CFM)	EZ ZONE AIR DISTRIBUTION EFFECTIVENESS	Voz ZONE OUTDOOR AIRFLOW (CFM)	DESIGN OSA (CFM)
EXIST. AC UNIT, EAST	OFFICE 103, 114, 115, PRIVATE THERAPY 104, 105, 107, 110, 112, 113	1090	5	5.00	0.06	6	11	120	0.8	151	155
EXIST. AC UNIT, EAST	LARGE THERAPY 111	680	25	5.00	0.06	17	17	126	0.8	157	160
EXIST. AC UNIT, EAST	HALL	375	0	0.00	0.06	0	6	23	0.8	28	30
NOTES: 1 2	BREATHING ZONE OUTDOOR AIRFLOW: Vbz = Rp*Pz + Ra*Az. ZONE OUTDOOR AIRFLOW: Voz= Vbz/Ez.										TOTAL: 345

OUTSIDE AIR VENTILATION SCHEDULE - EXISTING AC UNIT, WEST											
EQUIPMENT TAG	ROOM	Az NET OCCUPIABLE FLOOR AREA (SF)	DEFAULT OCCUPANT DENSITY (#/1000SF)	Rp PEOPLE OUTDOOR AIR RATE (CFM / PERSON)	Ra AREA OUTDOOR AIR FLOW RATE (CFM/SQ FT)	DEFAULT ZONE POPULATION	Pz ACTUAL ZONE POPULATION	Vbz BREATHING ZONE OUTDOOR AIRFLOW (CFM)	EZ ZONE AIR DISTRIBUTION EFFECTIVENESS	Voz ZONE OUTDOOR AIRFLOW (CFM)	DESIGN OSA (CFM)
EXIST. AC UNIT, WEST	TRAINING 118	372	50	5.00	0.06	19	19	117	0.8	147	150
EXIST. AC UNIT, WEST	COPIES 117	155	4	5.00	0.06	1	1	14	0.8	18	20
EXIST. AC UNIT, WEST	BREAK ROOM	230	25	5.00	0.06	6	6	44	0.8	55	55
EXIST. AC UNIT, WEST	PRIVATE THERAPY 124, 125, 126, 131	440	5	5.00	0.06	3	4	46	0.8	58	60
EXIST. AC UNIT, WEST	HALL 122, 128, 132	589	0	0.00	0.06	0	4	35	0.8	44	45
NOTES: 1 2	BREATHING ZONE OUTDOOR AIRFLOW: Vbz = Rp*Pz + Ra*Az. ZONE OUTDOOR AIRFLOW: Voz= Vbz/Ez.										TOTAL: 330



Project

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Revisions

No.	Description	Date
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Stamp



Issuance

Permit Set

Date

Mar 22nd, 2024

Project Number

2023-1255

Drawing Title

SCHEDULES -  
MECHANICAL

Sheet No

M002





Consultant

**INTERFACE**  
ENGINEERING

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Revisions

No.	Description	Date
-----	-------------	------

Stamp



Issuance

Permit Set

Date

Mar 22nd, 2024

Project Number

2023-1255

Drawing Title

FLOOR PLAN -  
MECHANICAL

Sheet No

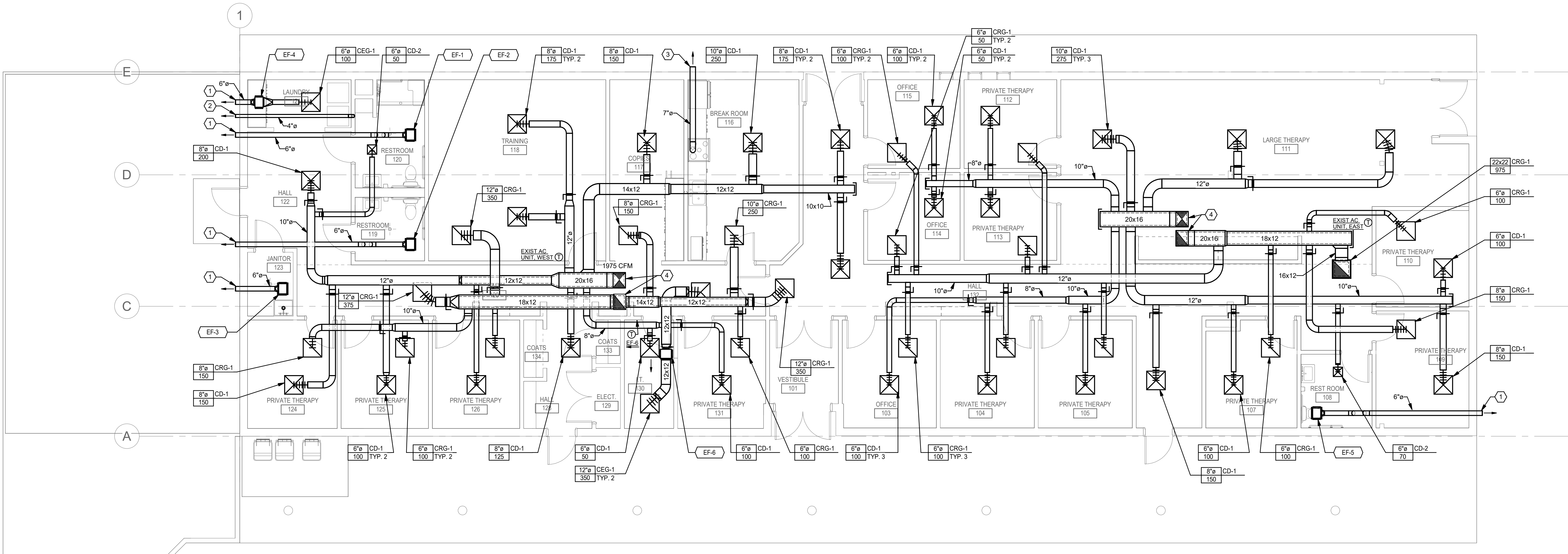
M201

## GENERAL SHEET NOTES

- SEE ARCHITECTURAL DRAWINGS FOR HVAC DEMOLITION NOTES.
- TWO EXISTING 5-TON ROOFTOP AC UNITS WITH GAS HEAT ARE TO REMAIN.
- EXISTING DOMESTIC HOT WATER HEATER GAS FLUE IN EXISTING JANITOR CLOSET IS TO REMAIN.
- PROVIDE NEW PROGRAMMABLE THERMOSTATS TO CONTROL TWO EXISTING ROOFTOP AC UNITS WITH GAS HEAT.
- PROVIDE AIR FLOW BALANCING INFORMATION FOR TWO EXISTING ROOFTOP AC UNITS PRIOR TO DEMOLITION PER 23 05 93.
- BALANCE EXISTING AC UNIT SUPPLY FAN TO AIR FLOW EQUAL TO SUM OF SUPPLY GRILLES. BALANCE EXISTING AC UNIT OUTSIDE AIR DAMPER TO AIRFLOW SHOWN IN OUTSIDE AIR VENTILATION SCHEDULE.
- COORDINATE ELEVATIONS OF ALL EXTERIOR SIDEWALL DUCT TERMINATIONS WITH ARCHITECT.

## SHEET KEYNOTES

- TERMINATE EXHAUST DUCT WITH FACTORY WALL CAP PROVIDED BY FAN MANUFACTURER.
- TERMINATE DRYER DUCT WITH HOODED WALL CAP WITH BACKDRAFT FLAPPER.
- TERMINATE RESIDENTIAL EXHAUST HOOD DUCT WITH HOODED WALL CAP WITH BIRD SCREEN.
- ROUTE LINED 20x16 SUPPLY AND RETURN DUCTS UP TO EXISTING AC UNIT ON ROOF.



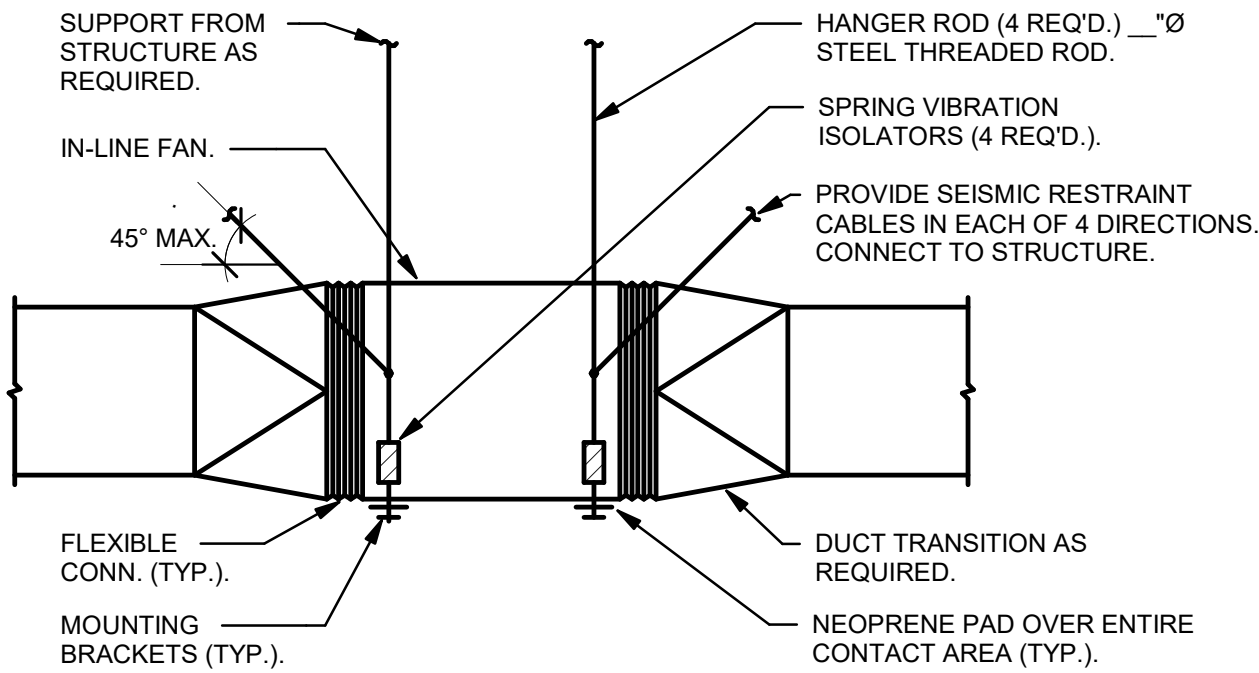
1 LEVEL 1 MECHANICAL PLAN - OVERALL



0' 4' 8' 16'  
3/16" = 1'-0"

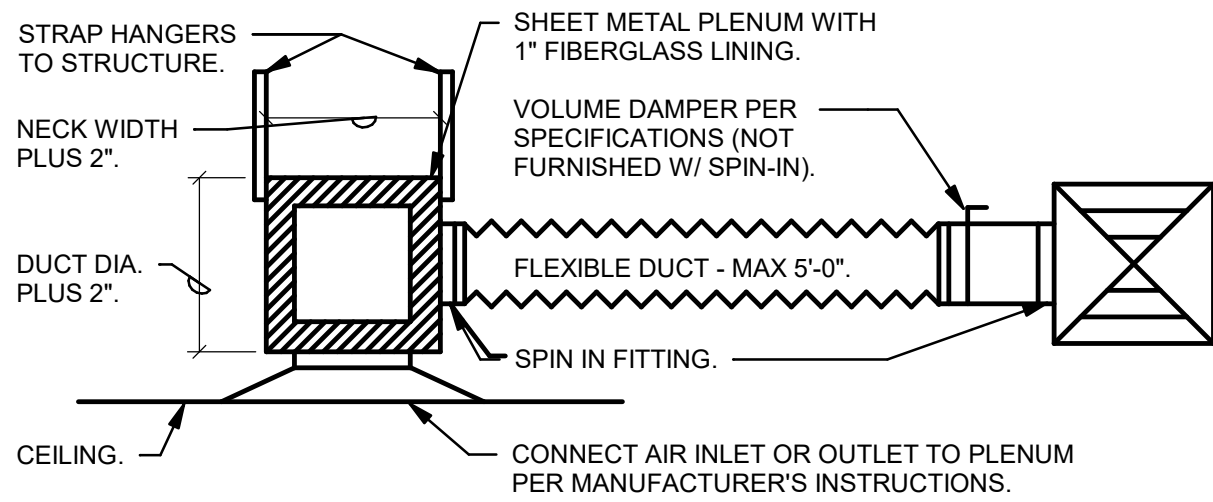


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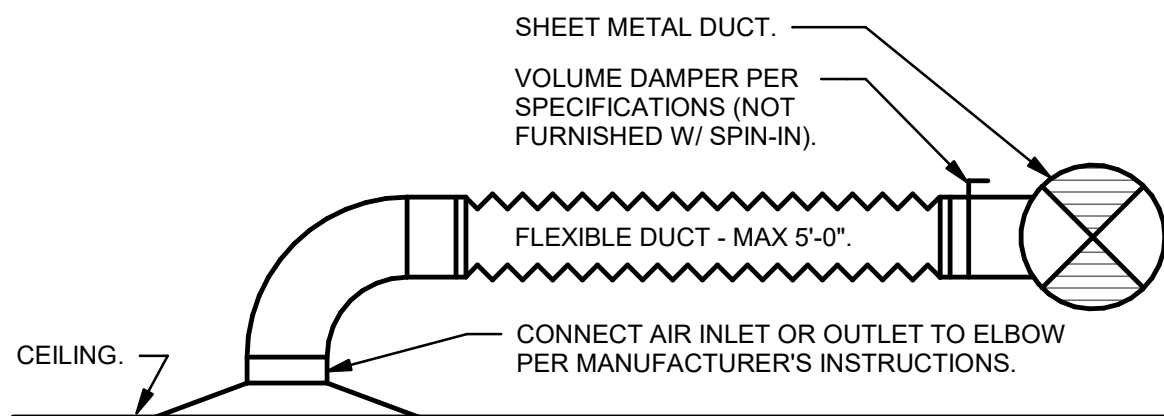
### 1 IN-LINE FAN

NO SCALE



### 2 AIR INLET OR OUTLET SQUARE NECK

NO SCALE



### 3 AIR INLET OR OUTLET ROUND NECK

NO SCALE



Project

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Revisions

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Mar 22nd, 2024

Project Number

2023-1255

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DETAILS -  
MECHANICAL

Sheet No

M500



PLUMBING SYMBOL LIST

NOTE: This is a standard symbol list and not all items listed may be used.

Abbreviations	
(A)	ABANDON IN PLACE
AF	ABOVE FINISHED FLOOR
AP	ACCESS PANEL
&	AND
A	AQUASTAT, ARCHITECT, ANCHOR, AMPHERE
@	AT
BFP	BACKFLOW PREVENTER
BFF	BELOW FINISHED FLOOR
BTUH	BRITISH THERMAL UNITS PER HOUR
BLDG	BUILDING
CV	CHECK VALVE
CO	CLEANOUT
CW	COLD WATER
CD	CONDENSATE DRAIN
CONT.	CONTINUATION
CFH	CUBIC FEET PER HOUR
CFS	CUBIC FEET PER SECOND
(X)	DEMOLISH
DW	DISHWASHER, DOMESTIC WATER
DET	DOMESTIC EXPANSION TANK
DCVA	DOUBLE CHECK VALVE ASSEMBLY
DN	DOWN
DS	DOWNSPOUT
DSN	DOWNSPOUT NOZZLE
D	DRAIN
DFU	DRAINAGE FIXTURE UNIT
DWV	DRAINAGE, WASTE AND VENT
DF	DRINKING FOUNTAIN
EW	ELECTRIC WATER COOLER
EW	ELECTRIC WATER HEATER
(E)	EXISTING
FT	FEET
FFE	FINISHED FLOOR ELEVATION
F	FIRE, FAHRENHEIT
FL	FLOOR
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FV	FLASH VALVE
'	FOOT, FEET
(F)	FUTURE
GPM	GALLONS PER MINUTE
GWH	GAS WATER HEATER
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HZ	HERTZ
HB	HOSE BIBB
HW	HOT WATER
HWFU	HOT WATER FIXTURE UNIT
HWR	HOT WATER RETURN
IN, "	INCHES
IW	INDIRECT WASTE
INV	INVERT ELEVATION
L	LAVATORY
MIN	MINIMUM
MX	MIXING VALVE
MS	MOP SINK
(N)	NEW
N	NORTH
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
#	NUMBER
NO.	NUMBER
OD	OVERFLOW DRAIN, OUTSIDE DIAMETER
OF	OWNER FURNISHED, CONTRACTOR INSTALLED
OFI	OWNER FURNISHED, OWNER INSTALLED
PLBG	PLUMBING
P	PLUMBING, PUMP
POC	POINT OF CONNECTION
PSI	POUNDS PER SQUARE INCH
PD	PRESSURE DROP, PLUMBING DEMOLITION, PUMPED DISCHARGE
PRV	PRESSURE REDUCING VALVE
QTY	QUANTITY
RWL	RAINWATER LEADER
RBP	REDUCED PRESSURE BACKFLOW PREVENTER
(R)	RELOCATE / RELOCATED LOCATION
RD	ROOF DRAIN
SAN	SANITARY
SB	SERVICE BOX
SHT	SHEET
SA	SHOCK ARRESTOR
SOV	SHUT OFF VALVE
S, SK	SINK
SF	SQUARE FEET
SD	STORM DRAIN
SP	SUMP PUMP, STATIC PRESSURE
TEMP	TEMPERATURE
TP	TRAP PRIMER, TOTAL PRESSURE
TYP	TYPICAL
U, UR	URINAL
V	VACUUM, VENT, VOLT
VTR	VENT THRU ROOF
WCO	WALL CLEANOUT
W	WASTE
WC	WATER COLUMN, WATER CLOSET
WHA	WATER HAMMER ARRESTOR
WH	WATER HEATER, WALL HYDRANT
WTFU	WATER SUPPLY FIXTURE UNIT
W/	WITH

General

	KEYED NOTE
	DEMOLISH
	EXISTING WORK
	NEW WORK
	PIPE OR CONDUIT BELOW GRADE
	CONTINUATION
	EXTENT OF DEMOLITION
	POINT OF CONNECTION
	FIXTURE TAG (LEVEL BELOW FIXTURE)
	HVAC EQUIPMENT IDENTIFICATION (REF. ONLY)
	PLUMBING EQUIPMENT IDENTIFICATION
	ACCESS PANEL
	AQUASTAT
	BLIND FLANGE
	CAP
	CLEANOUT TO GRADE
	CONCENTRIC REDUCER
	DOWNSPOUT NOZZLE
	ECCENTRIC REDUCER
	FLOOR CLEANOUT
	FLOOR DRAIN
	FLOOR SINK
	FLOW DIRECTION
	HOSE BIBB / WALL HYDRANT
	OVERFLOW ROOF DRAIN
	PIPE DROP
	PIPE RISE
	PUMP
	ROOF DRAIN
	SHOCK ABSORBER / WATER HAMMER ARRESTOR
	STRAINER
	T&P RELIEF VALVE WITH PIPE TO DRAIN
	TEE DOWN ON PIPE
	TEE UP ON PIPE
	VENT THROUGH ROOF
	WALL CLEANOUT

Piping Systems

	COLD WATER PIPING
	CONDENSATE / INDIRECT DRAIN PIPING
	HOT WATER PIPING
	HOT WATER RETURN PIPING
	NATURAL GAS PIPING, 2 LB
	NATURAL GAS PIPING, 7" WC PRESSURE
	OVERFLOW DRAIN PIPING ABOVE GRADE OR FINISHED FLOOR
	SANITARY VENT PIPING
	SANITARY WASTE OR SOIL PIPING ABOVE GRADE OR FINISHED FLOOR
	SANITARY WASTE OR SOIL PIPING BELOW GRADE OR FINISHED FLOOR
	STORM DRAIN PIPING ABOVE GRADE OR FINISHED FLOOR
	STORM DRAIN PIPING BELOW GRADE OR FINISHED FLOOR
	TRAP PRIMER PIPING

Valves

	BACKFLOW PREVENTER
	CHECK VALVE
	SHUTOFF VALVE, GENERAL

GENERAL PLUMBING NOTES

- A. CONDITIONS SHOW ON THE PLANS RELATIVE TO THE WORK TO BE PERFORMED ARE BASED ON THE BEST INFORMATION AVAILABLE BUT ARE SUBJECT TO VERIFICATION. VERIFY LOCATIONS AND ELEVATIONS OF UTILITIES TO BE CROSSED OR CONNECTED. CORRECT DEFICIENCIES CAUSED BY FAILURE TO PERFORM SUCH VERIFICATIONS AT NO EXPENSE TO OWNER. IMMEDIATELY NOTIFY ARCHITECT AND ENGINEER OF CONDITION IN CONFLICT WITH THE DETAILS/PLANS.
- B. PROVIDE GAS SHUTOFF VALVES, PRESSURE REGULATORS AND UNION AT CONNECTIONS TO GAS-FIRED EQUIPMENT. PROVIDE REGULATOR RELIEF VENT PIPING TO ATMOSPHERE WHERE REQUIRED BY CODE.
- C. COORDINATE INSTALLATION OF PIPING BELOW AND ABOVE GRADE WITH STRUCTURAL COMPONENTS AND OTHER SYSTEMS INSTALLATION.
- D. COORDINATE FIXTURES, EQUIPMENT, PIPE ROUGH-IN/CONNECTION LOCATIONS AND DRAIN LOCATIONS WITH ARCHITECTURAL DRAWINGS.
- E. PROVIDE CLEANOUTS FOR SANITARY WASTE AND STORM DRAINAGE SYSTEMS WHERE SHOWN AND AS OTHERWISE REQUIRED BY CODE.
- F. FURNISH AND INSTALL VALVES, TRAPS, STRAINERS, BACK FLOW PREVENTER, ETC. NOT FURNISHED BY EQUIPMENT SUPPLIER, BUT REQUIRED FOR PROPER EQUIPMENT OPERATION.
- G. SHUT-OFF VALVES TO BE INSTALLED IN ALL WATER AND GAS PIPING AT LOCATIONS SHOWN. PROVIDE ACCESS PANELS IF CEILING AND STRUCTURAL CONDITIONS DO NOT ALLOW NORMAL ACCESS. COORDINATE EXACT TYPE AND LOCATION WITH OWNER AND GENERAL CONTRACTOR PRIOR TO ROUGH-IN.
- H. CONTRACTOR TO PROVIDE LOCATE/SCOPING SERVICES FOR EXISTING PIPING BELOW GRADE AND DOCUMENT/RECORD, COORDINATE WITH NEW WORK PRIOR TO START OF CONSTRUCTION.
- I. SEE PLUMBING FIXTURE SCHEDULE FOR PIPE CONNECTION SIZES.
- J. COORDINATE INSTALLATION OF DUCTWORK, PIPING, FIXTURES, EQUIPMENT, ETC. WITH ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL AND FIRE PROTECTION SYSTEMS PRIOR TO INSTALLATION.
- K. REFER TO ARCHITECTURAL DRAWINGS FOR ADA ACCESSIBILITY REQUIREMENTS.
- L. PROVIDE CEILING ACCESS PANELS FOR VALVES LOCATED ABOVE INACCESSIBLE CEILING SYSTEMS. VALVES INSTALLED ABOVE CEILING SHALL BE WITHIN 18" OF CEILING. MAINTAIN FIRE RATINGS WHERE REQUIRED.
- M. SEE ARCHITECTURAL DRAWINGS FOR EXACT FIXTURE LOCATIONS.
- N. REFER TO SPECIFICATIONS FOR SEISMIC RESTRAINT REQUIREMENTS FOR PIPING/EQUIPMENT.

SHEET INDEX

P001	SYMBOL LIST AND GENERAL NOTES - PLUMBING
P002	SCHEDULES - PLUMBING
P200	UNDERGROUND PLAN - PLUMBING
P201	FLOOR PLAN - PLUMBING

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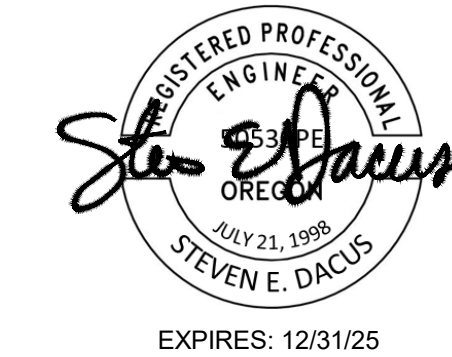
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No. Description Date

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Permit Set

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Mar 22nd, 2024

Project Number

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Drawing Title

SYMBOL LIST AND  
GENERAL NOTES -  
PLUMBING

Sheet No

P001



PLUMBING FIXTURE SCHEDULE											
SYMBOL	FIXTURE TYPE	DESCRIPTION	BASIS OF DESIGN		ACCESSORIES	CONNECTION				ELECTRICAL	COMMENTS
			MFR	MODEL		W	V	CW	HW		
L-1	LAVATORY	WALL HUNG, ADA COMPLIANT, VITREOUS CHINA, SINGLE-HOLE PUNCH, FRONT OVERFLOW	AMERICAN STANDARD	0356 421	DECK MOUNTED, TOUCH-FREE, SENSOR OPERATED FAUCET, HARD WIRED, SINGLE HOLE, SINGLE-SUPPLY, 0.50 GPM, CHICAGO FAUCETS MODEL 116-706 AB-1; HARD-WIRE, MULTI-USE, CLASS 2 TRANSFORMER FOR UP TO 8 FAUCETS; CHICAGO FAUCETS MODEL 243-293.00 1; ASSE-1070 COMPLIANT MIXING VALVE, INTEGRAL CHECK VALVES, WATTS MODEL LFMMV (SET DISCHARGE TEMPERATURE AT 110 DEG. F.)	1-1/2"	1-1/2"	1/2"	1/2"	--	MOUNT LAVATORY AT ADA COMPLIANT HEIGHT, SEE ARCHITECTURAL PLANS FOR HEIGHT AND LOCATION. SEE SPECIFICATION SECTION 224000 FOR FLOOR MOUNTED CARRIER, TRAP COVERS, SUPPLY STOPS AND ADDITIONAL ACCESSORIES. COORDINATE INSTALLATION AND POWER REQUIREMENTS WITH DIVISION 26.
MS-1	MOP SINK	FLOOR MOUNTED, ONE PIECE MOLDED STRUCTURAL FIBERGLASS, 24-INCHES X 24-INCHES X 10-INCHES	MUSTEE	63M	WALL HUNG, MOP SINK FAUCET, 8-INCH CENTERS, LEVER HANDLES, PAIL HOOK, CHROME PLATED, ATMOSPHERIC VACUUM BREAKER, 3/4" THREADED HOSE OUTLET AND WALL FLANGE, CHICAGO FAUCETS MODEL 540-LD897SWXFABCP; 3/8" OFFSET INLET SUPPLY ARM WITH INTEGRAL CHECK; CHICAGO FAUCETS MODEL CCKJABCP; VINYL BUMPER GUARDS; MUSTEE MODEL 63-401	3"	2"	1/2"	1/2"	--	
S-1	SINK	DROP-IN, DOUBLE BOWL, 18 GAUGE STAINLESS STEEL, 33-INCHES X 21-INCHES X 6-1/2-INCHES DEEP, 36-INCH MINIMUM CABINET SIZE, 3-HOLE PUNCH, BARRIER FREE	ELKAY	LRAD332165	DECK MOUNTED FAUCET, 8-INCH RIGID/SWING GOOSENECK, 4" WRISTBLADE HANDLES, 8-INCH FIXED CENTERS, 1.5 GPM AERATED FLOW RATE, CHICAGO FAUCETS MODEL 201-AGN8AE35-317AB	2"	1-1/2"	1/2"	1/2"	--	SEE SPECIFICATION SECTION 224000 FOR SUPPLY STOPS AND ADDITIONAL ACCESSORIES
SH-1	SHOWER	BARRIER FREE, ONE PIECE, 60-INCHES X 30-INCHES X 77-1/2-INCHES INSIDE DIMENSIONS, SLIP RESISTANT TEXTURED BOTTOM, HORIZONTAL BACK AND SIDE WALL GRAB BARS, VERTICAL SIDE WALL GRAB BAR, FOLD UP SEAT, STEEL CURTAIN ROD, 3/4-INCH THRESHOLD	COMFORT DESIGNS	SSS 6233BF-F .75 L-BAR	SINGLE HANDLE PRESSURE BALANCING SHOWER VALVE, SERVICECHECK STOPS, 1.5 GPM HANDHELD SHOWER HEAD FLOW RATE, 60-INCH FLEXIBLE METAL HOSE, 24-INCH MOUNTING BAR, VACUUM BREAKER; ZURN MODEL Z7300-SS-HW-MT-H9	2"	1-1/2"	1/2"	1/2"	--	HANDING BASED ON SEAT LOCATION, COORDINATE WITH ARCHITECT PRIOR TO PROCUREMENT. PROVIDE WITH OPTIONS AS LISTED IN DESCRIPTION.
WC-1	WATER CLOSET	FLOOR MOUNTED, FLOOR OUTLET, GRAVITY TANK TYPE, VITREOUS CHINA, ADA HEIGHT, ELONGATED, 1.28 GPF, 12" ROUGH-IN	SLOAN	WETS-4029.40 10	SEAT - ELONGATED, PLASTIC, SELF-SUSTAINING CHECK HINGES WITH NON-CORRODING STAINLESS STEEL POSTS; BEMIS MODEL 1955SCCT	3"	2"	1/2"	--	--	SEE ARCHITECTURAL PLANS FOR LOCATION. SEE SPECIFICATION SECTION 224000 FOR ADDITIONAL ACCESSORIES.
WM-1	OUTLET BOX	WASHING MACHINE OUTLET BOX (NON-FIRE RATED) - NSF-372 COMPLIANT, ABS BOX/FRAME, NO-LEAD BRASS VALVES, ASSE 1010 WATER HAMMER ARRESTORS, 3/4" OUTLET CONNECTIONS, 2" DRAIN CONNECTION, INDIVIDUAL DRAIN AND SUPPLY BOXES	SILOUX CHIEF	696G2313		2"	1-1/2"	1/2"	1/2"	--	SUPPLY CONNECTION TYPE PER PIPING MATERIAL. STANDARD PACK (SUPPLY BOX, FRAME, BRACKET & DEBRI COVER). INSTALL WITH BOTTOM OF BOX AT 34" A.F.F. UNLESS NOTED OTHERWISE.

GAS WATER HEATER SCHEDULE - TANK TYPE											
SYMBOL	EQUIPMENT TYPE	LOCATION/ SERVING	BASIS OF DESIGN		GAS		CAPACITY		ELECTRICAL		
			MFR	MODEL	TYPE	INPUT (BTU/H)	TANK CAPACITY(G ALLONS)	RECOVERY RATE @ 100°F RISE (GPH)	VOLTS	PH	AMPS
(E)GWH-1	NATURAL GAS FIRED, DIRECT VENTED, CONDENSING, HIGH EFFICIENCY - TANK TYPE	JANITOR 123	AO SMITH	GDVH	TANK	55000	60	0	120	1	490

FIXTURE UNIT CALCULATIONS - UPC					
COUNT	DESCRIPTION	WATER SUPPLY FIXTURE UNITS		DRAINAGE FIXTURE UNITS	
		CWFU (TABLE A-2)	CWFU TOTAL	DFU (TABLE 7-3)	DFU TOTAL
1	CLOTHES WASHER, DOMESTIC, STANDPIPE	4	4	3	3
2	FLOOR DRAIN		0	0	2
3	LAVATORY	1	3	2.25	1
1	MOP SINK	3	3	2.25	3
1	SHOWER, PER HEAD	2	2	1.5	2
1	SINK	2	2	1.5	2
3	WATER CLOSET, FLUSH TANK	2.5	7.5	0	4
FIXTURE UNIT COUNT TOTALS:			21.5	10.5	29



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PROJECT 2023-1253  
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100 SW Main Street, Suite 1600  
Portland, OR 97204  
TEL 503.382.2266  
www.interfaceengineering.com

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Project Number  
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Drawing Title  
SCHEDULES - PLUMBING

Sheet No  
P002

SHEET KEYNOTES

1. CONNECT NEW SANITARY PIPING TO EXISTING SANITARY AS REQUIRED.

OREGON TECH  
Applied Behavioral Analysis Clinic  
200 Commercial Street  
Klamath Falls, OR 97601



Project

Consultant

INTERFACE  
ENGINEERING  
PROJECT: 2023-1255  
CONTACT: Scott Lunsford  
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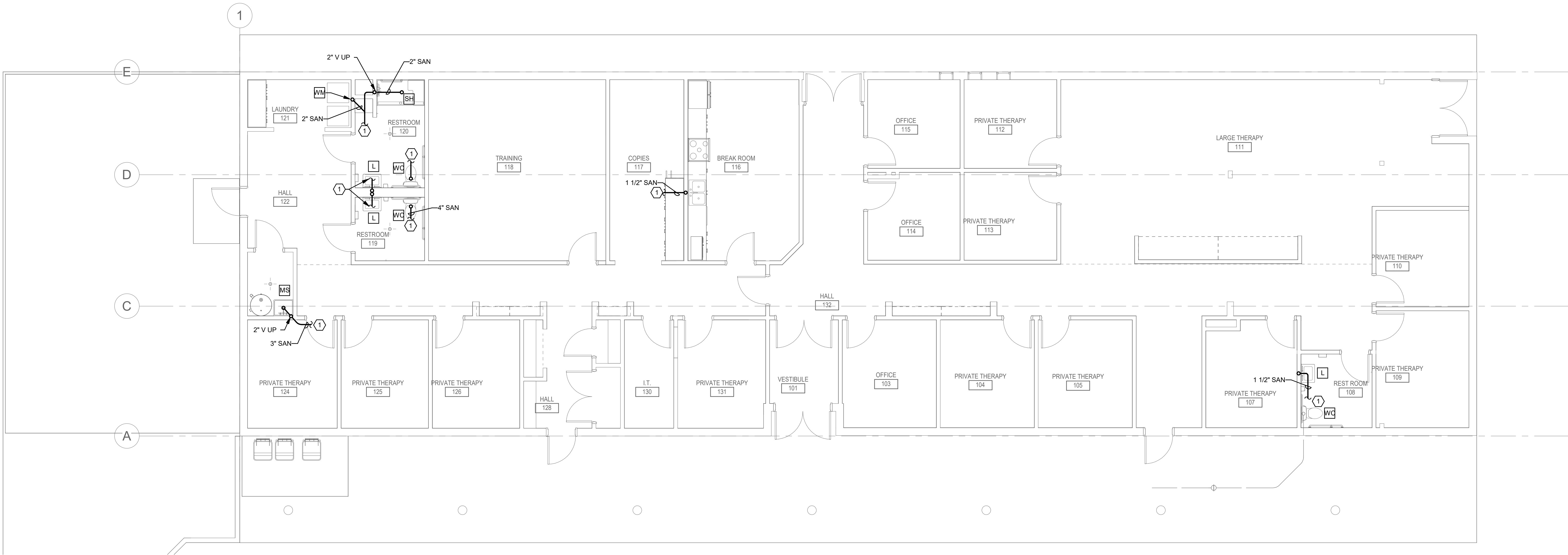
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Project Number  
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Drawing Title  
UNDERGROUND  
PLAN - PLUMBING

Sheet No.

P200



1 LEVEL 1 PLUMBING UNDERGROUND PLAN - OVERALL

0' 4' 8' 16'  
3/16" = 1'-0"





Project

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**INTERFACE**  
ENGINEERING

PROJECT: 2023-1255  
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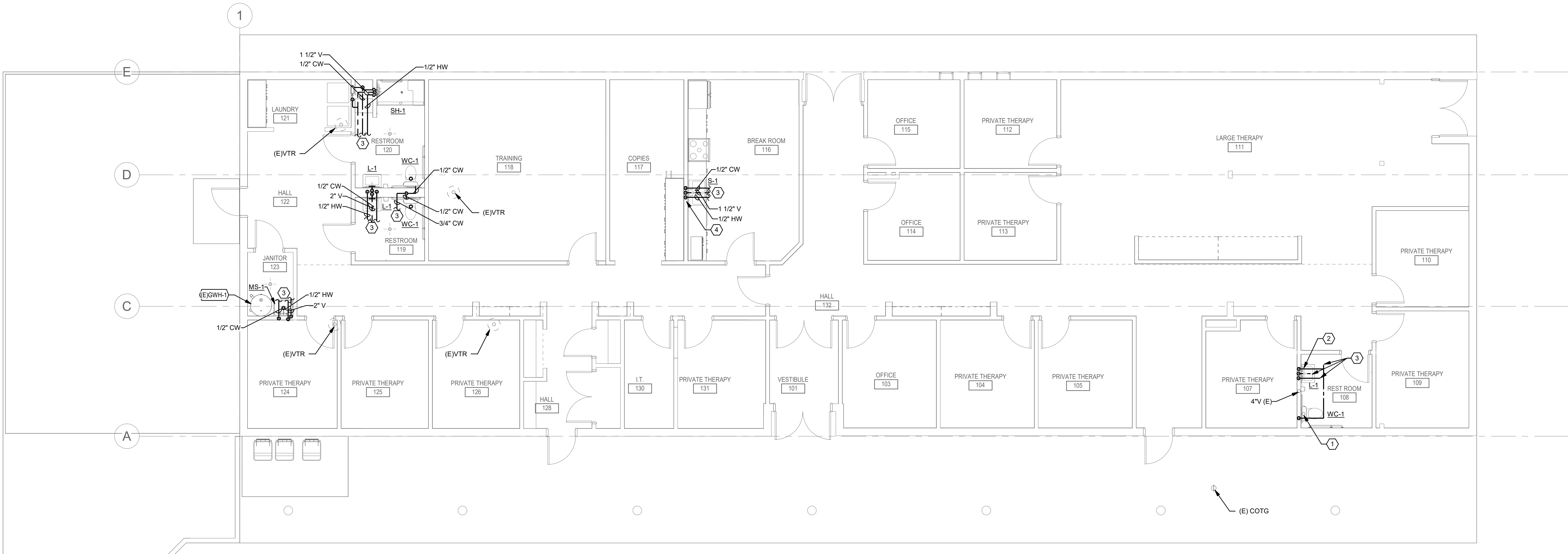
FLOOR PLAN -  
PLUMBING

Sheet No.

P201

## SHEET KEYNOTES

1. INSTALL NEW PLUMBING FIXTURE, EXTEND NEW COLD WATER, SANITARY AND VENT PIPING TO EXISTING PIPING AS REQUIRED, AT THIS APPROXIMATE LOCATION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING PIPING. CONNECT NEW VENT PIPING TO EXISTING VENT PIPING PER CODE REQUIREMENTS.
2. INSTALL NEW PLUMBING FIXTURE, EXTEND NEW HOT/COLD DOMESTIC PIPING, VENT AND SANITARY PIPING AS REQUIRED TO EXISTING PIPING. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING PIPING.
3. CONNECT NEW HOT/COLD AND VENT PIPING TO EXISTING PIPING, AT THIS APPROXIMATE LOCATION.
4. ROUTE 1/2" HOT WATER SUPPLY PIPING TO CONNECTION WITH DISHWASHER, ROUTE DRAIN PIPING HIGH BENEATH CASEWORK TO A DECK MOUNTED AIR GAP FITTING TO TERMINATION TO SINK TAIL PIECE.



## 1 LEVEL 1 PLUMBING PLAN - OVERALL

0' 4' 8' 16'  
3/16" = 1'-0"



---

# Applied Behavioral Analysis Clinic

## Oregon Institute of Technology

---

200 Commercial Street  
Klamath Falls, Oregon 97601

## PROJECT MANUAL

ISSUE STATUS: Permit Set  
ISSUE DATE: MARCH 22nd, 2024

**Soderstrom**  
Architects

1200 NW Naito Parkway, Suite 410  
Portland, OR 97209

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SECTION 00 0102 - PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Project Name: Oregon Tech Behavioral Analysis Clinic.
- B. Architect's Project Number: 23020.
- C. Project Location:  
200 Commercial Street.  
Klamath, Falls 97061.
- D. The Owner, hereinafter referred to as Owner: Oregon Institute of Technology

1.02 NOTICE TO PROSPECTIVE BIDDERS

- A. These documents constitute an Invitation to Bid to General Contractors for the construction of the project described below.

1.03 PROJECT DESCRIPTION

- A. Summary Project Description: The project consists of interior renovations and minor sitework intended for use as a mental and behavioral health clinic.

1.04 PROCUREMENT DOCUMENTS

- A. Availability of Documents: Complete electronic sets of procurement documents may be obtained:
  - 1. From Owner at the Project Manager's address listed above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 00 0110 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

1.01 DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

- A. 00 0102 - Project Information
- B. 00 0110 - Table of Contents

SPECIFICATIONS

2.01 DIVISION 01 -- GENERAL REQUIREMENTS

- A. 01 2500 - Substitution Procedures
- B. 01 3000 - Administrative Requirements
- C. 01 3050 - Design-Build Requirements
- D. 01 4000 - Quality Requirements
- E. 01 6000 - Product Requirements
- F. 01 6116 - Volatile Organic Compound (VOC) Content Restrictions
- G. 01 7000 - Execution and Closeout Requirements
- H. 01 7800 - Closeout Submittals

2.02 DIVISION 02 -- EXISTING CONDITIONS

- A. 02 4100 - Demolition
- B. 02 4110 - Cutting and Patching

2.03 DIVISION 03 -- CONCRETE (NOT USED)

2.04 DIVISION 04 -- MASONRY (NOT USED)

2.05 DIVISION 05 -- METALS (NOT USED)

2.06 DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES

- A. 06 1000 - Rough Carpentry
- B. 06 4100 - Architectural Wood Casework
- C. 06 8316 - Fiberglass Reinforced Paneling

2.07 DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

- A. 07 9200 - Joint Sealants

2.08 DIVISION 08 -- OPENINGS

- A. 08 1113 - Hollow Metal Doors and Frames
- B. 08 1416 - Flush Wood Doors
- C. 08 3100 - Access Doors and Panels
- D. 08 4313 - Aluminum-Framed Storefronts
- E. 08 7100 - Door Hardware
- F. 08 8000 - Glazing

2.09 DIVISION 09 -- FINISHES

- A. 09 2116 - Gypsum Board Assemblies
- B. 09 5100 - Acoustical Ceilings
- C. 09 6500 - Resilient Flooring



D. 09 9113 - Exterior Painting

E. 09 9123 - Interior Painting

2.10 DIVISION 10 -- SPECIALTIES

A. 10 1419 - Dimensional Letter Signage

B. 10 2800 - Toilet, Bath, and Laundry Accessories

C. 10 2819 - Tub and Shower Enclosures

D. 10 4400 - Fire Protection Specialties

2.11 DIVISION 11 -- EQUIPMENT (NOT USED)

2.12 DIVISION 12 -- FURNISHINGS

A. 12 4813 - Entrance Floor Mats and Frames

2.13 DIVISION 13 -- SPECIAL CONSTRUCTION (NOT USED)

2.14 DIVISION 14 -- CONVEYING EQUIPMENT (NOT USED)

END OF SECTION

## SECTION 00 0130 - DRAWING ABBREVIATIONS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Drawing abbreviations.

## 1.02 DRAWING ABBREVIATIONS

- A. Abbreviations used on the Drawings are fully spelled out below:

#	pound/number	COL	column
AB	anchor bolt	CONC	concrete
A/C	air conditioning	CONST	construction
AC	asphaltic concrete	CONT	continuous, continue
ACP	acoustical ceiling panel	COORD	coordinate
ACT	acoustical tile	CPT	carpet
AD	area drain	CRS	course(s)
ADD/ADM	addendum	CS	countersink
ADH	adhesive	CSMT	casement
ADJ	adjustable/adjacent	CT	ceramic tile
ALT	alternate	CTR	center
AL(UM)	aluminum	CY	cubic yard
ANOD	anodized		
AP	access panel, acoustical panel	DEM(O)	demolish, demolition
APPROX	approximate	DEP	depressed, depression
ARCH	architect(ural)	DF	drinking fountain, Douglas Fir
ASPH	asphalt	DIA	diameter
AUTO	automatic	DIAG	diagonal
AV	audio visual	DIM	dimension
		DISP	dispenser
BATT	batt insulation	DIV	division
BD	board	DN	down
BIT(UM)	bituminous	DR	down
BKR	backer	DS	door
BLDG	building	DTL	downspout
BLKG	blocking	DWG	detail
BM	bench mark, beam	DWR	drawing(s)
BO	bottom of		drawer
BOL	bollard	E	
BOT	bottom	EA	east
BR(N)Z	bronze	EB	each
BSMT	basement	EJ	existing base
		ELEC	expansion joint
CAB	cabinet	EL/ELEV	electric(al)
CB	catch basin	EMER(G)	elevation, elevator
CCTV	closed circuit TV	ENCL	emergency
CEM	cement	EP	enclosure
CF	cubic foot	EQ	electrical panel
CG	corner guard	EQUIP	equal
CH	ceiling height	EXH	equipment
CHK	chalk	EXIST/(E)	exhaust
		EXP	existing



CI	cast iron, continuous insulation	EXT	exposed, expansion exterior
CJ	control joint	FD	
CL	centerline	FE	floor drain, fire damper
CLG	ceiling	FEC	fire extinguisher
CLR	clear(ance)	FF	fire extinguisher cabinet
CMP	composite metal panel	FFSAM	finish floor, factory finish
CMU	concrete masonry unit	FGL	foil faced self-adhered membrane
		FHC	fiberglass fire hose cabinet

FIN	finish(ed)	KO	knockout
FLCO	floor cleanout	LAM	laminated
FLG	flashing	LAV	lavatory
FLSHG	flashing	LH	left hand
FLR	floor(ing)	LW	lightweight
FLUOR	fluorescent		
FTG	footing	MAX	maximum
FND	foundation	MB	machine bolt, marker board
FOC	face of concrete	MECH	mechanic(al)
FOF	face of finish	MEZZ	mezzanine
FOM	face of masonry	MFR	manufacture(r)
FOS	face of stud/steel	MGR	manager
FP	fireproofing	MH	manhole
FR	fire resistive, fire rated	MIN	minimum
FRM	frame(d), framing	MISC	miscellaneous
FOIO	furnished by owner, installed by owner	MO	masonry opening
FOIC	furnished by owner, installed by contractor	MOD	modular
		MP	metal panel
GA	gage/gauge	MRGB	moisture resistant gypsum wall board
GALV	galvanized	MTL	metal
GB	grab bar	MULL	mullion
GL	glass, glazing, grid line	MWP	membrane waterproofing
GYP	gypsum		
GYP	gypsum board	N	north
BD	gypsum wall board	NAT	natural
GWB		NIC	not in contract
	hose bib	NOM	nominal
HB	hardboard	NTS	not to scale
HBD	hollow core		
HC	heavy duty	OA	overall
HD	header	OC	on center(s)
HDR	hardware	OD	outside diameter
HDW	hollow metal	OH	overhead, opposite hand
HM	horizontal	OPG	opening
HOR(IZ)	hollow steel section	OPP	opposite
HSS	height		
HT	heating	P	paint(ed)
HTG	high temperature self-	PAR	parapet
HTSAM	adhered membrane	PCP	putty coat plaster
	heating, ventilating, air	PERF	perforate(d)
	conditioning	PJT	panel joint
HWD		PL	property line
HVAC		PLAM	plastic laminate
	inside diameter	PLAS	plaster
ID	include(d), including	PLAT	platform
INCL	insulation	PNL	panel
INSUL	interior	PP	pre-painted
INT	intumescent	PSF	pounds per square foot
INTUM			



JAN	janitor	PSI	pounds per square inch
JC	janitor closet	PT	pressure treated, point
JT	joint	PTD	paper towel dispenser
		PTN	partition
		PVC	polyvinyl chloride
		PWD	plywood
QT	quarry tile	TOPL	top of plate
R	radius, riser	TOS	top of steel
RA	return air	TOW	top of wall
RAD	radius	TS	tube steel (see also HSS)
RB	resilient base	TYP	typical
RCP	reflected ceiling plan	UC	undercounter
RD	roof drain	UNO,	unless noted otherwise
REF	reference	UON	
REFR	refrigerator		vapor barrier
REINF	reinforce, (ing)	VB	vinyl composition tile
REQ	required	VCT	vertical
REV	revision(s), revised	VERT	vestibule
RH	right hand	VEST	verify
RM	room	VFY	vertical grain
RND	round	VG	
RO	rough opening		west
S	south	W	with
SA	supply air	W/	wood base, weather barrier
SAM	self-adhered membrane	WB	wall covering, water closet
SC	solid core	WC	wood
SCHED	schedule	WD	waterproof
SEC(T)	section	WP	without
SIM	similar	W/O	waterstop
SL	sleeve	WS	woven wire fabric
SPEC	specification(s)	WWF	
SQ	square		yard
SS	stainless steel	YD	
STD	standard		extruded polystyrene
STL	steel	XPS	
STR(UCT)	structural		
SUSP	suspended		
SV	sheet vinyl		
T	tread, tile		
TB	tackboard		
TEL	telephone		
TEMP	tempered, temperature		
TG, T&G	tongue and groove		
TO	top of		
TOC	top of curb/concrete		
TOF	top of framing		
TOP	top of parapet		

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

## SECTION 01 2500 - SUBSTITUTION PROCEDURES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

## 1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

## 1.03 REFERENCE STANDARDS

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage).
- B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase).

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

## 3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
  - 1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- D. Limit each request to a single proposed substitution item.
  - 1. Submit an electronic document, combining the request form with supporting data into single document.

## 3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Time Restrictions:
  - 1. Owner will consider requests for substitutions only if submitted at least 10 business days prior to the date for receipt of bids.
- B. Submittal Form (before award of contract):
  - 1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

## 3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
  - 1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating). See this form for additional information and instructions. Use



only this form; other forms of submission are unacceptable.

- B. Architect will consider requests for substitutions only within 30 days after date of Agreement.
- C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 10 business days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
  - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
  - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
  - 3. Bear the costs engendered by proposed substitution of:
    - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
- D. Substitutions will not be considered under one or more of the following circumstances:
  - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
  - 2. Without a separate written request.
  - 3. When acceptance will require revisions to Contract Documents.

#### 3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

#### 3.05 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

END OF SECTION

## SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Site mobilization meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Submittals for review, information, and project closeout.
- F. Number of copies of submittals.
- G. Requests for Information (RFI) procedures.
- H. Submittal procedures.

## 1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: General product requirements.

## 1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
  - 1. Requests for Information (RFI).
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Manufacturer's instructions and field reports.
  - 7. Applications for payment and change order requests.
  - 8. Progress schedules.
  - 9. Coordination drawings.
  - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
  - 11. Closeout submittals.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

## 3.01 SITE MOBILIZATION MEETING

- A. Attendance Required:
  - 1. Contractor.
  - 2. Owner.
  - 3. Contractor's superintendent.
  - 4. Major subcontractors.
- B. Agenda:
  - 1. Use of premises by Owner and Contractor.
  - 2. Owner's requirements.
  - 3. Construction facilities and controls provided by Owner.
  - 4. Temporary utilities provided by Owner.
  - 5. Survey and building layout.
  - 6. Security and housekeeping procedures.

7. Schedules.
  8. Application for payment procedures.
  9. Procedures for testing.
  10. Procedures for maintaining record documents.
  11. Requirements for start-up of equipment.
  12. Inspection and acceptance of equipment put into service during construction period.
- C. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

### 3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.
- B. Attendance Required:
1. Contractor.
  2. Owner.
  3. Contractor's superintendent.
  4. Major subcontractors.
- C. Agenda:
1. Site safety update.
  2. Hot issues.
  3. Schedule, three week review:
    - a. Review of Work progress.
    - b. Maintenance of progress schedule.
    - c. Corrective measures to regain projected schedules.
    - d. Planned progress during succeeding work period
    - e. Construction milestones.
  4. RFI Review: Review of RFIs log and status of responses.
  5. Review of off-site fabrication and delivery schedules.
    - a. Provide spreadsheet indicating estimated and actual delivery schedules, and estimated and actual installation dates.
  6. Submittal Review: Review of submittals schedule and status of submittals.
  7. Construction Review.
    - a. Field observations, problems, and decisions.
    - b. Identification of problems that impede, or will impede, planned progress.
    - c. Trade specific updates for the following:
      - 1) Logistics and safety.
      - 2) Civil/sitework.
      - 3) Structural.
      - 4) Architectural.
      - 5) Mechanical, plumbing, and fire protection.
      - 6) Electrical.
  8. Testing and inspections.
  9. Other business relating to work.
- D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

### 3.03 CONSTRUCTION PROGRESS SCHEDULE

- A. If preliminary schedule requires revision after review, submit revised schedule within 30 days.



B. Submit updated schedule with each Application for Payment.

1. In addition to complete project schedule, submit an updated three (3) week schedule at each Progress Meeting.

### 3.04 REQUESTS FOR INTERPRETATION(RFI)

A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.
  - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
  - b. Do not forward requests which solely require internal coordination between subcontractors.
2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
  - a. Approval of submittals (use procedures specified elsewhere in this section).
  - b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
  - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
  - d. Communications regarding Contractor-originated Value Engineering requests.
  - e. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
  - f. Customary construction coordination between trades.
  - g. Work required to provide complete, working assemblies of materials.
  - h. Work required by codes under which a subcontractor is licensed to perform.
2. The Architect will review each RFI, and determine whether or not the document qualifies as a Request for Interpretation as defined above. If the Architect determines that the document is not a legitimate RFI and/or missing key information required to render an actionable response, it may be returned without a response, with an explanatory note.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

1. Official Project name.
2. Discrete and consecutive RFI number, and descriptive subject/title.
3. Issue date, and requested reply date.
4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or

- specification section number, title, and paragraph(s).
- 5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
- 6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
  - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
  - 2. Note dates of when each request is made, and when a response is received.
  - 3. Highlight items requiring priority or expedited response.
- H. Review Time: Architect will respond and return RFIs to Contractor within fourteen calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
  - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
  - 1. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
  - 2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

### 3.05 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data.
  - 2. Shop drawings.
  - 3. Samples for selection.
  - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

### 3.06 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Sustainability design submittals and reports.

3. Certificates.
4. Test reports.
5. Inspection reports.
6. Manufacturer's instructions.
7. Manufacturer's field reports.
8. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

### 3.07 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
  1. Project record documents.
  2. Operation and maintenance data.
  3. Warranties.
  4. Bonds.
  5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

### 3.08 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
  1. After review, produce duplicates.
  2. Retained samples will not be returned to Contractor unless specifically so stated.

### 3.09 SUBMITTAL PROCEDURES

- A. General Requirements:
  1. Transmit using approved form.
    - a. Use Contractor's form, subject to prior approval by Architect.
  2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
  3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
  4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
  5. Schedule submittals to expedite the Project, and coordinate submission of related items.
    - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
  6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
  7. Provide space for Contractor and Architect review stamps.
  8. When revised for resubmission, identify all changes made since previous submission.
  9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.



10. Submittals not requested will not be recognized or processed.
  - B. Product Data Procedures:
    1. Submit only information required by individual specification sections.
    2. Collect required information into a single submittal.
    3. Do not submit (Material) Safety Data Sheets for materials or products.
    4. Submit sustainable design reporting submittals under separate cover.
  - C. Shop Drawing Procedures:
    1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
    2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
  - D. Samples Procedures:
    1. Transmit related items together as single package.
    2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
    3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.
- 3.10 SUBMITTAL REVIEW
- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
  - B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
  - C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
  - D. Architect's and consultants' actions on items submitted for review:
    1. Authorizing purchasing, fabrication, delivery, and installation:
      - a. "No Exception Taken".
      - b. "Make Revisions Noted".
        - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
    2. Not Authorizing fabrication, delivery, and installation:
      - a. "Revise and Resubmit".
        - 1) Resubmit revised item, with review notations acknowledged and incorporated.
      - b. "Rejected".
        - 1) Submit item complying with requirements of Contract Documents.
  - E. Architect's and consultants' actions on items submitted for information:
    1. Items for which no action was taken:
      - a. "Received" - to notify the Contractor that the submittal has been received for record only.
    2. Items for which action was taken:
      - a. "Reviewed" - no further action is required from Contractor.
- END OF SECTION

## SECTION 01 3050 - DESIGN-BUILD REQUIREMENTS

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Certain work components of this project have not been designed or detailed by the Architect or the Architect's Consultants, and the components must be designed, engineered, and built by the Contractor.
- B. Design-Build Components are defined as either or both of the following:
  - 1. Complete and operational systems that perform their intended use.
  - 2. Structural elements which will be subject to lateral or vertical Loads.
- C. The Contractor shall coordinate and assume (or assign to Subcontractor) complete responsibility for design, engineering, submittals, fabrication, transportation, and installation of this Work.
- D. Prior to starting Work, the Contractor shall submit all Design-Build documents to the governing Building Department or Authority having jurisdiction for review and approval. Each Design-Build item may require a separate permit and fee, which shall be paid by the Contractor when so required.

## 1.02 DESIGN-BUILD COMPONENTS OF THE WORK

- A. Requiring Building Department review and approval as deferred submittals:
  - 1. Section 05 5000 - Metal Fabrications: Stairs and railings.
  - 2. Section 07 8400 - Firestopping.
  - 3. Section 08 4413 - Glazed Aluminum Curtain Walls.
  - 4. Section 09 5000 - Acoustical Ceilings: Ceiling suspension systems.
  - 5. Section 09 5426 - Suspended Wood Ceilings: Ceiling suspension systems.
  - 6. Division 22 - Plumbing: Equipment anchorage and bracing.
  - 7. Division 23 - Heating, Ventilating, and Air Conditioning (HVAC): Equipment anchorage and bracing.
  - 8. Division 26 - Electrical: Equipment anchorage and bracing.
- B. Requiring Building Department review and approval as separate permits:
  - 1. Division 21 - Fire Sprinkler Systems.
  - 2. Division 28 - Fire Detection and Alarm Systems.
- C. Any other components required by Building Department.

## 1.03 SUBMITTALS

- A. Comply with Building Department requirements.
- B. Include design criteria, design assumptions, structural calculations, fabrication and construction details, required clearances, and interface requirements.
- C. Affix Design Professional's seal of Oregon State license on all submittals.

## 1.04 QUALITY ASSURANCE

- A. Designer Qualifications: Where delegated engineering design is to be performed under the construction contract provide the direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State of Oregon.

1.05 OWNER'S RESPONSIBILITIES

- A. The Owner will not pay for progress delays, additional work, additional products, restocking, or reworking required by sub-contractor's or Contractor's failure to coordinate Design-Build work with other project work.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION



## SECTION 01 4000 - QUALITY REQUIREMENTS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Submittals.
- B. Testing and inspection agencies and services.
- C. Control of installation.
- D. Mock-ups.
- E. Tolerances.
- F. Manufacturers' field services.
- G. Defect Assessment.

## 1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: Requirements for material and product quality.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
  - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
  - 2. Include required product data and shop drawings.
  - 3. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
  - 1. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
  - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
  - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
  1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

#### 1.04 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

#### PART 2 PRODUCTS - NOT USED

#### PART 3 EXECUTION

##### 3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

##### 3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
  - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
  - 2. Make corrections as necessary until Architect's approval is issued.
- H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

### 3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### 3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
  - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 2. Perform specified sampling and testing of products in accordance with specified standards.
  - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
  - 5. Perform additional tests and inspections required by Architect.
  - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not approve or accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.
  - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
  - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  - 3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.

- d. To provide storage and curing of test samples.
- 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
- 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### 3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### 3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION



## SECTION 01 6000 - PRODUCT REQUIREMENTS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.
- F. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- G. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

## 1.02 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

## PART 2 PRODUCTS

## 2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
  - 1. Made using or containing CFC's or HCFC's.
  - 2. Made of wood from newly cut old growth timber.
  - 3. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
  - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
  - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
  - 3. Are extracted, harvested, and/or manufactured closer to the location of the project.
  - 4. Have longer documented life span under normal use.
  - 5. Result in less construction waste.
  - 6. Are made of recycled materials.

## 2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

### 2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

## PART 3 EXECUTION

### 3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

### 3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### 3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

- G. Comply with manufacturer's warranty conditions, if any.
- H. Do not store products directly on the ground.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

## SECTION 01 6116 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Section 01 3000 - Administrative Requirements: Submittal procedures.

## 1.02 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Interior paints and coatings applied on site.
  - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
  - 3. Flooring.
  - 4. Composite wood.
  - 5. Thermal and acoustical insulation.
  - 6. Fire-retardant treated wood for blocking and/or framing.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Interior paints and coatings applied on site.
  - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
  - 1. Concrete.
  - 2. Clay brick.
  - 3. Metals that are plated, anodized, or powder-coated.
  - 4. Glass.
  - 5. Ceramics.
  - 6. Solid wood flooring that is unfinished and untreated.

## 1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2.
- D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products.



- E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- F. CHPS (HPPD) - High Performance Products Database.
- G. CRI (GLP) - Green Label Plus Testing Program - Certified Products.
- H. SCAQMD 1113 - Architectural Coatings.
- I. SCAQMD 1168 - Adhesive and Sealant Applications.
- J. SCS (CPD) - SCS Certified Products.
- K. UL (GGG) - GREENGUARD Gold Certified Products.

#### 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

#### 1.05 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
  - 1. Wet-Applied Products: State amount applied in mass per surface area.
  - 2. Paints and Coatings: Test tinted products, not just tinting bases.
  - 3. Evidence of Compliance: Acceptable types of evidence are the following;
    - a. Current UL (GGG) certification.
    - b. Current SCS (CPD) Floorscore certification.
    - c. Current SCS (CPD) Indoor Advantage Gold certification.
    - d. Current listing in CHPS (HPPD) as a low-emitting product.
    - e. Current CRI (GLP) certification.
    - f. Test report showing compliance and stating exposure scenario used.
  - 4. Product data submittal showing VOC content is NOT acceptable evidence.
  - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
  - 1. Evidence of Compliance: Acceptable types of evidence are:
    - a. Report of laboratory testing performed in accordance with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
  - 1. Evidence of Compliance: Acceptable types of evidence are:
    - a. Current SCS "No Added Formaldehyde (NAF)" certification; [www.scs-certified.com](http://www.scs-certified.com).
    - b. Report of laboratory testing performed in accordance with requirements.
    - c. Published product data showing compliance with requirements.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
  - 1. Flame Retardants: Comply with State requirements and CARB for polybrominated diphenyl ethers (PBDEs).
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
  - 1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
  - 2. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
  - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
  - 2. Joint Sealants: SCAQMD 1168 Rule.
  - 3. Paints and Coatings: Each color; most stringent of the following:
    - a. 40 CFR 59, Subpart D.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).

## PART 3 EXECUTION

### 3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

## SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Cutting and patching.
- C. Surveying for laying out the work.
- D. Cleaning and protection.
- E. Starting of systems and equipment.
- F. Demonstration and instruction of Owner personnel.
- G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- H. General requirements for maintenance service.
- I. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- J. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

## 1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

## 1.03 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical

control points necessary for laying out construction work on project of similar size, scope and/or complexity.

#### 1.04 PROJECT CONDITIONS

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  - 1. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
  - 2. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
  - 3. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
  - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
- G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

#### 1.05 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.



- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## PART 2 PRODUCTS

### 2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### 3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### 3.03 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.

- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

### 3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### 3.05 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
  - 1. Complete the work.
  - 2. Fit products together to integrate with other work.
  - 3. Provide openings for penetration of mechanical, electrical, and other services.
  - 4. Match work that has been cut to adjacent work.
  - 5. Repair areas adjacent to cuts to required condition.
  - 6. Repair new work damaged by subsequent work.
  - 7. Remove samples of installed work for testing when requested.
  - 8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.
- D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- I. Patching:
  - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  - 2. Match color, texture, and appearance.
  - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### 3.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### 3.07 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### 3.08 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### 3.09 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
- D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

### 3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### 3.11 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### 3.12 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of



Substantial Completion.

- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.13 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

## SECTION 01 7800 - CLOSEOUT SUBMITTALS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.
- D. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- E. Individual Product Sections: Specific requirements for operation and maintenance data.
- F. Individual Product Sections: Warranties required for specific products or Work.

## 1.02 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

## 3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed shop drawings, product data, and samples.
  - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.

- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Manufacturer's name and product model and number.
  - 2. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured depths of foundations in relation to finish first floor datum.
  - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 4. Field changes of dimension and detail.
  - 5. Details not on original Contract drawings.

### 3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### 3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

### 3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Provide control diagrams by controls manufacturer as installed.
- J. Include test and balancing reports.
- K. Additional Requirements: As specified in individual product specification sections.

### 3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Arrangement of Contents: Organize each volume in parts as follows:
  - 1. Part 1:
    - a. Project Directory.
    - b. Table of Contents, of all volumes, and of this volume.
  - 2. Part 2:
    - a. Operation and Maintenance Data: Arranged by system, then by product category subdivided by specification section.
      - 1) Source data.
      - 2) Product data, shop drawings, and other submittals.
      - 3) Operation and maintenance data.
      - 4) Field quality control data.
      - 5) Photocopies of warranties and bonds.
  - 3. Part 3:
    - a. Project Documents: Product data, shop drawings, and other submittals.

### 3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which



specified, and the name of product or work item.

- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

## SECTION 02 4100 - DEMOLITION

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

## 1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- D. Section 02 4110 - Cutting and Patching: Cutting, coring, fitting, and patching as required in existing construction.

## 1.03 DEFINITIONS

- A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.
- B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
- D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
- E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

## 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

## PART 2 PRODUCTS -- NOT USED

## PART 3 EXECUTION

## 3.01 DEMOLITION

- A. Remove portions of building and items as indicated on drawings.

## 3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of

- unstable structures.
- 3. Provide, erect, and maintain temporary barriers and security devices.
- 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
- 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
- 6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
- 7. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Protect existing structures and other elements to remain in place and not removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations.
- F. Hazardous Materials:
  - 1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
- G. Perform demolition in a manner that maximizes salvage and recycling of materials.
  - 1. Dismantle existing construction and separate materials.
  - 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

### 3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

- I. Maintain operation of existing fire sprinkler system. Notify Owner days before system or parts of system must be inactive to allow tie-in of new work. Minimize hazardous exposures during time fire sprinkler system is out of service.

### 3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
  - 1. Verify construction and utility arrangements are as indicated.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.
- C. Remove existing work as indicated and required to accomplish new work.
  - 1. Remove items indicated on drawings.
  - 2. Remove rotted wood, corroded metals, and deteriorated masonry and concrete when encountered. Notify and provide cost of work for approval by Owner prior to removal of any unforeseen items.
- D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
  - 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
  - 2. Where existing systems or equipment are not active and the work requires reactivation, put back into operational condition. Repair supply, distribution, and equipment as required.
  - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    - a. Disable existing systems only to make switchovers and connections. Minimize duration of outages.
    - b. Provide temporary connections as required to maintain existing systems in service.
  - 4. Verify that abandoned services serve only abandoned facilities before removal.
  - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification. Patch holes left by the removal using materials specified for new construction.
- E. Protect existing work to remain.
  - 1. Prevent movement of structure. Provide shoring and bracing as required.
  - 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
  - 4. Patch to match new work.

### 3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION



## SECTION 02 4110 - CUTTING AND PATCHING

## PART 1 GENERAL

## 1.01 DESCRIPTION

- A. This section includes cutting, coring, fitting, and patching as required in existing construction.
- B. Perform the work of this section as necessary to:
  - 1. Complete the work.
  - 2. Fit products together to integrate with other work.
  - 3. Provide openings for penetration of mechanical, electrical, and other services.
  - 4. Match work that has been cut to adjacent work.
  - 5. Repair areas adjacent to cuts to required condition.
  - 6. Repair existing areas and new work damaged by subsequent work.
  - 7. Remove and replace defective and non-conforming work.
  - 8. Repair or removal of hazardous or unsanitary conditions.
  - 9. Uncover portions of the work to provide for installation of ill-timed work.
  - 10. Remove abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring.

## PART 2 PRODUCTS

## 2.01 MATERIALS

- A. New Materials: Use materials specified in technical sections of these specifications.
- B. Existing Materials: Determine type and quality of existing materials by inspecting and testing products where necessary.

## PART 3 EXECUTION

## 3.01 INSPECTION

- A. Inspect existing conditions of the project, especially elements subject to damage or to movement during cutting, coring, patching, and alterations.
- B. Comply with the requirements of Section 01 7000, Execution Requirements, for investigation prior to penetration of floor slabs.
- C. After uncovering work, inspect the conditions affecting the installation of products or performance of the work.
- D. Report unsatisfactory or dubious conditions to Owner/Architect in writing. Proceed with the work only after the Owner/Architect has provided further instructions.

## 3.02 PREPARATION

- A. Provide shoring, bracing, and other support as necessary to prevent movement of the structure and to assure the structural safety of that portion of the work.
- B. Provide devices and methods to protect the existing facility and other portions of the work from damage.
- C. Provide protection from the elements for that portion of the existing facility and work which will be exposed by cutting and patching and alterations work.

### 3.03 CUTTING AND PATCHING

- A. Execute cutting, coring, and demolition by methods which will assure safety, will prevent damage to other work or existing areas to remain, and will provide proper surfaces to receive repairs.
- B. Pneumatic tools will not be allowed without prior written approval.
- C. Fit work air-tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- D. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
- E. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes. Where not specified, match existing materials and finishes for color, texture, and appearance.
- F. Where removal results in adjacent spaces becoming one, rework floors and ceilings to provide smooth planes without breaks, steps or bulkheads, unless otherwise indicated.
- G. Unless shown otherwise, perform cutting so that a smooth transition with new work is possible and terminate existing surface along a straight line at a natural line of division.
- H. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Port review and request instructions.
- I. Restore work that has been cut or removed.
- J. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance so that the patch or transition is invisible from a normal viewing distance.
- K. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
  - 1. For continuous surfaces, refinish to nearest intersection or natural break.
  - 2. For an assembly, refinish the entire unit.
- L. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.
- M. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
- N. At completion of work in each area, return space to a condition suitable for use.

### 3.04 ALTERATIONS

- A. Remove existing work as indicated and as required to accomplish new work.
  - 1. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
  - 2. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- B. Adhere to requirements for cutting and patching where applicable.
- C. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

- D. Verify that construction and utility arrangements are as shown.
  - 1. Report discrepancies to Owner/Architect before disturbing existing installation.
  - 2. Beginning of alterations work constitutes acceptance of existing conditions.
- E. Clean existing systems and equipment that become unclean due to the work.
- F. Remove demolition debris and abandoned items from work area and dispose of off-site.

## SECTION 06 1000 - ROUGH CARPENTRY

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Structural dimension lumber framing.
- B. Nonstructural dimension lumber framing.
- C. Rough opening framing for doors, windows, and roof openings.
- D. Concealed wood blocking, nailers, and supports.

## 1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings.
- E. PS 1 - Structural Plywood.
- F. PS 20 - American Softwood Lumber Standard.

## PART 2 PRODUCTS

## 2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
  - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at [www.alsc.org](http://www.alsc.org), and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

## 2.02 DIMENSION LUMBER

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Stud Framing (2 by 2 through 2 by 6 ):
  - 1. Species: Douglas Fir-Larch.
  - 2. Grade: No. 2.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

## 2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- B. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
3. Other Locations: PS 1, C-D Plugged or better.

#### 2.04 ACCESSORIES

- A. Fasteners and Anchors:
  1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. General Purpose Construction Adhesives: Comply with ASTM C557.

### PART 3 EXECUTION

#### 3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

#### 3.02 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
- E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.
- G. For interior walls:
  1. Size headers for actual loads.
  2. Use two-stud corners.
- H. Space interior wall studs at 16 inches on center unless otherwise indicated.

#### 3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is



explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific nonstructural framing and blocking:

1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

### 3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

### 3.05 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

## SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Countertops.
- C. Hardware.

## 1.02 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.
- E. BHMA A156.9 - Cabinet Hardware.
- F. NEMA LD 3 - High-Pressure Decorative Laminates.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- C. Product Data: Provide data for hardware accessories.

## 1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

## PART 2 PRODUCTS

## 2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Cabinets:
  - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
  - 2. Finish - Concealed Surfaces: Manufacturer's option.
  - 3. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
  - 4. Adjustable Shelf Loading: 40 psf.
- C. Cabinet Style: Flush overlay.
  - 1. Drawer Construction Technique: Dovetail joints.

## 2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

## 2.03 PANEL CORE MATERIALS

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.

1. Panel Thickness: 3/4 inch.
2. Products:
  - a. Roseburg Forest Products; SkyBlend: [www.roseburg.com/#sle](http://www.roseburg.com/#sle).
- B. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.
  1. Panel Thickness: 3/4 inch.
  2. Products:
    - a. Roseburg Forest Products; Medite II: [www.roseburg.com/#sle](http://www.roseburg.com/#sle).

#### 2.04 LAMINATE MATERIALS

- A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- B. Provide specific types as indicated.
  1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, finish as indicated.
  2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, finish as indicated.
  3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, white color, satin finish.

#### 2.05 COUNTERTOPS

- A. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL, conventionally fabricated and self-edge banded.

#### 2.06 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
  1. Color: To match cabinet face.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.
- E. Grommets: Standard plastic grommets with cap for cut-outs, in color to match adjacent surface.
  1. Size: 2-inch diameter.

#### 2.07 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports for Cabinets: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing adjustments.
  1. Pin Supports: L-shape type with screw hole.
- C. Adjustable Shelf Supports for Wall Shelves: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch spacing adjustments.
- D. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.
  1. Materials: Steel; L-shape cross-section.
    - a. Finish: Manufacturer's standard, factory-applied, powder coat.
    - b. Color: Black.

- c. Support Length: As required for counter depth.
- 2. Products:
  - a. FastCap; SpeedBrace SB Size-Color: [www.fastcap.com](http://www.fastcap.com).
  - b. Substitutions: See Section 01 6000 - Product Requirements.
- E. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.
- F. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
- G. Cabinet Catches:
  - 1. Type: Magnetic catch.
- H. Drawer Slides:
  - 1. Type: Full extension with overtravel.
  - 2. Static Load Capacity: Heavy Duty grade.
  - 3. Mounting: Side mounted.
  - 4. Stops: Positive type.
  - 5. Features: Provide self closing/stay closed type.
- I. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

## 2.08 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths of tops using best method recommended by manufacturer.
  - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- E. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
- F. Height: 4 inches, unless otherwise indicated.
- G. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
- H. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
- I. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.
- J. Wall-Mounted Counters: Provide skirts and aprons as indicated on drawings, finished to match.
- K. Adjustable Shelves:

1. 30 inches long, maximum: 3/4 inch thick substrate.
2. Over 30 inches long: 1 inch thick substrate.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

#### 3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
  1. Upper and lower cabinets shall be anchored top and bottom to each backing stud at 16 inches on center.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
  1. Keep use of fillers to a minimum; color match to HDPL color.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- H. Seal joint between back/end splashes and vertical surfaces.

#### 3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

#### 3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION



## SECTION 06 8316 - FIBERGLASS REINFORCED PANELING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.

## 1.02 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- B. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- C. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. FM 4880 - Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Samples: Submit two samples 4 by 4 inch in size illustrating material and surface design of panels.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Panels: Quantity equal to 10 percent of total installed.

## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
  - 1. Crane Composites, Inc; Glasbord: [www.cranecomposites.com/#sle](http://www.cranecomposites.com/#sle).
  - 2. Marlite, Inc: [www.marlite.com/#sle](http://www.marlite.com/#sle).
  - 3. Nudo Products, Inc: [www.nudo.com/#sle](http://www.nudo.com/#sle).
  - 4. Panolam Industries International, Inc: [www.panolam.com/#sle](http://www.panolam.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 PANEL SYSTEMS

- A. Wall Panels:
  - 1. Panel Size: 4 by 8 feet.
  - 2. Panel Thickness: 0.09 inch.
  - 3. Surface Design: Linen.
  - 4. Color: White or gray.
  - 5. Attachment Method: Adhesive only, with trim and sealant in joints.

## 2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
  - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
  - 2. Class 1 fire rated when tested in accordance with FM 4880.
  - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 4. Impact Strength: Greater than 10 ft lb force per inch, when tested in accordance with ASTM D256.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Silicone; white.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

### 3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

## SECTION 07 9200 - JOINT SEALANTS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

## 1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

## 1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- B. ASTM C834 - Standard Specification for Latex Sealants.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- F. ASTM C1311 - Standard Specification for Solvent Release Sealants.
- G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
- H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- I. UL 263 - Standard for Fire Tests of Building Construction and Materials.

## 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Executed warranty.

## 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.

## 1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

## 1.07 MOCK-UP

- A. Install one sealant installation representative of each type of joint sealant and each joint sealant application. Install a minimum of 1 linear ft (1/3 linear m) of sealant.
- B. If accepted, mock-up will represent minimum standard for the Work.
- C. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

## PART 2 PRODUCTS

### 2.01 JOINT SEALANT APPLICATIONS

- A. Scope:
  - 1. Interior Joints:
    - a. Do not seal interior joints indicated on drawings as not sealed.
    - b. Seal the following joints:
      - 1) Joints between door frames, window frames, and other frames and adjacent construction.
      - 2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
- B. Exterior Joints: Use non-sag silyl-terminated polyether/polyurethane sealant, unless otherwise indicated.
  - 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
  - 2. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
  - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
  - 2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
  - 3. Floor Joints in Wet Areas: Self-leveling polyurethane "traffic-grade" sealant suitable for continuous liquid immersion.
  - 4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
  - 5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant or butyl rubber, non-curing.
  - 6. At Penetrations in Fire-Rated, Sound-Rated Assemblies: Acrylic latex sealant, firestopping type.
  - 7. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
  - 8. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other

similar items.

- E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

## 2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 6116.
- B. Colors: As indicated on drawings.

## 2.03 NONSAG JOINT SEALANTS

- A. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
  - 1. Color: White.
  - 2. Products:
    - a. Dow Chemical Company; DOWSIL 784 Silicone Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html](http://consumer.dow.com/en-us/industry/ind-building-construction.html).
    - b. General Electric Company; SCS1700 Sanitary Silicone Sealant: [www.ge.com](http://www.ge.com).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- B. Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 50 percent, minimum.
  - 2. Color: Match adjacent finished surfaces.
  - 3. Service Temperature Range: 0 to 180 degrees F.
  - 4. Products:
    - a. Franklin International Inc; Titebond WeatherMaster Metal Roof Sealant: [www.titebond.com/#sle](http://www.titebond.com/#sle).
    - b. Master Builders Solutions; MasterSeal NP100: [www.master-builders-solutions.com/en-us/#sle](http://www.master-builders-solutions.com/en-us/#sle).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Tamper-Resistant, Silyl-Terminated Polyether (STPE) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 50 percent, minimum
  - 2. Hardness Range: 15 to 20, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Match adjacent finished surfaces.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F.
  - 5. Products:
    - a. Master Builders Solutions by BASF; MasterSeal NP150: [www.master-builders-solutions.basf.us/en-us](http://www.master-builders-solutions.basf.us/en-us).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Color: Match adjacent finished surfaces.
  - 3. Service Temperature Range: Minus 40 to 180 degrees F.
  - 4. Products:
    - a. Master Builders Solutions; MasterSeal NP1: [www.master-builders-solutions.com/en-us/#sle](http://www.master-builders-solutions.com/en-us/#sle).



- b. Tremco Commercial Sealants & Waterproofing; Vulkem 116:  
www.tremcosealants.com/#sle.
  - c. Substitutions: See Section 01 6000 - Product Requirements.
- E. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
  - 1. Movement Capability: Plus and minus 35 percent, minimum.
  - 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Match adjacent finished surfaces.
  - 4. Service Temperature Range: Minus 40 to 170 degrees F.
  - 5. Products:
    - a. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- F. Acrylic Emulsion Latex: Water-based acoustical; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
  - 1. Color: Standard colors matching finished surfaces, Type OP (opaque).
  - 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
  - 3. Products:
    - a. Henkel Corporation; OSI SC175 Draft & Acoustical Sound Sealant:  
www.ositough.com.
    - b. USG Corporation; USG Sheetrock Brand Acoustical Sealant: www.usg.com.
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- G. Acrylic Latex Sealant: ASTM C834; for use as acoustical sealant and in firestopping systems for expansion joints and through penetrations.
  - 1. Color: White.
  - 2. Fire Rated System: Complies with UL 263 and ASTM E119 with UL fire resistance classifications.
  - 3. Products:
    - a. Pecora Corporation; AC-20 FTR (Fire and Temperature Rated):  
www.pecora.com/#sle.
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- H. Non-Curing Butyl Sealant: Solvent-based acoustical, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.
  - 1. Products:
    - a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant:  
www.pecora.com/#sle.
    - b. Tremco Commercial Sealants & Waterproofing; Tremco Acoustical Sealant (interior applications only): www.tremcosealants.com.
    - c. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.04 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Gray.

4. Service Temperature Range: Minus 40 to 170 degrees F.
5. Products:
  - a. Sika Corporation; Sikaflex-1c SL: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
  1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  3. Color: Gray.
  4. Service Temperature Range: Minus 40 to 170 degrees F.
  5. Products:
    - a. Sika Corporation; Sikaflex-1c SL: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- C. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
  1. Composition: Multicomponent, 100 percent solids by weight.
  2. Durometer Hardness: Minimum of 85 for Type A, after seven days when tested in accordance with ASTM C661.
  3. Color: Concrete gray.
  4. Joint Width, Minimum: 1/8 inch.
  5. Joint Width, Maximum: 3/4 inch.
  6. Joint Depth: Provide product suitable for joints from 1/2 inch (13 mm) to 3 inches (76 mm) in depth excluding space for sand filler.
  7. Products:
    - a. Substitutions: See Section 01 6000 - Product Requirements.

## 2.05 ACCESSORIES

- A. Sealant Backing Rod, Closed-Cell Type:
  1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
  2. Size: 25 to 50 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

### 3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

### 3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
  - 1. Width/depth ratio of 2:1.
  - 2. Neck dimension no greater than 1/3 of the joint width.
  - 3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

## SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Thermally insulated hollow metal doors with frames.
- D. Hollow metal borrowed lites glazing frames.

## 1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- H. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- I. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.
- J. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

## PART 2 PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
  4. Typical Door Face Sheets: Flush.
  5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

## 2.02 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
  2. Door Thickness: 1-3/4 inches, nominal.
  3. Weatherstripping: Refer to Section 08 7100.
  4. Door Finish: Factory primed and field finished.

## 2.03 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements unless otherwise indicated.
- B. Exterior Door Frames: Full profile/continuously welded type, thermally insulated.
1. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
  2. Frame Finish: Factory primed and field finished.
  3. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames, Non-Fire Rated: Knock-down type.
1. Level 1 - Standard-duty.
  2. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
  3. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
  4. Frame Finish: Factory primed and field finished.
- D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- F. Provide guard boxes for hardware cut-outs in frames to be filled with spray foam insulation.
- G. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

## 2.04 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

## 2.05 ACCESSORIES

- A. Glazing: As specified in Section 08 8000, factory installed.



- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Provide guard boxes for hardware cut-outs in frames to be filled with spray foam insulation.
- D. Silencers for Interior Door: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### 3.02 PREPARATION

- A. Apply primer to inside of frames to be filled with spray foam insulation in accordance with manufacturer's instructions.

### 3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Apply spray foam insulation and trim excess away; brace frames so that pressure from spray foam before setting will not deform frames.
- D. Install door hardware as specified in Section 08 7100.
- E. Comply with glazing installation requirements of Section 08 8000.

### 3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

### 3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

## END OF SECTION

## SECTION 08 1416 - FLUSH WOOD DOORS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. New Flush wood doors; flush configuration; non-rated.

## 1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 7100 - Door Hardware.

## 1.03 REFERENCE STANDARDS

- A. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

## 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Warranty, executed in Owner's name.

## 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

## 1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
  - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## PART 2 PRODUCTS

## 2.01 DOORS

- A. Doors: See drawings for locations and additional requirements.
  - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.
  - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.

- 2. Wood veneer facing with factory transparent finish.

## 2.02 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated. Particle board to have no added urea formaldehyde.

## 2.03 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: White birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

- 1. Vertical Edges: Any option allowed by quality standard for grade.

## 2.04 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at lock edge for hardware reinforcement.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

## 2.05 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
  - 1. Transparent:
    - a. System - TR-8, UV Cured Acrylated Polyester/Urethane.
    - b. Sheen: Semigloss.

## 2.06 ACCESSORIES

- A. Door Hardware: See Section 08 7100.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### 3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.

### 3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

## SECTION 08 3100 - ACCESS DOORS AND PANELS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Wall- and ceiling-mounted access units.

## 1.02 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting: Field paint finish.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Manufacturer's Installation Instructions: Indicate installation requirements.
- D. Project Record Documents: Record actual locations of each access unit.

## PART 2 PRODUCTS

## 2.01 WALL- AND CEILING-MOUNTED ACCESS UNITS

- A. Manufacturers:
  1. Activar Construction Products Group - JL Industries: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  2. ACUDOR Products Inc: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  3. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  4. Cendrex, Inc: [www.cendrex.com/#sle](http://www.cendrex.com/#sle).
  5. MIFAB, Inc: [www.mifab.com/#sle](http://www.mifab.com/#sle).
  6. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated, typical, and stainless steel, Type 304, at toilet rooms.
  2. Style: Exposed frame with door surface flush with frame surface.
  3. Door Style: Single thickness with rolled or turned in edges.
  4. Frames: 16-gauge, 0.0598-inch minimum thickness.
  5. Steel Finish: Primed.
  6. Stainless Steel Finish: No.4 brushed finish.
  7. Door/Panel Size: As indicated on the drawings.
  8. Hardware:
    - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    - b. Latch/Lock: Screw driver slot for quarter turn cam latch.
    - c. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
    - d. Gasketing: Extruded neoprene, around perimeter of door panel.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

### 3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION



## SECTION 08 4313 - ALUMINUM-FRAMED STOREFRONTS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.

## 1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.
- B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- D. Section 08 8000 - Glazing: Glass and glazing accessories.

## 1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document).
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
- E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- J. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- M. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

## 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.

- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

#### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

#### 1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

#### 1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against excessive degradation of exterior finish.  
Include provision for replacement of units with excessive fading, chalking, or flaking.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Aluminum-Framed Storefronts Manufacturers:
  1. Arcadia, Inc: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).
  2. Kawneer North America: [www.kawneer.com/#sle](http://www.kawneer.com/#sle).
  3. Oldcastle BuildingEnvelope: [www.oldcastlebe.com/#sle](http://www.oldcastlebe.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.02 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  1. Glazing Position: Centered (front to back).
  2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep at exterior applications and 1-3/4 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep) at interior applications.
  3. Finish: Class I natural anodized.
    - a. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
  4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments

- concealed from view; reinforced as required for imposed loads.
- 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
- 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
- 8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
- 9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements
  - 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
    - a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
  - 2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
  - 3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
  - 4. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
  - 5. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
  - 6. Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F), maximum.
  - 7. Overall Solar Heat Gain Coefficient (SHGC) Including Glazing: 0.38, maximum.
  - 8. Overall Visible Transmittance to Solar Heat Gain Coefficient Ratio (VT/SHGC) Including Glazing: 1.10, minimum.

## 2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
  - 1. Framing members for interior applications need not be thermally broken.
  - 2. Glazing Stops: Flush.
  - 3. Manufacturers:
    - a. Kawneer North America; Trifab VG 451T Framing System at exterior applications and Trifab VG 451 Framing System at interior applications: [www.kawneer.com](http://www.kawneer.com).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Glazing: See Section 08 8000.
- C. Swing Doors: Glazed aluminum, thermally broken with interior section insulated from exterior.
  - 1. Thickness: 2-1/4 inches.
  - 2. Top Rail: 3-1/2 inches wide.
  - 3. Vertical Stiles: 3-1/2 inches wide.
  - 4. Bottom Rail: 12 inches wide.
  - 5. Glazing Stops: Square.

6. Finish: Same as storefront.
7. Assembly Thermal and Optical Performance: Provide glazed building entrance doors with performance properties as indicated.
  - a. Thermal Transmittance (U-Value): 0.63, maximum.
  - b. Solar Heat Gain Coefficient (SHGC): 0.33, maximum.
  - c. Visible Transmittance to Solar Heat Gain Coefficient Ratio (VT/SHGC): 1.10, minimum.
8. Manufacturers:
  - a. Kawneer North America; 350T Insulpour Thermal Entrances: [www.kawneer.com](http://www.kawneer.com).
  - b. Substitutions: See Section 01 6000 - Product Requirements.

## 2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Fasteners: Stainless steel.
- D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.
- E. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch minimum thickness.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- G. Sealant for Setting Thresholds: Non-curing butyl type.
- H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- I. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

## 2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

## 2.06 HARDWARE

- A. For each door, include weatherstripping.
- B. Other Door Hardware: See Section 08 7100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, of neoprene; provide on all exterior doors.
- E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all exterior doors.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

### 3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Install glass in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### 3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### 3.04 ADJUSTING

- A. Adjust operating hardware for smooth operation.

### 3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

### 3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

## SECTION 08 7100 - DOOR HARDWARE

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Hardware for wood and aluminum doors.
- B. Lock cylinders for doors that hardware is specified in other sections.
- C. Thresholds.
- D. Weatherstripping and gasketing.

## 1.02 RELATED REQUIREMENTS

- A. Section 06 4100 - Architectural Wood Casework: Cabinet hardware.
- B. Section 07 9200 - Joint Sealants: Sealants for setting exterior door thresholds.
- C. Section 08 4313 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

## 1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. BHMA A156.1 - Standard for Butts and Hinges.
- C. BHMA A156.2 - Bored and Preamsembled Locks and Latches.
- D. BHMA A156.3 - Exit Devices.
- E. BHMA A156.4 - Door Controls - Closers.
- F. BHMA A156.5 - Cylinders and Input Devices for Locks.
- G. BHMA A156.6 - Standard for Architectural Door Trim.
- H. BHMA A156.7 - Template Hinge Dimensions.
- I. BHMA A156.8 - Door Controls - Overhead Stops and Holders.
- J. BHMA A156.13 - Mortise Locks & Latches Series 1000.
- K. BHMA A156.16 - Auxiliary Hardware.
- L. BHMA A156.18 - Materials and Finishes.
- M. BHMA A156.21 - Thresholds.
- N. BHMA A156.22 - Standard for Gasketing.
- O. BHMA A156.26 - Standard for Continuous Hinges.
- P. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems.
- Q. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
- R. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames.
- S. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
- T. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors.
- U. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- V. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- W. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
- X. UL (DIR) - Online Certifications Directory.
- Y. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.



#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
  - 1. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- D. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
  - 1. Submit final typed finish hardware schedule that includes any corrections and changes to the submittal schedule.
- E. Keying: All final keying furnished by Owner.
- F. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

#### 1.06 QUALITY ASSURANCE

- A. Single Source: Where several manufacturers are specified for one type of hardware, use only products of one manufacturer.
- B. Installer's Qualifications:
  - 1. Locally recognized installer of commercial hardware products and an employer of workers trained and approved by product manufacturers and who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- C. Supplier's Qualifications:
  - 1. Hardware supplier shall have and maintain a factory direct status with all manufacturer's specified or approved.
  - 2. Supplier shall employ an Architectural Hardware Consultant (AHC) who will coordinate and produce required submittals and who is available during the course of the project for meetings with the Architect and Owner.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.
  - 1. Deliver in unopened containers.
- B. Delivery of Keys: Deliver to Owner in person, or by registered mail.

### 1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
  - 1. Closers: 30 years, minimum.
  - 2. Exit Devices: Three years, minimum.
  - 3. Locksets and Cylinders: 10 years, minimum.
  - 4. Other Hardware: Two years, minimum.
- C. Upon notification of defects within warranty period, make necessary repairs and replacements at Owner's convenience.

## PART 2 PRODUCTS

### 2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
  - 1. Applicable provisions of federal, state, and local codes.
  - 2. Accessibility: ADA Standards and ICC A117.1.
  - 3. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
  - 4. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
    - a. Air Leakage Rate: Tested in accordance with UL 1784, with air leakage rate not to exceed 3.0 cfm/sf of door opening at 0.10 inch of water for both ambient and elevated temperature tests.
  - 5. Auxiliary Hardware: BHMA A156.16.
  - 6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
  - 7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
- D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.
- E. Fasteners:
  - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    - a. Aluminum fasteners are not permitted.
    - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
  - 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    - a. Self-drilling (Tek) type screws are not permitted.

- b. Through-bolting type are not permitted.
- 3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
- 4. Provide wall grip inserts for hollow wall construction.
- 5. Fire-Rated Applications: Comply with NFPA 80.
  - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
  - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
- 6. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

## 2.02 HINGES

- A. Manufacturers:
  - 1. Ives, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  - 2. McKinney; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Stanley, dormakaba Group: [www.stanleyhardwarefordoors.com/#sle](http://www.stanleyhardwarefordoors.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Hinges: Comply with BHMA A156.1, Grade 1.
  - 1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
    - a. Provide hinge width required to clear surrounding trim.
  - 2. Continuous Hinges: Comply with BHMA A156.26.
  - 3. Provide hinges on every swinging door.
  - 4. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
  - 5. Provide ball-bearing hinges at each door with closer.
  - 6. Provide non-removable pins on exterior outswinging doors.
  - 7. Provide non-removable pins on interior outswinging doors at locations as indicated.
  - 8. Provide power transfer hinges where electrified hardware is mounted in door leaf.
  - 9. Provide following quantity of butt hinges for each door:
    - a. Doors up to 60 inches High: Two hinges.
    - b. Doors From 60 inches High up to 95 inches High: Three hinges.
    - c. Doors at 96 inches High: Four hinges.

## 2.03 FLUSH BOLTS

- A. Manufacturers:
  - 1. Ives, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  - 2. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Flush Bolts: Comply with BHMA A156.16, Grade 1.
  - 1. Flush Bolt Throw: 3/4 inch, minimum.
  - 2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
    - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
  - 3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
  - 4. Automatic Flush Bolts: Automatically latch upon closing of door; automatic retraction of bolts when active leaf is opened; located on inactive leaf of pair of doors.

## 2.04 EXIT DEVICES

- A. Manufacturers:
  - 1. Von Duprin, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).

2. Substitutions: Not permitted.
- B. Exit Devices: Comply with BHMA A156.3, Grade 1.
  1. Provide exit devices properly sized for door width and height.
  2. Provide strike as recommended by manufacturer for application indicated.
  3. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

## 2.05 LOCK CYLINDERS

- A. Manufacturers:
  1. Schlage, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  2. Substitutions: Not permitted.
- B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
  1. Provide full size interchangeable core (FSIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
  2. Provide cylinders from same manufacturer as locking device.
  3. Provide cams and/or tailpieces as required for locking devices.
  4. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.

## 2.06 CYLINDRICAL LOCKS

- A. Manufacturers:
  1. Schlage, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  2. Substitutions: Not permitted.
- B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
  1. Bored Hole: 2-1/8 inch diameter.
  2. Latchbolt Throw: 1/2 inch, minimum.
  3. Backset: 2-3/4 inch unless otherwise indicated.
  4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
    - a. Finish: To match lock or latch.
    - b. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
    - c. Extra-Long-Lip Strikes: Provide for locks used on frames with applied wood casing trim.
    - d. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.

## 2.07 MORTISE LOCKS

- A. Manufacturers:
  1. Schlage, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  2. Substitutions: Not permitted.
- B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
  1. Latchbolt Throw: 3/4 inch, minimum.
  2. Deadbolt Throw: 1 inch, minimum.
  3. Backset: 2-3/4 inch unless otherwise indicated.
  4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
    - a. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.

- b. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.
- c. Finish: To match lock or latch.

## 2.08 DOOR PULLS AND PUSH PLATES

### A. Manufacturers:

- 1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
- 2. Forms+Surfaces: [www.forms-surfaces.com/#sle](http://www.forms-surfaces.com/#sle).
- 3. Hager Companies: [www.hagerco.com/#sle](http://www.hagerco.com/#sle).
- 4. Hiawatha, Inc, division of Activar Construction Products Group, Inc: [www.activarcpg.com/hiawatha/#sle](http://www.activarcpg.com/hiawatha/#sle).
- 5. Pamex, Inc: [www.pamexinc.com/#sle](http://www.pamexinc.com/#sle).
- 6. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
- 7. Ives, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
- 8. Substitutions: See Section 01 6000 - Product Requirements.

### B. Door Pulls and Push Plates: Comply with BHMA A156.6.

- 1. Pull Type: Offset, unless otherwise indicated.
- 2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
  - a. Edges: Beveled, unless otherwise indicated.
- 3. Material: Aluminum, unless otherwise indicated.

## 2.09 COORDINATORS

### A. Manufacturers:

- 1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
- 2. DORMA USA, Inc; TS93 GSR: [www.dorma.com/#sle](http://www.dorma.com/#sle).
- 3. Hiawatha, Inc, division of Activar Construction Products Group, Inc: [www.activarcpg.com/hiawatha/#sle](http://www.activarcpg.com/hiawatha/#sle).
- 4. Ives, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
- 5. Pamex, Inc: [www.pamexinc.com/#sle](http://www.pamexinc.com/#sle).
- 6. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
- 7. Substitutions: See Section 01 6000 - Product Requirements.

### B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.

- 1. Type: Bar, unless otherwise indicated.
- 2. Material: Aluminum, unless otherwise indicated.
- 3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

## 2.10 CLOSERS

### A. Manufacturers; Surface Mounted:

- 1. Stanley, dormakaba Group: [www.stanleyhardwarefordoors.com/#sle](http://www.stanleyhardwarefordoors.com/#sle).
- 2. Substitutions: Not permitted.

### B. Manufacturers; Low Energy for ADA Applications:

- 1. LCN, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
- 2. Substitutions: Not permitted.

### C. Closers: Comply with BHMA A156.4, Grade 1.

- 1. Type: Surface mounted to door.
- 2. Provide door closer on each exterior door.
- 3. Provide door closer on each fire-rated and smoke-rated door.

4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
5. At corridor entry doors, mount closer on room side of door.
6. At outswinging exterior doors, mount closer on interior side of door.

## 2.11 OVERHEAD STOPS AND HOLDERS

- A. Manufacturers:
  1. Rixson; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  2. Glynn-Johnson, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.

## 2.12 KICK PLATES

- A. Manufacturers:
  1. Ives, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  2. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
  3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
  1. Size: 10 inch high by 2 inch less door width (LDW) on push side of door.

## 2.13 FLOOR STOPS

- A. Manufacturers:
  1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  2. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
  3. Ives, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
  1. Type: Heavy-duty, with bumper floor stop.
  2. Material: Steel housing with rubber insert.

## 2.14 WALL STOPS

- A. Manufacturers:
  1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  2. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
  3. Ives, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
  1. Type: Bumper, convex, wall stop.
  2. Material: Brass housing with rubber insert.

## 2.15 ASTRAGALS

- A. Manufacturers:
  1. Pemko; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  2. National Guard Products, Inc: [www.ngpinc.com/#sle](http://www.ngpinc.com/#sle).
  3. Zero International, Inc: [www.zerointernational.com/#sle](http://www.zerointernational.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.



- B. Astragals: Comply with BHMA A156.22.
  - 1. Type: Meeting and overlapping type, and with sealing gasket.
  - 2. Material: Steel or aluminum, see hardware groups.
  - 3. Provide non-corroding fasteners at exterior locations.

## 2.16 THRESHOLDS

- A. Manufacturers:
  - 1. Pemko; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. National Guard Products, Inc: [www.ngpinc.com/#sle](http://www.ngpinc.com/#sle).
  - 3. Zero International, Inc: [www.zerointernational.com/#sle](http://www.zerointernational.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Thresholds: Comply with BHMA A156.21.
  - 1. Provide threshold at each exterior door, unless otherwise indicated.
  - 2. Type: Flat surface.
  - 3. Material: Aluminum.
  - 4. Threshold Surface: Fluted horizontal grooves across full width.
  - 5. Field cut threshold to profile of frame and width of door sill for tight fit.
  - 6. Provide non-corroding fasteners at exterior locations.

## 2.17 WEATHERSTRIPPING AND GASKETING

- A. Manufacturers:
  - 1. Pemko; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. National Guard Products, Inc: [www.ngpinc.com/#sle](http://www.ngpinc.com/#sle).
  - 3. Zero International, Inc: [www.zerointernational.com/#sle](http://www.zerointernational.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
  - 1. Head and Jamb Type: Self-adhesive.
  - 2. Door Sweep Type: Door shoe with drip cap; or mortise or concealed automatic, encased in retainer.
  - 3. Material: Aluminum, with brush weatherstripping or bio-based polymer extrusion.
  - 4. Provide gasketing for smoke and draft control doors (Indicated as "S" on Drawings) that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
  - 5. Provide frame-applied intumescent gasketing on wood doors that are labeled as smoke and draft control doors (Indicated as "S" on Drawings), unless otherwise indicated.
  - 6. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
  - 7. Provide door bottom sweep on each exterior door, unless otherwise indicated.
  - 8. Provide sound-rated gasketing and automatic door bottom on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.

## 2.18 LATCH PROTECTOR

- A. Manufacturers:
  - 1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Ives, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Latch Protector: Provide on door to protect latch from being tampered with while in locked position.
  - 1. Type: Standard latch protector.
  - 2. Material: Stainless steel.

## 2.19 SILENCERS

- A. Manufacturers:
  - 1. Ives, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  - 2. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
  - 1. Single Door: Provide three on strike jamb of frame.
  - 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
  - 3. Material: Rubber, gray color.

## 2.20 KEY CABINET

- A. Manufacturers:
  - 1. MMF Industries: [www.mmfind.com](http://www.mmfind.com).
  - 2. Telkee: [www.telkee.com](http://www.telkee.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
  - 1. Mounting: Wall-mounted.
  - 2. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
  - 3. Finish: Baked enamel, manufacturer's standard color.
  - 4. Key cabinet lock to building keying system.

## 2.21 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
  - 1. Primary Finish: 630; satin stainless steel, with stainless steel 300 series base material (former US equivalent US32D); BHMA A156.18.
  - 2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
    - a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
  - 3. Unless otherwise specified, match finish of each item of hardware with finish selected for lock sets and latches.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.

### 3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- D. Use templates provided by hardware item manufacturer.

- E. Do not install surface mounted items until application of finishes to substrate are fully completed.
- F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list, unless noted otherwise on drawings.
  - 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
  - 2. For Aluminum-Framed Storefront Doors and Frames: See Section 08 4313.
  - 3. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
  - 4. Mounting heights in compliance with ADA Standards: Distance from finished floor to centerline of hardware item. As indicated on following list, unless noted otherwise on drawings.
    - a. Locksets: 40-5/16 inch.
    - b. Push Plates/Pull Bars: 42 inch.
    - c. Deadlocks (Deadbolts): 48 inch.
    - d. Exit Devices: 40-5/16 inch.
- G. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.
  - 1. See Section 07 9200 for additional requirements.

### 3.03 ADJUSTING

- A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

### 3.04 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

### 3.05 PROTECTION

- A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

## SECTION 08 8000 - GLAZING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.

## 1.02 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- E. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
- F. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
- G. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- H. GANA (GM) - GANA Glazing Manual.
- I. GANA (SM) - GANA Sealant Manual.
- J. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
- K. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
- L. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- M. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

## 1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), and IGMA TM-3000 for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

## 1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

## PART 2 PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  - 3. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
  - 1. In conjunction with weather barrier related materials described in other sections, as follows:
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
  - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 3. Solar Optical Properties: Comply with NFRC 300 test method.

### 2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
  - 1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
  - 2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

### 2.03 INSULATING GLASS UNITS

- A. Insulating Glass Units: Types as indicated.
  - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  - 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  - 3. Spacer Color: Black.
  - 4. Edge Seal:
    - a. Color: Black.
  - 5. Purge interpane space with dry air, hermetically sealed.
- B. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
  - 1. Applications: Exterior glazing unless otherwise indicated.
  - 2. Space between lites filled with argon.
  - 3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    - a. Tint: Clear.
  - 4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.

- a. Tint: Clear.
- 5. Total Thickness: 1 inch.
- 6. Thermal Transmittance (U-Value): \_\_\_\_\_, nominal.

#### 2.04 GLAZING UNITS

- A. Type G-1 - Monolithic Interior Vision Glazing:
  - 1. Applications: Interior glazing unless otherwise indicated.
  - 2. Glass Type: Fully tempered float glass.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch, nominal.

### PART 3 EXECUTION

#### 3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

#### 3.02 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Seal all butt joints with clear silicone sealant.

#### 3.03 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

#### 3.04 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

## SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Acoustic insulation.
- B. Gypsum wallboard.
- C. Joint treatment and accessories.
- D. Plenum space sound control.

## 1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 1000 - Rough Carpentry: Building framing.
- C. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

## 1.03 REFERENCE STANDARDS

- A. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality.
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- E. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- F. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- I. GA-216 - Application and Finishing of Gypsum Panel Products.
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

## 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
  - 1. Provide data on gypsum board, accessories, and joint finishing system.

## 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of experience.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.



## PART 2 PRODUCTS

### 2.01 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. Gold Bond Building Products, LLC provided by National Gypsum Company: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
  - 3. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold resistant board is required in toilet rooms and other wet areas.
  - 3. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
- C. Impact Resistant Wallboard:
  - 1. Application: High traffic areas or as indicated on drawings.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. Thickness: 5/8 inch.
  - 4. Edges: Tapered.

### 2.02 PLENUM SPACE SOUND CONTROL

- A. Manufacturers:
  - 1. AcoustiGuard – WILREP LTD; Privacy Board and Return-Air Silencers: [www.acoustiguard.com/#sle](http://www.acoustiguard.com/#sle).
- B. Description: Acoustical extension wall board for noise control within ceiling plenums above wall partitions.
- C. General Requirements:
  - 1. Airstream surfaces installed in return air plenum to comply with requirements in ASHRAE Std 62.1.
- D. Configuration: As indicated on drawings.
- E. Materials:
  - 1. Mineral Fiber Insulation Board:
    - a. Surface Burning Characteristics: Flame spread/smoke development index of 0/0 when tested in accordance with ASTM E84 or UL 723.
  - 2. Return-Air Silencer:
    - a. Fabricate in accordance with SMACNA (DCS) HVAC Duct Construction Standards.
    - b. Provide return-air silencer on both sides of privacy board.
    - c. Dimensions: As indicated on drawings.
    - d. Mineral Fiber Insulation Board: 2 inch thick insulation board with flame spread/smoke development index of 0/0 when tested in accordance with ASTM E84 or UL 723.

### 2.03 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 inch.

- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
  - 1. Products:
    - a. Franklin International, Inc; Titebond Acoustical Smoke & Sound Sealant:  
www.titebond.com/#sle.
    - b. Specified Technologies Inc; Smoke N Sound Acoustical Sealant:  
www.stifirestop.com/#sle.
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
  - 1. Types: As detailed or required for finished appearance.
  - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
  - 1. Joint Compound: Drying type, vinyl-based, ready-mixed.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

#### 3.02 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

#### 3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

#### 3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
  - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

#### 3.05 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
  - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 3. Level 3: Not permitted - textured wall finish.
  - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

- 5. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

#### 3.06 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

#### 3.07 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

## SECTION 09 5100 - ACOUSTICAL CEILINGS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

## 1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

## 1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.
- D. CHPS (HPPD) - High Performance Products Database.
- E. UL (GGG) - GREENGUARD Gold Certified Products.

## 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.

## PART 2 PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category C and complying with the following:

- 1. ICC-ES Evaluation Report No. 1308.

## 2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
  - 1. VOC Content: Certified as Low Emission by one of the following:
    - a. Product listing in UL (GGG).
    - b. Product listing in CHPS (HPPD).
- B. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:
  - 1. Classification: ASTM E1264 Type IV.
  - 2. Size: 24 by 48 inches.
  - 3. Thickness: 3/4 inch.
  - 4. NRC Range: 0.75 to 0.80, determined in accordance with ASTM E1264.
  - 5. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
  - 6. Panel Edge: Tegal.
  - 7. Tile Edge: Beveled.
  - 8. Color: White.
  - 9. Suspension System: Exposed grid.
  - 10. Products:
    - a. Armstrong World Industries, Inc; Ultima: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.

## 2.03 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- C. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
  - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
  - 2. Profile: Tee; 15/16 inch face width.
  - 3. Finish: Baked enamel.
  - 4. Color: White.
  - 5. Products:
    - a. Armstrong Prelude with Seismic RX.
    - b. Substitutions: See Section 01 6000 - Product Requirements.

## 2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
  - 1. Size: As required for installation conditions and specified Seismic Design Category.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

### 3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM E580/E580M and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
- D. Seismic Suspension System, Seismic Design Category C: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Maintain a 3/8 inch clearance between grid ends and wall.
- E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- H. Do not eccentrically load system or induce rotation of runners.

### 3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.

### 3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

### 3.05 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean surfaces.
- C. Replace damaged or abraded components.

END OF SECTION

## SECTION 09 6500 - RESILIENT FLOORING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Resilient sheet flooring.
- B. Resilient base.
- C. Installation accessories.

## 1.02 REFERENCE STANDARDS

- A. SCAQMD 1168 - Adhesive and Sealant Applications.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base.
- C. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing.
- D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

## 1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Protect roll materials from damage by storing on end.

## PART 2 PRODUCTS

## 2.01 SHEET FLOORING

- A. Vinyl Sheet Flooring: Homogeneous without backing, with color and pattern throughout full thickness.
  - 1. Minimum Requirements: Comply with ASTM F1913.
  - 2. Thickness: 0.080 inch nominal.
  - 3. Seams: Heat welded.
  - 4. Color: As indicated on drawings.
- B. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

## 2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset.
  - 1. Finish: Satin.
  - 2. Profile: Flat at carpet, coved elsewhere.
  - 3. Length: Roll.
  - 4. Color: As indicated on drawings.
  - 5. Accessories: Premolded external corners and internal corners.



## 2.03 ACCESSORIES

- A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer. VOC content below limits specified in SCAQMD 1168.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

### 3.02 PREPARATION

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.

### 3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
  - 1. Spread only enough adhesive to permit installation of materials before initial set.
  - 2. Fit joints and butt seams tightly.
  - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
  - 1. Resilient Strips: Attach to substrate using adhesive.
- F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

### 3.04 INSTALLATION - SHEET FLOORING

- A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
- B. Seal seams by heat welding where indicated.

### 3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

#### 3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

#### 3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

## SECTION 09 9113 - EXTERIOR PAINTING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Non-metallic roofing and flashing.
  - 6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
  - 7. Floors, unless specifically indicated.
  - 8. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
  - 9. Glass.
  - 10. Concealed pipes, ducts, and conduits.

## 1.02 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting.

## 1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

## 1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
- D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

## 1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  4. Manufacturer's installation instructions.
  5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### 1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  1. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  2. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Chemical Components: Provide coatings that comply with MPI Green Performance Standard GPS-2.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: As indicated on drawings.
  - 1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

## 2.03 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including fiber cement siding and primed wood.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
    - a. Products:
      - 1) Sherwin-Williams A-100 Exterior Latex Low Sheen. (MPI #214)
      - 2) Sherwin-Williams A-100 Exterior Latex Gloss. (MPI #11)
  - 3. Primer: As specified under "PRIMERS" below.

## 2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - 1. Alkali Resistant Water Based Primer, MPI Green Extreme Standard; MPI #3 X-Green.
    - a. Products:
  - 2. Interior/Exterior Latex Block Filler, MPI Extreme Green Standard; MPI #4.

- a. Products:
  - 1) Sherwin-Williams ConFlex Block Filler. (MPI #4)
- 3. Latex Primer for Exterior Wood; MPI #6.
  - a. Products:
    - 1) Sherwin-Williams Multi-Purpose Interior/Exterior Latex Primer/Sealer. (MPI #6).
- 4. Bonding Primer, Water Based, MPI Extreme Green Standard; MPI #17.
  - a. Products:
    - 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer, No. 436. (MPI #17)
- 5. Acrylic Surface Conditioner; Fiber-Cement Siding Primer.
  - a. Products:
    - 1) Sherwin-Williams Loxon Acrylic Conditioner.

## 2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Fiber Cement Siding: 12 percent.
  - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  - 3. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

- G. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

### 3.03 APPLICATION

- A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### 3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### 3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION



## SECTION 09 9123 - INTERIOR PAINTING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Prime surfaces to receive wall coverings.
  - 3. Mechanical and Electrical:
    - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
    - c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    - d. Paint dampers exposed behind louvers, grilles, to match face panels.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
  - 9. Glass.
  - 10. Acoustical materials, unless specifically indicated.
  - 11. Concealed pipes, ducts, and conduits.

## 1.02 RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting.

## 1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.
- B. Specular Gloss: Ranges determined by Master Painters Institute (MPI). Sheen is specified to establish required gloss range.

	Sheen	Geometry/Deg.	Gloss Range	MPI Gloss Level
1.	Flat	60	Below 5	1
2.	Flat, light sheen	60	Max 10	2
3.	Eggshell	60	10 to 25	3
4.	Satin	60	20 to 35	4
5.	Semi-gloss	60	35 to 70	5

6. Gloss 60 70 to 85 6

- C. Finish (gloss level) of all painted surfaces shall be as specified herein or as noted on Finish Schedule.

#### 1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
- D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- F. SCAQMD 1113 - Architectural Coatings.
- G. SSPC-SP 1 - Solvent Cleaning.
- H. SSPC-SP 6 - Commercial Blast Cleaning.
- I. SSPC-SP 13 - Surface Preparation of Concrete.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. MPI product number (e.g., MPI #47).
  - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
  - 4. Manufacturer's installation instructions.
  - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.

3. Label each container with color in addition to the manufacturer's label.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### 1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  1. Miller Paint Company: [www.millerpaint.com](http://www.millerpaint.com).
  2. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
  1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

5. Supply each paint material in quantity required to complete entire project's work from a single production run.
  6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. SCAQMD 1113 Rule.
    - c. Architectural coatings VOC limits of 50 g/L, maximum, per MPI Green Performance Standard GPS-2.
  2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Chemical Components: Provide coatings that comply with MPI Green Performance Standard GPS-2.
- D. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

## 2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, wood, uncoated steel, and shop primed steel.
1. Two top coats and one coat primer.
  2. Top Coat(s): Institutional Low Odor/VOC Interior Latex, MPI Extreme Green Standard; MPI #143 and 144.
  3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    - b. Satin: MPI gloss level 4; use this sheen for wall surfaces.
  4. Primer: As specified under "PRIMERS" below.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
1. Medium duty applications include door frames.
  2. Two top coats and one coat primer.
  3. Top Coat(s): Interior Light Industrial Coating, Water Based, MPI Extreme Green Standard; MPI #153.
  4. Top Coat Sheen:
    - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
  5. Primer: As specified under "PRIMERS" below.

## 2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer, MPI Extreme Green Standard; MPI #3.
  2. Interior Institutional Low Odor/VOC Primer Sealer, MPI Extreme Green Standard; MPI #149.

3. Interior Rust-Inhibitive Water Based Primer, MPI Extreme Green Standard; MPI #107.
4. Stain Blocking Primer, Water Based, MPI Extreme Green Standard; MPI #137.
5. Latex Primer for Interior Wood; MPI #39.
6. Bonding Primer, Water Based, MPI Extreme Green Standard; MPI #17.

## 2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  1. Gypsum Wallboard: 12 percent.
  2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete:
  1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
  3. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- F. Masonry:
  1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  2. Prepare surface as recommended by top coat manufacturer.
  3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.

- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- I. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.
- J. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- K. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### 3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### 3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### 3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

## SECTION 10 1419 - DIMENSIONAL LETTER SIGNAGE

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Dimensional letter signage.

## 1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - 2010 ADA Standards for Accessible Design.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Package dimensional letter signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.
- C. Store tape adhesive at a normal room temperature of 68 to 72 degrees F.

## 1.05 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Dimensional Letter Signs:
  - 1. FASTSIGNS International, Inc: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).
  - 2. Inpro Corporation: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 REGULATORY REQUIREMENTS

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

## 2.03 DIMENSIONAL LETTERS

- A. Applications: Room and door signs.
  - 1. Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
  - 2. Use flat signs with sand blasted plastic laminate panel media with tactile braille.



3. Office and Classroom Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings.
  4. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings.
  5. Service and Storage Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
  6. Toilet Rooms: Identify with pictograms, the names of the room, room numbers to be determined later, and braille.
- B. Applications: Interior Directional and Informational Signs:
1. Sign Type: Same as room and door signs.
  2. Wording of signs in accordance with Owner standards to be determined later.
- C. Flat Plastic Signs: Signage media without frame.
1. Material: Laminate colored plastic; sandblasted through face to expose core as background color.
  2. Edges: Square.
  3. Corners: Square.
  4. Thickness: 1/8 inch minimum.
  5. Letter Height: 1 inch.
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper case only.
    - c. Background Color: As scheduled.
    - d. Character Color: Contrasting color.
  6. Sign Height: 1-1/2 inches greater than text body height, unless otherwise indicated.
- D. Non-Tactile Signs: Silk screened plastic panels, bracket mounted.
1. Letters and Graphics: Silk screened onto plastic surface.
  2. Thickness: 1/8 inch minimum.
  3. Sign Color: As selected.

## 2.04 ACCESSORIES

- A. Tape Adhesive: Double-sided tape, permanent adhesive.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

## SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Under-lavatory pipe supply covers.
- D. Utility room accessories.

## 1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.
- B. Section 08 8300 - Mirrors: Other mirrors.

## 1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- F. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.
- G. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- H. ASTM C1036 - Standard Specification for Flat Glass.
- I. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities.

## 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

## 1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
  - 1. AJW Architectural Products: [www.ajw.com/#sle](http://www.ajw.com/#sle).
  - 2. American Specialties, an ASI American Specialties, Inc, company: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 3. Bobrick Washroom Equipment, Inc: [www.bobrick.com](http://www.bobrick.com).
  - 4. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 5. Substitutions: Section 01 6000 - Product Requirements.
- B. Under-Lavatory Pipe Supply Covers:
  - 1. Plumberex Specialty Products, Inc: [www.plumberex.com/#sle](http://www.plumberex.com/#sle).
  - 2. IPS Corporation Truebro Brand: [www.ipscorp.com/plumbing/brands/truebro](http://www.ipscorp.com/plumbing/brands/truebro).
  - 3. Substitutions: Section 01 6000 - Product Requirements.
- C. Provide products of each category type by single manufacturer.

### 2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  - 1. Grind welded joints smooth.
  - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Zinc Alloy: Die cast, ASTM B86.
- F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

### 2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

- E. Back paint components where contact is made with building finishes to prevent electrolysis.

## 2.04 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser: Double roll, surface mounted, for coreless type rolls.
  - 1. Product: Owner supplied, Contractor installed.
- B. Paper Towel Dispenser: Manual, roll paper type.
  - 1. Paper Discharge: Manual dispense by lever operation.
  - 2. Mounting: Surface mounted.
  - 3. Product: Owner supplied, Contractor installed.
- C. Waste Receptacle: Vinyl, freestanding style.
  - 1. Product: Owner supplied, Owner installed.
- D. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with plastic cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
  - 1. Product: Owner supplied, Contractor installed.
- E. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
  - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
  - 2. Size: 24 inches wide by 36 inches high (610 mm wide by 91 mm high).
  - 3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
  - 4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
  - 5. Products:
    - a. Bobrick B-290 Glass Mirror with Stainless Steel Angle Frame.
    - b. Substitutions: Section 01 6000 - Product Requirements.
- F. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base.
  - 1. Minimum capacity: 250 seat covers.
  - 2. Products:
    - a. Bobrick B-4221 Contura Series Surface-Mounted Seat-Cover Dispenser.
    - b. Substitutions: Section 01 6000 - Product Requirements.
- G. Grab Bars: Stainless steel, smooth surface.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Finish: Satin.
    - d. Length and Configuration: As indicated on drawings.
    - e. Products:
      - 1) Bobrick B-6806 Series with Snap Flange.
      - 2) Substitutions: Section 01 6000 - Product Requirements.
- H. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
  - 1. Products:
    - a. Bobrick B-270 Contura Series Surface-Mounted Sanitary Napkin Disposal.

- b. Substitutions: Section 01 6000 - Product Requirements.

## 2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Shower Curtain Rod: Stainless steel tube, 1-1/4 inch outside diameter, 0.05 inch wall thickness, satin-finished, with 2-9/16 inch square, minimum 0.04 inch thick satin-finished stainless steel flanges, for concealed mounting.
- B. Shower Curtain:
  - 1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
  - 2. Size: 42 by 72 inches, hemmed edges.
  - 3. Grommets: HDPE; pierced through top hem on 6 inch centers.
  - 4. Color: White.
  - 5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
  - 6. Products:
    - a. Bobrick 204-2 Vinyl Shower Curtains.
    - b. Substitutions: Section 01 6000 - Product Requirements.
- C. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand and L-shaped, left hand seat.
  - 1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of antique white color.
  - 2. Size: ADA Standards compliant.
  - 3. Products:
    - a. Bobrick B-5181 Reversible Solid Phenolic Folding Shower Seat.
    - b. Substitutions: Section 01 6000 - Product Requirements.
- D. Towel Pin: Cast brass with nickel-plated finish, 3 inch extension from wall; round-shaped bracket and backplate for concealed attachment, satin finish.
  - 1. Products:
    - a. Bobrick B-2116 Heavy-Duty Clothes Hook with Concealed Mounting.
    - b. Substitutions: Section 01 6000 - Product Requirements.
- E. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, bright polished finish.
  - 1. Products:
    - a. Bobrick B-7671 Surface-Mounted Robe Hook.
    - b. Substitutions: Section 01 6000 - Product Requirements.

## 2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers:
  - 1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
  - 2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
  - 3. Construction: 1/8 inch flexible PVC.
    - a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
    - b. Comply with ICC A117.1.
    - c. Microbial and Fungal Resistance: Comply with ASTM G21.

- 4. Color: White.
- 5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
- 6. Products:
  - a. IPS Corporation Truebro Lav Guard 2 E-Z Series.
  - b. Substitutions: See Section 01 6000 - Product Requirements.

## 2.07 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
  - 1. Hooks: Four, 0.06 inch stainless steel rag hooks at shelf front.
  - 2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
  - 3. Length: 34 inches.
  - 4. Products:
    - a. Bobrick B-239 Utility Shelf with Mop/Broom Holdersa and Rag Hooks.
    - b. Substitutions: 01 6000 - Product Requirements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.
- E. See Section 06 1000 - Rough Carpentry for installation of blocking in walls.

### 3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

### 3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
  - 1. Grab Bars: As indicated on drawings.
  - 2. Mirrors: 40 inch, measured from floor to bottom of mirrored surface.
  - 3. Other Accessories: As indicated on drawings.

### 3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

## SECTION 10 2819 - TUB AND SHOWER ENCLOSURES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Fiberglass shower enclosures

## 1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASME A112.18.1 - Plumbing Supply Fittings.
- C. IAPMO Z124 - Plastic Plumbing Fixtures.

## 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's literature for enclosure.
- C. Shop Drawings: Indicate layout, dimensions, identification of components, and interface with adjacent construction.
- D. Manufacturer's Installation Instructions: Indicate complete preparation, installation, and cleaning requirements.

## 1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until installation.

## 1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Fiberglass Shower Enclosures:
  - 1. Everfab: [www.everfabbath.com](http://www.everfabbath.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 FIBERGLASS SHOWER ENCLOSURES

- A. Roll-in Cabinet, ADA Compliant: IAPMO Z124 one-piece reinforced glass fiber with reinforcing bottom plate, 63W by 39D by 79-5/8H inches with slip-resistant floor , no recess type threshold, soap dish, fold-down shower seat , grab bars, removable chrome-plated strainer, tail piece, white color.
  - 1. Products:
    - a. Everfab; Model S6339TA: [www.everfabbath.com](http://www.everfabbath.com).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Shower Valve with Hand-Held Shower Head:
  - 1. Comply with ASME A112.18.1 and ADA Standards.
  - 2. Provide two-way, in-wall diverter valve body with integral thermostatic mixing valve to supply 1.5 gpm, trim kit, and 30 inch slide bar with 69 inch hose.

3. Finish: Satin stainless steel.
4. Product:
  - a. Everfab; Slide Bar Shower Kit EF-0000-SK: [www.everfabbath.com](http://www.everfabbath.com).
  - b. Substitutions: See Section 01 6000 - Product Requirements.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Do not begin installation until supports and adjacent substrates are complete.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. Fit and align tub and shower enclosure level and plumb.

#### 3.03 CLEANING

- A. Remove protective film and temporary stickers from exposed metal and glass surfaces.

#### 3.04 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION



## SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

## 1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

## 1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide.
- B. NFPA 10 - Standard for Portable Fire Extinguishers.
- C. UL (DIR) - Online Certifications Directory.

## 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher ratings and classifications and color and finish.
- C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

## PART 2 PRODUCTS

## 2.01 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  - 1. Class: B:C type.
  - 2. Finish: Baked polyester powder coat, red color.
  - 3. Temperature range: Minus 40 degrees F to 120 degrees F.

## 2.02 FIRE EXTINGUISHER CABINETS

- A. Cabinet Construction: Non-fire rated.
- B. Cabinet Configuration: Surface mounted type.
  - 1. Size to accommodate accessories.
- C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- E. Finish of Cabinet Interior: White colored enamel.

## 2.03 ACCESSORIES

- A. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers in cabinets.

END OF SECTION

## SECTION 12 4813 - ENTRANCE FLOOR MATS AND FRAMES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Carpet mat.

#### 1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.
- C. Maintenance Data: Include cleaning instructions, and stain removal procedures.

### PART 2 PRODUCTS

#### 2.01 MATS

- A. Carpet Mat: Large loop nylon permanently bonded to synthetic backing; glue down application for wall to wall installation.
  - 1. Thickness: 1/2 inch.
  - 2. Size: Roll.
  - 3. Pile Weight: 93 ounces per square yard.
  - 4. Colors: As indicated in Finish Summary.
- B. Recessed Frame: 1/8 inch thick extruded aluminum exposed top strip, 1/2 inch deep, with anchoring features.
  - 1. Product: By same manufacturer as carpet mat.

#### 2.02 FABRICATION

- A. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Vacuum clean floor recess.

#### 3.02 INSTALLATION

- A. Install frame where
- B. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.
- C. Fully adhere walk-off carpet to substrate.
- D. Trim walk-off mat neatly at walls, exposed transistons, and around interuptions.

#### 3.03 TOLERANCES

- A. Maximum Gap Formed at Recessed Frame From Mat Size: 1/8 inch.

END OF SECTION

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## PLUMBING BASIC REQUIREMENTS

## PART 1 - GENERAL

## 1.01 SECTION INCLUDES

- A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of plumbing systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
  - 1. Provide: To furnish and install, complete and ready for intended use.
  - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
  - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
  - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
  - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

## 1.02 RELATED SECTIONS

- A. Contents of Section applies to Division 22, Plumbing Contract Documents.
- B. Related Work:
  - 1. Additional conditions apply to this Division including, but not limited to:
    - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
    - b. Drawings
    - c. Addenda
    - d. Owner/Architect Agreement
    - e. Owner/Contractor Agreement
    - f. Codes, Standards, Public Ordinances and Permits

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 22, Plumbing Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Oregon:
  - a. OAR - Oregon Administrative Rules
  - b. 2023 OESC - Oregon Electrical Specialty Code
  - c. 2022 OFC - Oregon Fire Code
  - d. 2022 OMSC - Oregon Mechanical Specialty Code
  - e. 2023 OPSC - Oregon Plumbing Specialty Code
  - f. 2022 OSSC - Oregon Structural Specialty Code
  - g. 2021 OEESC - Oregon Energy Efficiency Specialty Code
  - h. 2011 Oregon Elevator Specialty Code
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
  1. ABA - Architectural Barriers Act
  2. ADA - Americans with Disabilities Act
  3. AHRI - Air-Conditioning Heating & Refrigeration Institute
  4. ANSI - American National Standards Institute
  5. ASCE - American Society of Civil Engineers
  6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
  7. ASHRAE Guideline 0, the Commissioning Process
  8. ASME - American Society of Mechanical Engineers
  9. ASPE - American Society of Plumbing Engineers
  10. ASSE - American Society of Sanitary Engineering
  11. ASTM - ASTM International
  12. AWWA - American Water Works Association
  13. CFR - Code of Federal Regulations
  14. CGA - Compressed Gas Association
  15. CISPI - Cast Iron Soil Pipe Institute
  16. ETL - Electrical Testing Laboratories
  17. EPA - Environmental Protection Agency
  18. FM - FM Global
  19. IAPMO - International Association of Plumbing and Mechanical Officials
  20. GAMA - Gas Appliance Manufacturers Association
  21. HI - Hydraulic Institute Standards
  22. ISO - International Organization for Standardization
  23. MSS - Manufacturers Standardization Society
  24. NEC - National Electric Code
  25. NEMA - National Electrical Manufacturers Association
  26. NFGC - National Fuel Gas Code
  27. NFPA - National Fire Protection Association
  28. NRCA - National Roofing Contractors Association
  29. NSF - National Sanitation Foundation
  30. OSHA - Occupational Safety and Health Administration

- 31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
- 32. TEMA - Tubular Exchanger Manufacturers Association
- 33. TIMA - Thermal Insulation Manufacturers Association
- 34. UL - Underwriters Laboratories Inc.

D. See Division 22, Plumbing individual Sections for additional references.

#### 1.04 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
  - 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
  - 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be posted to ftp site. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
  - 3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.
  - 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
    - a. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
    - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.
    - c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
    - d. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
    - e. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to Contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
  - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
  - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
11. Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.
  - a. Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Architect for approval prior to installation.
  - b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
  - a. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.



- 1) Resubmit for review until review indicates no exception taken or "make corrections as noted".
  - 2) When submitting drawings for Engineer's re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Owner's Instructions:
- a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
    - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
    - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
    - 3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
    - 4) Include copy of startup and test reports specific to each piece of equipment.
    - 5) Include copy of final water systems balancing log along with pump operating data.
    - 6) Include commissioning reports.
    - 7) Include copy of pressure, flow, leakage and purity test data and water systems test data, as applicable. Include copy of third-party and state and local jurisdiction inspection reports.
    - 8) Include copy of valve charts/schedules.
    - 9) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
    - 10) Include product certificates of warranties and guarantees.
    - 11) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
  - b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 22 00 00, Plumbing Basic Requirements article titled "Demonstration."
  - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
  - b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for Project.

- c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
- d. Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.
- e. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

#### 1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL and CSA listed.
- G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
- H. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.
- I. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- J. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

#### 1.06 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

## 1.07 COORDINATION DOCUMENTS

- A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings) to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Prepare Drawings as follows:
  - 1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
  - 2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
  - 3. Indicate plumbing system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
  - 4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible items. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork and piping.
  - 5. Incorporate Addenda items and change orders.
  - 6. Distribute drawings to trades and provide additional coordination as requested by other trades.
- C. Advise Architect in the event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

## 1.08 WORK INCLUDED

- A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.
- B. Electrical: For plumbing trim/devices/equipment, provide, from the line voltage connection by Division 26, the low voltage electrical connections and wiring as required for complete and operable system. Includes, but is not limited to: Low voltage electrical raceway, wiring and accessories, such as step-down transformers as necessary for function of sensors and automatic valve and faucet controls. Supply step-down transformers and size wiring as recommended by manufacturer of plumbing trim/faucets requiring electrical low voltage connection.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

## 2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or CSA listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
  - 1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
  - 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
  - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

## PART 3 - EXECUTION

### 3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Install equipment requiring access (i.e., drain pans, drains, control operators, valves, motors, cleanouts and water heaters) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Earthwork:
  - 1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
    - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
    - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
    - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
  - 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

- a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

- 1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
- 2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

- 1. Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

### 3.02 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, and individual Division 22 Plumbing Sections.
- B. Equipment Importance Factor: 1.0.
- C. Seismic Design Category: D, E, or F.
- D. Building Occupancy Category: II.
- E. General:
  - 1. Earthquake resistant designs for Plumbing (Division 22) equipment and distribution, i.e. motors, plumbing systems, piping, equipment, water heaters, boilers, etc. to conform to regulations of jurisdiction having authority.
  - 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
  - 3. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for piping equipment and water heaters. Submit Shop Drawings along with equipment submittals.
  - 4. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.
- F. Piping:
  - 1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.
- G. Provide means to prohibit excessive motion of plumbing equipment during earthquake.

### 3.03 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
  - 1. Underground piping installation prior to backfilling.
  - 2. Prior to covering walls.
  - 3. Prior to ceiling cover/installation.
  - 4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.
- D. Final Punch:
  - 1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the plumbing systems are ready for final punch.
  - 2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

### 3.04 CUTTING AND PATCHING

- A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
  - 1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
  - 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.
  - 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
  - 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
  - 5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

### 3.05 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

### 3.06 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bright finished shafts, bearing housings and similar items until in service.

### 3.07 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

### 3.08 CLEANING

- A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

### 3.09 INSTALLATION

- A. Confirm installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
  1. Do not place equipment in sustained operation prior to initial balancing of plumbing systems.
  2. Provide pump impellers to obtain Basis of Design design capacities.
- D. Provide miscellaneous supports/metals required for installation of equipment and piping.

### 3.10 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Ferrous Metal: After completion of plumbing work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt for exterior or black enamel for interior, suitable for hot surfaces.
2. In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

### 3.11 DEMOLITION

- A. Confirm Demolition requirements in Division 01, General Requirements and Division 02, Existing Conditions. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
  1. Scope:
    - a. It is the intent of these documents to provide necessary information and adjustments to plumbing system required to meet code, and accommodate installation of new work.
    - b. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.
    - c. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.
  2. Equipment: Unless otherwise directed, equipment, fixtures, or fittings being removed as part of demolition process are Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.
  3. Unless specifically indicated on Drawings, remove exposed, unused piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap piping and patch surfaces to match surrounding finish.
  4. Unless specifically indicated on Drawings, remove unused equipment, fixtures, fittings, rough-ins, and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).

### 3.12 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
  1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
    - a. Testing and Balancing Reports
    - b. Cleaning
    - c. Operation and Maintenance Manuals
    - d. Training of Operating Personnel



- e. Record Drawings
- f. Warranty and Guaranty Certificates
- g. Start-up/Test Document and Commissioning Reports

### 3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Tests:
  - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
  - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

### 3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that plumbing items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

### 3.15 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize plumbing equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

END OF SECTION

## SECTION 22 00 05

## PLUMBING PRE-CLOSEOUT CHECKLIST

## PART 1 - GENERAL

## 1.01 WORK INCLUDED

- A. Booster Pumps
- B. Circulation Pumps
- C. Gas Water Heaters
- D. Plumbing Fixtures
- E. Plumbing Piping
- F. Plumbing System Controls

## 1.02 PRE-CLOSEOUT CHECKLIST SUBMITTAL

- A. Two weeks prior to the Engineer's Punch-Walk request, complete and submit Pre-Closeout Checklist to document compliance with the Contract Documents and that systems are functionally operational and ready for Closeout Inspection.
- B. A Closeout/Punch-Walk inspection will only be scheduled after completion of Pre-Closeout Checklist and Engineer's acceptance of its completeness.
- C. The Pre-Closeout Checklist is a general guide to document compliance with the Contract Documents and is not an all-inclusive list of Contract requirements, and it is the responsibility of the Contractor to ensure the installation is complete and in full conformance with the Contract Documents.
- D. Complete and submit Pre-Closeout Checklist, as indicated in Part 3.
- E. Unless all similar equipment have exactly the same level of completeness, reproduce the Checklist as needed and submit one checklist for each equipment.

## PART 2 - EQUIPMENT - NOT USED

## PART 3 - INSTALLATION

## 3.01 PRE-CLOSEOUT CHECKLIST

## A. Booster Pumps:

## 1. General:

Yes	No	Task	Comment
		Piping system installed.	
		Piping system pressure tested.	
		Pump not leaking.	
		Field-assembled couplings aligned to meet manufacturer's prescribed tolerances.	
		Pressure and temperature gauges properly installed.	

## 2. Expansion Tank:

Yes	No	Task	Comment
		Expansion tank has adequate mounting support.	

Yes	No	Task	Comment
		Piping connection union provided.	
		Isolation valve provided.	
		Tank pressure set at desired pressure.	
		No isolation valve installed.	

## 3. Electrical:

Yes	No	Task	Comment
		Power available to pump disconnect.	
		Pump rotation verified.	
		Control system interlocks functional.	
		Power disconnect is located within sight of the unit it controls.	
		VFD is installed and connected.	
		Maintenance power outlet provided.	

## 4. Testing, Adjusting, and Balancing:

Yes	No	Task	Comment
		Water balance complete.	
		Water balance with design maximum flow.	
		TAB report submitted.	
		TAB closeout items resolved.	

## B. Circulation Pumps:

## 1. General:

Yes	No	Task	Comment
		Piping system installed.	
		Piping system pressure tested.	
		Pump not leaking.	
		Field-assembled couplings aligned to meet manufacturer's prescribed tolerances.	
		Pressure and temperature gauges properly installed.	

## 2. Electrical:

Yes	No	Task	Comment
		Power available to pump disconnect.	
		Pump rotation verified.	
		Control system interlocks functional.	
		Power disconnect is located within sight of the unit it controls.	
		VFD is installed and connected.	

## 3. Testing, Adjusting and Balancing:

Yes	No	Task	Comment
		Water balance complete.	
		Water balance with design maximum flow.	
		TAB report submitted.	
		TAB closeout items resolved.	

## C. Gas Water Heaters:

## 1. Electrical:

Yes	No	Task	Comment
		Power connected.	

## 2. Gas Supply:

Yes	No	Task	Comment
		Local isolation valve provided at water heater.	
		Gas piping properly supported.	

## 3. Flue:

Yes	No	Task	Comment
		Provided with correct flue type/size.	

## 4. Piping:

Yes	No	Task	Comment
		Piping connection provided with union or flexible connector.	
		Valves and fittings installed per piping diagram (or boiler MPR recommendation).	
		Temperature gauges provided.	
		Relief valve set at relief/release pressure.	
		Relief valve piped to floor sink/drain.	
		Integral boiler circulator accessible (if provided).	
		Piping pressure tested.	
		Piping inlet-outlet connection matched with supply-return flow.	

## 5. Expansion Tank:

Yes	No	Task	Comment
		Expansion tank has adequate mounting support.	
		Piping connection union provided.	
		Isolation valve provided.	
		Tank pressure set at desired pressure.	
		No isolation valve installed.	

## 6. Master Mixing Valve:

Yes	No	Task	Comment
		Piped per manufacturers piping diagram.	
		Set temperature is being provided.	

## 7. Drain Pan:

Yes	No	Task	Comment
		Verify if drain pan is installed per detail.	
		Verify if drain pan drain is routed indirect to indirect waste receiver.	

## 8. Seismic Bracing:

Yes	No	Task	Comment
		Seismic bracing is installed.	

## 9. Unit:

Yes	No	Task	Comment
		Equipment identification plate intact.	
		Equipment tag provided.	

## D. Plumbing Fixtures:

## 1. General:

Yes	No	Task	Comment
		Installed at all locations on Drawings.	
		Installed plumbing and edge at wall caulked.	
		Test with no leaks.	
		Insulation installed on ADA fixtures, p-trap, and hot water supply/stop.	

## E. Plumbing Piping:

## 1. Installation:

Yes	No	Task	Comment
		Piping complete.	
		As-built shop drawings submitted to Interface Engineering.	
		Piping flushed and cleaned (Interface has received report from contractor).	
		Strainers cleaned.	
		Valves installed as required.*	
		Piping insulated as required.	
		Thermometers and gauges installed as required.*	
		Air vents installed as specified.*	
		Flexible connectors installed as specified.*	
		Verify that piping has been labeled and valves are identified as specified.**	
		Piping properly supported.**	

a. \*Checklist completed using sampling: 10-percent were reviewed for each system (terminal units, fan coils, heat pumps, and the like). Sampling was not used for pumps, chillers, boilers, central heat pumps, storage tanks, heat exchangers, and central system air handlers.

b. \*\*Spot-checking was completed during pre-closeout review.

## 2. Miscellaneous:

Yes	No	Task	Comment
		Seismic bracing expansion/contraction compensators installed.	
		Piping systems identification completed per specification requirements.	
		Valves identified per specifications.	
		Valves (type) per specifications.	

## F. Plumbing System Controls:

## 1. Installation:

Yes	No	Task	Comment
		As-built shop drawings submitted.	
		Framed instructions mounted in or near control panel.	
		Components properly labeled (on inside and outside of panel).	
		Control components piped and/or wired to each labeled terminal strip.	
		EMCS connection made to each labeled terminal strip as shown.	
		Control wiring and tubing labeled at all terminations, splices, and junctions.	
		Shielded wiring used on electric sensors.	
		Air dryer installed as specified (pneumatic).	
		Water drain installed as specified (pneumatic).	
		Temperature sensors installed in each room specified.	
		Carbon dioxide sensors installed in each room specified.	

END OF SECTION

## SECTION 22 05 13

## COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Work Included:
  - 1. General Motor Construction and Requirements
  - 2. Starters
  - 3. Variable Frequency Drives
  - 4. Disconnects

## 1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  - 1. NEMA Premium Efficiency.
  - 2. Energy Policy Act (EPACT), latest applicable version(s) for minimum motor efficiencies.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.
- B. In addition, meet the following:
  - 1. Field Installed Motors: Installed motors to be of single type, from one source and from a single manufacturer.
  - 2. Electrical components and materials to be UL and ETL listed/labeled as suitable for location and use.
  - 3. Variable Frequency Drives: Materials and installation for a complete adjustable frequency motor drive consisting of a pulse width modulated (PWM) inverter for use on a standard NEMA Design B induction motor. Design drive specifically for variable torque applications. Variable Frequency Drive (VFD) provided by Controls Section or equipment manufacturer.
    - a. A firm engaged in the production of this type of equipment for a minimum of 10 years.
    - b. Testing: Test printed circuit boards and burned in before being assembled into the completed VFD. Subject VFD to a preliminary functional test, minimum 8-hour burn-in, and computerized final test at 104 degrees F at full rated load.
    - c. Qualifications:
      - 1) UL Listed.
      - 2) C-UL listed or CSA approved.
      - 3) Warranty: 12 months from the date of certified start-up. Include parts, labor, travel time, and expenses.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  - 1. For motors 50 HP and Larger: Provide five year manufacturer's limited warranty from date of substantial completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Motors (General):
  - 1. Lincoln Motors
  - 2. Century Electric Motors (formerly A.O. Smith Electrical Products)
  - 3. Baldor Electric (Reliance Electric)
  - 4. General Electric
  - 5. Toshiba
  - 6. Or approved equivalent.
  - 7. Exceptions: Motors integral to equipment efficiency listing (EER, COP, etc.) per listing agency.
- B. Starters:
  - 1. Cerus
  - 2. Eaton Electrical
  - 3. General Electric
  - 4. Siemens
  - 5. Schneider Electric/Square D
  - 6. Or approved equivalent.
- C. Variable Frequency Drives:
  - 1. ABB
  - 2. Allen Bradley
  - 3. Cerus
  - 4. Danfoss
  - 5. Emerson
  - 6. General Electric
  - 7. Siemens
  - 8. Schneider Electric/Square D
  - 9. Toshiba
  - 10. Trane
  - 11. Yaskawa
  - 12. Or approved equivalent.
- D. Disconnects:
  - 1. Provided and installed by Division 26.



## 2.02 GENERAL MOTOR CONSTRUCTION AND REQUIREMENTS

- A. Electrical components and materials to be UL to ETL listed/labeled as suitable for location and use.
- B. Wiring installed in conduit.
- C. Electrical Service: Power wiring from source to motor termination under Division 26, Electrical. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.
- D. Electrical Service - Unless otherwise noted in the Contract Documents, the following voltage and phase characteristics apply to motors:
  - 1. Motors 1/2 HP and Under: 120 volt, 1 phase.
  - 2. Motors 3/4 HP and Over: 208 volt, 3 phase.
  - 3. Motors 3/4 HP and Over: 480 volt, 3 phase
- E. Construction:
  - 1. Open drip-proof type except where specifically noted otherwise.
  - 2. Design for continuous operation in 104 degrees F environment.
  - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
  - 4. Built-in thermal overload protection or externally protected with separate over-load with low-voltage release or lock-out. Quick trip device on hermetically sealed motors.
  - 5. Service Factor: 1.15 for poly-phase motors. 1.25 for motors associated with shaft pressurization system fans. 1.35 for single phase motors.
  - 6. Noise Rating: Quiet.
  - 7. Efficiency: Provide premium efficiency motors.
  - 8. Motors used in Conjunction with Variable Speed Drives: Variable torque type matched for the full operating range of the variable frequency drive. As a minimum, motors to have Class F insulation, winding insulation rated for 1000 volts and insulated bearings to prevent high frequency ground path. Loads not-to-exceed 80 percent of nameplate rating.
- F. Explosion-Proof Motors: UL approved and labelled for hazard classification with over temperature protection.
- G. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- H. Wiring Terminations:
  - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Coordinate conductor sizes with Division 26, Electrical. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
  - 2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- I. Provide inverter ready motors per NEMA MG1-30 for variable speed drive or soft-start starter use. Provide shaft grounding for motors over 2 HP serving variable speed drives. Provide shaft grounding and insulated bearings on motors 25 HP and larger serving variable speed drives. Shielded cable required for power wiring from variable speed drive to motor connection.
- J. Unless otherwise indicated, motors 1-HP and larger to meet/exceed NEMA Premium Efficiency and latest EPACT.
- K. Vertical in-line pump motors per NEMA MG1, Motors and Generators.

## 2.03 STARTERS

### A. Single-Phase Motors:

1. Manual across-the-line starting switch having toggle-operated switch pilot running light and built-in thermal overload device with heating element rated not more than 115 percent motor full load current indicated on name plate of motor to be protected. Surface mount starters. Provide NEMA-1 enclosure.
2. Overload relays to be melting alloy type with a replaceable control circuit module. Thermal units to be interchangeable. Starter to be nonoperative if thermal unit is removed.
3. Single-phase motors with automatic controls. Provide motor-rated relay with coils rated for control voltage.

### B. Starters up to Size 8 to be suitable for the addition of a minimum of three external auxiliary contacts (normally open or normally closed). Contactor, coils and relays to perform the control functions of the associated equipment and control sequence.

### C. 3-Phase Motors up to and Including 15 HP:

1. Provide enclosed type magnetic across-the-line starter with thermal overload and undervoltage protection.
2. Operator: "Start-Stop" pushbutton, except where automatic control is indicated on Drawings or specified. Then provide "Hand-Off-Auto" selector switch.
3. Starters for 3-phase motors to have overload protection in each of the three legs, with external manual reset.

## 2.04 VARIABLE FREQUENCY DRIVES

### A. Design: Solid state, with a Pulse Width Modulated (PWM) output waveform enclosed in a NEMA 1 enclosure, completely assembled and tested by manufacturer. Employ a full wave rectifier (to prevent input line notching), DC Line Reactor, capacitors, and Insulated Gate Bipolar Transistors (IGBTs) as the output switching device drive efficiency: 97 percent or better at full speed and full load. Fundamental Power Factor: 0.98 at all speeds and loads. Unit designed to feed two motors simultaneously.

### B. Specifications:

1. Input 440/450/480/500VAC plus or minus 10 percent (capable of operation to 550VAC), 3-phase, 48 to 63Hz or Input 208/220/230/240VAC plus or minus 10 percent, 3-phase, 48 to 63Hz.
2. Output 0 - Input Voltage, 3-phase, 0 to 500Hz for drives up to 75 HP; 0 to 120Hz for drives over 75 HP.
3. Environmental Operating Conditions: 0 to 40C at 3kHz switching frequency, 0 to 3300-feet above sea level, less than 95 percent humidity, noncondensing.
4. Enclosure rated Type 1.

### C. Standard Features:

1. Provide VFDs with the same customer interface, including digital display, keypad and customer connections; regardless of horsepower rating. The keypad is to be used for local control (start/stop, forward/reverse, and speed adjust), for setting parameters, and for stepping through the displays and menus.
2. Fault Mode on Loss of Input:
  - a. Displaying a fault.
  - b. Running at a programmable preset speed as selected by user.

3. Utilize English digital display (code numbers are not acceptable). Digital Display: A 40 character (2 line by 20 characters/line) LCD display, backlit to provide easy viewing in light condition, adjustable contrast to optimize viewing at angles display. Set-up parameters, indications, faults, warnings and other information in words to allow the user to understand what is being displayed without the use of a manual or cross reference table.
  4. Utilize preprogrammed application macro's specifically designed to facilitate start-up. Provide one command to reprogram parameters and customer interfaces for a particular application to reduce programming time.
  5. Automatic restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts to be programmable. If the time between reset attempts is greater than zero, the time remaining until reset occurs to count down on the display to warn an operator that a restart will occur.
  6. Capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
  7. Automatic extended power loss ride-through circuit.
  8. Customer terminal strip isolated from the line and ground.
    - a. Prewired three-position Hand-Off-Auto switch and speed potentiometer. When in "Off" the VFD will be stopped. When in "Auto" the VFD will start via an external contact closure, and its speed will be controlled via an external speed reference.
  9. Current Limit Circuits to Provide Trip Free Operation:
    - a. Slow current regulation limit circuit adjustable to 125 percent (minimum) of the VFDs variable torque current rating. Adjustment made via the keypad, and displayed in amps.
    - b. Rapid current regulation limit adjustable to 170 percent (minimum) of the VFDs variable torque current rating.
    - c. Current switch off limit fixed at 255 percent (minimum, instantaneous) of the VFDs variable torque current rating.
  10. Overload Rating: 110 percent of its variable torque current rating for 1 minute every 10 minutes, and 140 percent of its H torque current rating for 2 seconds every 15 seconds.
  11. DC Line Reactor to reduce the harmonics to the power line.
  12. Optimized for a 3 kHz carrier frequency to reduce motor noise.
  13. Manual speed potentiometer or keypad as a means of controlling speed manually.
- D. Adjustments:
1. Five programmable critical frequency lockout ranges.
  2. PI setpoint controller.
  3. Two programmable analog inputs for reference for PI controller. Analog Inputs: Include filters; programmable from 0.01 to 10 seconds to remove oscillation in the input signal.
  4. Six programmable digital inputs for maximum flexibility in interfacing with external devices.
  5. Two programmable analog outputs proportional to frequency, motor speed, output voltage, output current.
  6. Two independently adjustable accel and decel ramps. Ramp times adjustable from 1 to 1800 seconds.
  7. The VFD to ramp or coast to a stop, as selected by user.
- E. Display: The following operating information displays to be standard on the VFD digital display.
1. Output Frequency
  2. Motor Speed (RPM, percent or engineering units)

3. Motor Current
  4. Calculated Motor Torque
  5. Calculated Motor Power
  6. Output Voltage
  7. Analog Input Values
  8. Keypad Reference Values
  9. Elapsed Time Meter
  10. kWh Meter
- F. Protection Circuits: In the case of a protective trip, stop the drive and announce the fault condition.
1. Overcurrent trip 315 percent instantaneous (225 percent RMS) of the VFDs variable torque current rating.
  2. Overvoltage trip 130 percent of the VFD's rated voltage.
  3. Undervoltage trip 65 percent of the VFD's rated voltage.
  4. Overtemperature plus 70C (ACH 501); plus 85C (ACH 502).
  5. Ground Fault either running or at start.
  6. Adaptable Electronic Motor Overload (I<sub>2t</sub>).
- G. Speed Command Input Via:
1. Keypad.
  2. Two analog inputs, each capable of accepting a 0 to 20mA, 4 to 20mA, 0 to 10V, 2 to 10V signal. Analog inputs programmable filter to remove an oscillation of the reference signal. Minimum and maximum values (gain and offset) adjustable within the range of 0 to 20mA and 0 to 10V.
- H. Accessories:
1. Door interlocked thermal magnetic circuit breaker disconnect handle, through-the-door type, and padlockable in the "Off" position.
  2. Fused disconnects for each motor.
  3. Trouble output contact.
  4. Include a set of contacts that signal the building automation system to open VAV boxes to 100 percent during bypass mode.
  5. Output filter to provide for wave shaping.
  6. Provide 5 percent impedance 3-phase line reactor on the input side of the VFD.

## 2.05 DISCONNECTS

- A. Provided by Division 26, Electrical unless specified otherwise.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Electrical Requirements:
1. Contractor to Provide the Following:
    - a. Motors.
    - b. Starters and disconnects that are integral parts of plumbing equipment as shown on the equipment schedules. Reference Drawings and subsequent Sections. Provide a working system. Coordinate with Division 26, Electrical.

- c. Low Voltage and Electronic Control Devices.
- d. Low Voltage Transformers.
- e. Low Voltage Conduit and Wire and Connecting Devices.
- f. Conduit and wire for electronic devices, except for line voltage wiring.
- 2. Electrical work listed above performed by a licensed electrical contractor or by the control manufacturer, but provided for and coordinated under Division 22, Plumbing work. In addition, controls work supervised and subsequently approved in writing by the control manufacturer.
- 3. Contractor to furnish the following to the Electrical Contractor where applicable: Line voltage control equipment, including switches (except disconnects), time switches, transformers, relays, etc. (except those part of MCC).
- 4. Include the Following Items under Division 26, Electrical Work:
  - a. Line voltage wire and conduit system.
  - b. Disconnects not provided with equipment.
  - c. Installation of line voltage control equipment supplied by Division 22.
- B. Electrical Interlocks: Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize mechanical equipment wiring diagrams to coordinate with the electrical systems so that proper wiring of the equipment involved is affected.
- C. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.
- D. Explosion-Proof Motors: UL approved and labeled for hazard classification, with over temperature protection.
- E. Provide inverter ready motors per NEMA MG1-30 for variable speed drive or soft-start starter use. Provide shaft grounding for motors over 2 HP serving variable speed drives. Provide shaft grounding and insulated bearings on motors 25 HP and larger serving variable speed drives. Shielded cable required for power wiring from variable speed drive to motor connection.
- F. Unless otherwise indicated, motors 1-HP and larger to meet/exceed NEMA Premium Efficiency and latest EPACT.
- G. Vertical in-line pump motors per NEMA MG1 vertical motor requirements.
- H. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- I. Check line voltage and phase and ensure agreement with nameplate.
- J. Verify motor rotation.
- K. Field Quality Control:
  - 1. Prepare for Acceptance Tests as Follows:
    - a. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
    - b. Test interlocks and control features for proper operation.
    - c. Verify that current in each phase is within nameplate rating.
  - 2. Testing: Perform the Following Field Quality-Control Testing:
    - a. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
    - b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
    - a. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
    - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - c. Verify bearing lubrication.
    - d. Verify proper motor rotation.
    - e. Test Reports:
      - 1) Prepare a written report to record the following test procedures used:
        - (a) Test results that comply with requirements.
        - (b) Test results that do not comply with requirements and corrective action taken to achieve compliance.
  - L. Adjusting: Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions.
  - M. Cleaning:
    1. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
    2. Clean motors, on completion of installation, according to manufacturer's written instructions.
- 3.02 GENERAL MOTOR CONSTRUCTION AND REQUIREMENTS
- A. Motor Installation: Install in accordance with manufacturer's instructions. Coordinate with starter or variable speed controller with control sequence to provide necessary starter accessories.
- 3.03 STARTERS
- A. Install starters in accordance with manufacturer's instructions.
  - B. Coordinate disconnect requirements and location with Division 26, Electrical if not integral to starter. If starter is installed out of line of sight of motor, provide additional disconnect at motor per code.
  - C. Provide NEMA housing appropriate to installation location.
  - D. Provide supports and install securely, in neat and workmanlike manner, as specified in NECA 1.
  - E. Meet mounting height and accessible location requirements per local code.
  - F. Provide fuses for fusible switches.
  - G. Select and install overload heater elements in motor starters to match installed motor characteristics.
  - H. Single phase 120 volt starter: If not furnished as single packaged controller/disconnect, provide contactors, relays, wiring, and devices necessary to match sequence of operation for equipment.
- 3.04 VARIABLE FREQUENCY DRIVES
- A. Variable Speed Controller Connection:
    1. Coordinate wiring length/type to meet controller manufacturer's requirements. Provide grounding per manufacturer's wiring diagram.
    2. Shaft Grounding:

- a. Provide shaft grounding assembly on motors controlled by variable frequency drive. Shaft grounding device to be in the form of brush that resides on the motor shaft. Brush assembly to be capable of tolerating misalignment and maintaining rotating contact throughout the motor's life.
  - b. Material: Material used in the grounding assembly to be of stable material commonly used within industry that is not believed to constitute a hazardous material under Occupational Safety and Health Administration (OSHA) regulations.
  - c. Brushes: Specifically developed carbon compounds of sustained performance with seal life expectancy of three years minimum.
  - d. Seals: Sealed type to keep contaminants from entering the shaft grounding system in wet or severe environment applications.
  - e. Shaft Grounding Assembly: For clean room air handling systems, use the type that contains the wear products within a special enclosure within the shaft grounding system.
  - f. Shaft grounding assembly installation not to affect the motor manufacturer warranty. Where the severe environment conditions require application of the shaft grounding types that are screwed into the motor shaft, the installation of the shaft grounding system performed either by the motor manufacturer or by the motor manufacturer authorized facility.
  - g. Bond the brush to the closest ground point using code sized green insulated stranded copper conductor per manufacturer instructions.
  - h. Test and verify the performance of the assembly to ensure that under no conditions the shaft exceeds three volts.
- 3. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
  - 4. Check line voltage and phase and ensure agreement with nameplate.
  - 5. Verify motor rotation.
- B. Ensure the area where the variable frequency drive is to be installed is within the range of ambient temperatures set by the manufacturer.
  - C. Ensure grounding and bonding is per manufacturer's recommendations.
  - D. Install per manufacturer's recommendations.
  - E. Install per NEC requirements.
  - F. Coordinate with Division 26, Electrical.

### 3.05 DISCONNECTS

- A. Provided by Division 26, Electrical unless specified otherwise.
- B. Provide disconnecting means within sight of each motor controller and of each motor. Motor controller disconnecting means equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Locate disconnect means in view of and not inside of equipment, such that tools are not needed to remove covers to access the disconnecting means.
- C. Install in accordance with manufacturer's instructions.
- D. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.
- E. Controllers:
  - 1. Single Phase 120 Volt Starter: If not furnished as single packaged controller/disconnect, provide contactors, relays, wiring, and devices necessary to match sequence of operation for equipment.

END OF SECTION



## SECTION 22 05 16

## EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Work Included:

1. Flexible Pipe Connectors, Copper Piping
2. Flexible Expansion Loop (for Thermal and Seismic Applications), Copper Piping
3. Expansion Joints, Two-Ply Bellows Type Copper Pipe

## 1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements. Include items listed below.

## B. In addition, provide:

1. Shop drawings for review and approval by Engineer. Illustrate Design Data and Expansion Joints items below on the Shop Drawing Submittal.
2. Design Data: Indicate selection calculations.
3. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
4. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.
5. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - a. Extra Packing for Packed Expansion Joints: One set for each joint.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

## A. Flexible Pipe Connectors, Copper Piping:

1. Mercer Rubber Company
2. Metraflex Company
3. Mason
4. Hyspan
5. Or approved equivalent.

B. Flexible Expansion Loop (for Thermal and Seismic Applications), Copper Piping:

1. Mercer Rubber Company
2. Metraflex Company
3. Mason
4. Hyspan
5. Or approved equivalent.

C. Expansion Joints, Two-Ply Bellows Type Copper Pipe:

1. Mercer Rubber Company
2. Metraflex Company
3. Mason
4. Hyspan
5. Or approved equivalent.

2.02 FLEXIBLE PIPE CONNECTORS, COPPER PIPING

- A. Inner Hose: Bronze, close pitch, annular corrugated hose.
- B. Exterior Sleeve: Braided bronze (piping over 2-inches to be 3-pound braided stainless steel).
- C. Pressure Rating: 125 PSI at 70 degrees F with a 4 to 1 safety factor.
- D. Joint: Sweat ends.
- E. Size: Use pipe sized units.
- F. Maximum offset: 3/8-inch on each side of installed center line.
- G. Basis of Design: Metraflex Model BBS.

2.03 FLEXIBLE EXPANSION LOOP (FOR THERMAL AND SEISMIC APPLICATIONS), COPPER PIPING

- A. Construction: Two flexible sections of hose and braid, two 90 degree elbows and a 180 degree return designed so piping does not change direction, but maintains course along a single axis. Use Vee Loop where space is limited. System to import no thrust loads to system support anchors or building structure.
- B. Inner Hose: Bronze, close pitch, annular corrugated hose.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 PSI at 70 degrees F with a 4 to 1 safety factor.
- E. Joint: Sweat ends.
- F. Size: Use pipe sized units.
- G. Support: Center support at bottom of 180 degree return.
- H. Basis of Design: Metraflex Metraloop. Vee configuration Mason-Mercer VCPSB.

2.04 EXPANSION JOINTS, TWO-PLY BELLWS TYPE COPPER PIPE

- A. Construction: Laminated bellows ASTM A240 Type 321 stainless steel, copper tube ASTM B88, ASTM A240 Type 321 stainless steel housing and guide, anti-torque device, limit stops, internal guides
- B. Working Pressure: 200 PSI.
- C. Maximum Temperatures: 500 degrees F.
- D. Maximum Compression: 2-inches.
- E. Maximum Extension: 1/2-inch.
- F. Joint: Sweat ends. ASME B16.22.
- G. Size: Use pipe sized units. Maximum 4-inch pipe.

H. Basis of Design: Hyspan Model 8509, 8510.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

#### A. Expansion/Contraction Fitting Installation:

1. Install expansion/contraction fittings according to manufacturer's written instructions.
2. Install expansion/contraction fittings in sizes matching pipe size in which they are installed.
3. Align expansion/contraction fittings to avoid end-loading and torsional stress.
4. Install in accordance with EJMA (Expansion Joint Manufacturer's Association) Standards.
5. Wood structures: install expansion/contraction fittings and guides at every floor.
6. Concrete structures: install expansion/contraction fittings and guides at interval spacing recommended by the manufacturers.

#### B. Pipe Bend and Loop Installation:

1. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
2. Attach pipe bends and loops to anchors.
  - a. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code Section IX, "Welding and Brazing Qualifications."
  - b. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

#### C. Swing Connections:

1. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
2. Connect mains, risers and branch connections to equipment with at least four pipe fittings, including tee in riser.

#### D. Guide Installation:

1. Install guides on piping adjoining expansion fittings and loops.
2. Attach guides to pipe and secure to building structure.

#### E. Anchor Installation:

1. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
2. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
3. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
4. Install pipe anchors according to expansion fitting manufacturer's written instructions if expansion fittings are indicated.
5. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

#### F. Painting:

1. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA1 requirements for touching up field-painted surfaces.
  - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.02 FLEXIBLE PIPE CONNECTORS, COPPER PIPING

- A. See General Installation Requirements above.
- B. Install per manufacturer's written recommendations and requirements.

3.03 FLEXIBLE EXPANSION LOOP (FOR THERMAL AND SEISMIC APPLICATIONS), COPPER PIPING

- A. See General Installation Requirements above.
- B. Install per manufacturer's written recommendations and requirements.

3.04 EXPANSION JOINTS, TWO-PLY BELLOWS TYPE COPPER PIPE

- A. See General Installation Requirements above.
- B. Install per manufacturer's written recommendations and requirements.

END OF SECTION

SECTION 22 05 19  
PLUMBING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
  - 1. Pressure Gauges
  - 2. Thermometers
  - 3. Water Hammer Arrestors (Shock Absorbers)
  - 4. Trap Primers

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pressure Gauges:
  - 1. Dwyer Instruments, Inc.
  - 2. Moeller Instrument Co., Inc.
  - 3. Omega Engineering, Inc.
  - 4. Trerice
  - 5. Or approved equivalent.
- B. Thermometers:
  - 1. Ashcroft
  - 2. Trerice
  - 3. Weiss
  - 4. Marshalltown
  - 5. Weksler
  - 6. Or approved equivalent.
- C. Water Hammer Arrestors (Shock Absorbers):
  - 1. Bellows Type:

- a. Amtrol
  - b. J.R. Smith
  - c. MIFAB
  - d. Wade
  - e. Zurn
  - f. Or approved equivalent.
2. Piston Type:
- a. MIFAB
  - b. PPP
  - c. Sioux Chief
  - d. Or approved equivalent.

D. Trap Primers:

- 1. J.R. Smith
- 2. MIFAB
- 3. PPP
- 4. Wade
- 5. Zurn
- 6. Or approved equivalent.

## 2.02 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, phosphor-bronze bourdon type, dry type.

- 1. Case: Cast aluminum, stem-mounted, flange less.
- 2. Size: 4-1/2-inch diameter.
- 3. Window: Clear glass.
- 4. Connector: Brass.
- 5. Scale: White aluminum with black graduation and markings.
- 6. Pointer: Black, adjustable.
- 7. Mid-Scale Accuracy: One percent.
- 8. Scale: PSI and KPa.
- 9. Basis of Design: Terice Model 600CB.

## 2.03 THERMOMETERS

A. Thermometers - Adjustable Angle: Red or blue appearing organic liquid in glass, ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

- 1. Size: 9-inch scale.
- 2. Window: Acrylic.
- 3. Scale: Aluminum, white background, black graduations and markings.
- 4. Stem: 3/4-inch NPT brass.
- 5. Accuracy: 2 percent, per ASTM E 77.
- 6. Calibration: 0-160 with 2 Degrees F graduations.
- 7. Basis of Design: Terice BX9.

## 2.04 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Bellows-type, stainless steel casing and bellows, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.
- B. Piston-type, copper, brass or stainless steel with O-ring piston, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.

## 2.05 TRAP PRIMERS

- A. Automatic trap primer assemblies meeting governing code requirements. Provide with air-gap fittings as required.
- B. Electronic trap seal automatic primer valve with integral anti siphon protection and timer or tied to BAS system as designated on Drawings. Coordinate quantity, locations, and voltage characteristics or control points.
- C. Trap seal primer valve (low lead) with integral automatic anti-siphon protection. The priming valve to discharge on both pressure drop and pressure spike. PPP CPO 500.

# PART 3 - EXECUTION

## 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. For plumbing devices requiring access from access panels (i.e. trap primers, water hammer arrestors and the like) submit location/size of all access panels to Architect for approval prior to purchase and installation of access panel. See Section 22 00 00, Plumbing Basic Requirements for additional requirements.
- B. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- C. Install per manufacturer recommendations.

## 3.02 PRESSURE GAUGES

- A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial can be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.
- B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.
- C. Install pressure gauges in piping tee with pressure gauge cock, in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- D. Locations: Install in the following locations, and elsewhere as indicated.
  - 1. At each pump inlet and outlet.
  - 2. At inlet and discharge of each pressure reducing valve.
  - 3. At make-up water service outlets.
  - 4. At inlets and outlets of all master mixing valves.
- E. Adjust gauges to final angle, clean windows and lenses, and calibrate to zero.
- F. Install per manufacturer recommendations.
- G. Pressure Gauge Range/Graduations:
  - 1. Cold Water: 0-100 PSI; graduation 1 PSI.
  - 2. Hot Water: 0-100 PSI; graduation 1 PSI.

## 3.03 THERMOMETERS

- A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- B. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

- C. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.
- D. Install per manufacturer recommendations.
- E. Thermometer Range/Graduations:
  - 1. Cold Water: 25-125 degrees F; graduation 1 degree F.
  - 2. Hot Water: 30-240 degrees F; graduation 2 degrees F.

### 3.04 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Install in upright position, in locations and of sizes in accordance with PDI WH-201 or ASSE 1010, and elsewhere as indicated.
- B. Locate shock absorbers in supply pipe in accordance with recommendations of Plumbing and Drainage Institute PDI-WH201 or ASSE 1010. Install ahead of solenoid operated valves. Determine size of absorber by fixture unit value of fixture supplied, using PDI symbols to designate sizes. Provide access panel for each shock absorber.
- C. Install per manufacturer recommendations.

### 3.05 TRAP PRIMERS

- A. Flush supply line prior to installation.
- B. Install valve plumb using caution to not over-tighten.
- C. Effective operating range 20 to 80 PSIG (138 to 552 kPa).
- D. Do not subject trap primer valve to pressure in excess of 125 PSI.
- E. Install trap primer per manufacturer's instructions. Install primer outlets a minimum of 12-inches above finished floor. For installations with primer lines in excess of 20 feet in length, the primer assembly should be raised 12-inches for each additional 20 feet of length. Maximum 80 feet primer length unless specifically approved by design engineer.
- F. Install primers at locations as indicated on Drawings. Extend primer lines to all trapped drains that are tied to sanitary.
- G. Provide the number of primer assemblies required at each primer "location" to feed the number of primer lines at that location.
- H. For electronic primers assemblies, coordinate required electrical connections with Division 26; coordinate required Building Automation System (BAS) with Division 23 "Controls."

END OF SECTION



## SECTION 22 05 23

## GENERAL-DUTY VALVES FOR PLUMBING PIPING

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Work Included:
  - 1. Valves, General
  - 2. Balancing Valves
  - 3. Ball Valves
  - 4. Swing Check Valves
  - 5. Backflow Prevention Assemblies
  - 6. Pressure Regulating Valve - Domestic Water
  - 7. Thermostatic Master Mixing Valves (ASSE 1017 Rated)
  - 8. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated)

## 1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  - 1. NSF 61, Annex G and/or NSF/ANSI 372 for potable water services. Valves must be 3rd-party certified.
  - 2. ISO 9001 Certified.
  - 3. IAPMO Certified for Low Lead.
- C. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.
- D. Model numbers indicated as Basis-of-Design indicate valve characteristics. All valves are to meet code Low Lead/Lead Free Standards.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

- A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

B. Valves, General:

1. Apollo
2. Armstrong
3. ASCO
4. Caleffi
5. Cla-Val
6. Conbraco
7. Crane
8. Clow
9. Griswold
10. Hammond
11. Hays
12. Jenkins
13. Josam
14. Kennedy
15. Milwaukee
16. Mueller
17. Nibco
18. Red-White Valve
19. Smith
20. Stockham
21. Tour Anderson
22. Wade
23. Watts
24. Wilkins
25. Zurn
26. Or approved equivalent.

C. Balancing Valves:

1. Caleffi
2. Griswold
3. Hays
4. Armstrong CBV
5. Tour Anderson
6. Or approved equivalent.

D. Ball Valves:

1. See Valves, General above.
2. NSF Valves:
  - a. Clow
  - b. Kennedy
  - c. Nibco
  - d. Or approved equivalent.

## E. Swing Check Valves:

1. See Valves, General above.

## F. Backflow Prevention Assemblies:

## 1. Backflow Preventers:

- a. Apollo
- b. Cla-Val
- c. Conbraco
- d. Watts
- e. Or approved equivalent.

## 2. Backflow Prevention Assemblies - Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications - 2-inches and Smaller:

- a. Febco 860-with 650A.
- b. Conbraco 40-210-AGD.
- c. Wilkins 375-XL-SAG.
- d. Watts 919-QT-S valve with 919AGC or 919AGF.
- e. Or approved equivalent.

## 3. Backflow Prevention Assemblies - Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications - 2-1/2-inches and Larger:

- a. Febco 860 with 758A.
- b. Conbraco Apollo 40-700 with 758A.
- c. Watts 909-S-NFA-NRS with AGC.
- d. Wilkins 375-FSC.
- e. Or approved equivalent.

## 4. Backflow Prevention Assemblies - Double Check Valve Assembly (DCVA) for Low Hazard Applications - 2-inches and Smaller:

- a. Febco 850-650A
- b. Conbraco Apollo 40-110-T2
- c. Watts 007-QT-FDA-S
- d. Wilkins 350-S-XL
- e. Or approved equivalent.

## 5. Backflow Prevention Assemblies - Double Check Valve Assembly (DCVA) for Low Hazard Applications - 2-1/2-inches and Larger:

- a. Conbraco Apollo 45-11-1
- b. Watts LF-709 with 77F-01-FDA-12
- c. Or approved equivalent.

## 6. Spill Resistant Pressure Vacuum Breaker:

- a. Febco
- b. Conbraco
- c. Watts
- d. Wilkins
- e. Or approved equivalent.

## 7. Atmospheric Vacuum Breakers:

- a. Febco
  - b. Conbraco
  - c. Watts
  - d. Wilkins
  - e. Or approved equivalent.
- G. Pressure Regulating Valve-Domestic Water:
  - 1. Cash Acme
  - 2. Cla-Val
  - 3. Watts
  - 4. Wilkins
  - 5. Or approved equivalent.
- H. Thermostatic Master Mixing Valves (ASSE 1017 Rated):
  - 1. Caleffi
  - 2. Holby Tempering Valve
  - 3. Lawler Series 66
  - 4. Leonard Type TM
  - 5. Powers LFMM430 (Lead Free)
  - 6. Symmons Temp Control Series 5
  - 7. Or approved equivalent.
- I. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated):
  - 1. Caleffi
  - 2. Lawler
  - 3. Leonard
  - 4. Powers Hydroguard
  - 5. Or approved equivalent.

## 2.02 VALVES - GENERAL

- A. General:
  - 1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
  - 2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6-inches and smaller. Provide gear operators for quarter-turn valves 8-inches and larger and plug valves installed over 5-feet above finished floor.
  - 3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- B. Valves in Insulated Piping: With 2-inch stem extension and following features:
  - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation on valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
- C. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
  - 3. Threaded: With thread according to ASME B1.20.1.
- D. Valve Bypass and Drain Connections: MSS SP-45.

## E. Building Service:

1. Shutoff and Isolation Valves:
  - a. Pipe Sizes 3-inches and Smaller: Ball Valve.
2. Drain Service: Ball Valves.
3. Strainer Blow-Off: Ball Valve.
4. Check Valves: Swing.

## 2.03 BALANCING VALVES

## A. Maximum 125 PSIG System Working Water Pressure.

## B. Manual Set Balancing Valves:

1. Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
  - a. Precise flow measurement.
  - b. Precision flow balancing.
  - c. Positive drip-tight shut-off.
2. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves to be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi to have two 1/4-inch threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves to be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug to be brass. The handwheel to be high-strength resin.
3. 2-1/2-inch and Larger: Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
  - a. Precise flow measurement.
  - b. Precision flow balancing.
  - c. Positive drip-tight shut off. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators location on the valve handwheel. Valves to have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valve body to be either cast iron with integrated cast iron flanges (2-1/2-inch to 12-inch) or ductile iron with industrial standard grooved ends (2-1/2-inch to 12-inch). Valve stem and plug disc to be bronze with handwheel that permits multi-turn adjustments. Sizes 2-1/2-inch and 3-inch: five turns; sizes 4-inch to 6-inch: 6 turns; sizes 8-inch to 10-inch: 12 turns; and size 12-inch: 14 turns. Flange adapters to be provided to prevent rotation.

## 2.04 BALL VALVES

- A. All ball valves on brazed piping are to be three-piece.
- B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.
- C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 82-100/82A 140 Series three-piece.

- D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.

## 2.05 SWING CHECK VALVES

- A. 2-inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80.
- B. 2-1/2-inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MSS SP-71.
- C. Rubber Flapper Check Valve: Horizontal or vertical upward flow installation. Working pressure to 175 PSI. Ductile iron or cast iron body. Steel reinforced Buna-N rubber flapper epoxy coating on wetted parts. MSS SP-80.
- D. Gruvlok Series 7800 Check Valve: Horizontal installation. Working pressure to 300 PSI, Type 304/302 Stainless Steel conforming to ASTM 167. Ductile body, ASTM A536, and stainless clapper, EPDM, nitrile or optional viton bumper and bonnet seals. Stainless wetted parts.

## 2.06 BACKFLOW PREVENTION ASSEMBLIES

- A. General: Assemblies model numbers listed below are for general comparison. Project specific model numbers to be verified contractor as approved by jurisdiction where project is located.
- B. Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications:
  - 1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1013 and AWWA C511. Bronze construction, threaded ends, stainless steel internal parts, FDA strainer, and air gap fitting. Route pipe from air gap fitting to approved waste receptor.
  - 2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C511. Epoxy coated cast iron body construction, flanged ends, stainless steel internal parts, bronze seats, and FDA strainer.
- C. Double Check Valve Assembly (DCVA) for Low Hazard Applications:
  - 1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and FDS strainer on inlet. Assemblies include test cocks and two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C510. Bronze construction, threaded ends, and stainless steel internal parts.
  - 2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C510. Epoxy coat cast iron body construction, strainer flanged ends, and stainless steel internal parts.
- D. Spill Resistant Pressure Vacuum Breaker: Watts Model 800MCQT with 777S "Y" strainer.
- E. Atmospheric Vacuum Breaker: Assembly consists of a bronze vacuum breaker body with silicone disc, and full size orifice. Device to be IAPMO listed, meet ASSE standard 1001, and ANSI standard A113.1.1 rough chrome plate finish.

## 2.07 PRESSURE REGULATING VALVE - DOMESTIC WATER

- A. Water: Bronze body, diaphragm or piston type, spring actuated, with separate or integral stainless steel strainer, pressure range to suit conditions, approved for potable water use, low lead. Provide shutoff valves, pressure relief valves, unions, drain valve and bypass.
- B. Water: Automatic control pressure regulating valve, stainless steel seat, stem and spring, diaphragm actuated with brass body, hydraulic control pilots with effluent operating temperature range 32 degrees F to 180 degrees F, FDA and AWWA approved.

- C. Water: Bronze body construction, stainless steel strainer screen, thermal expansion bypass with renewable stainless steel seat and high temperature resisting diaphragm.

#### 2.08 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED)

- A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1017.
- B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.
- C. Flow from the tempered water circulating pump to be split to mixing valve and building hot water heating system.

#### 2.09 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED)

- A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1070.
- B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.

### PART 3 - EXECUTION

#### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
  - 4. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.
- D. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.
- E. Purge and clean all piping to be connected to valve.
- F. Install per manufacturer's recommendations.
- G. Determine that the valve and its plumbing piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that all mating flanges are in line and parallel to minimize straining on joints and valve body.
- H. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- I. Do not attempt to repair defective valves; replace with new valves.
- J. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

- K. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.
- L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.
- M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.
- N. Stem Selection: Outside screw and yoke stems, except provide inside screw, non-rising stem where space prevents full opening of OS&Y valves.
- O. Seats: Renewable seats, except where otherwise indicated.
- P. When soldering, use paste flux that are approved by the manufacturer for use with lead free alloys.
- Q. If valve applications are not indicated on Drawings, use the following:
  - 1. Shutoff Service: Ball valves.
- R. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- S. Valves, except wafer/butterfly types, with the following end connections:
  - 1. For Copper Tubing, 2-inches and Smaller: Threaded ends except where solder-joint valve-end.
  - 2. For Copper Tubing, 2-1/2-inches to NPS 4-inches: Flanged ends except where threaded valve-end.
  - 3. For Copper Tubing: 5-inches and Larger: Flanged ends.
  - 4. For Steel Piping, 2-inches and Smaller: Threaded ends.
  - 5. For Steel Piping, 2-1/2-inches to NPS 4-inches: Flanged ends except where threaded valve-end.
  - 6. For Steel Piping, 5-inches and Larger: Flanged ends.
- T. Valve Adjusting and Cleaning:
  - 1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
  - 2. Valve Identification. Tag valves per Section 22 05 53, Identification for Plumbing Piping and Equipment.

### 3.02 BALANCING VALVES INSTALLATION

- A. See General Installation Requirements above.
- B. Install with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Mounting of valve in piping must prevent sediment build-up in metering ports.

### 3.03 BALL VALVES INSTALLATION

- A. See General Installation Requirements above.

### 3.04 SWING CHECK VALVES INSTALLATION

- A. See General Installation Requirements above.



- B. Swing Check Valve Installation: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow. Only install where there are 10 pipe diameters of straight pipe upstream of valve.
- C. Ejector and Sump Pump-Discharge Check Valves:
  - 1. 2-inches and Smaller: Bronze swing or spring-loaded lift check valves with bronze disc.
  - 2. 2-1/2-inches and Larger: Rubber flapper swing check valves with lever and weight.
- D. Domestic Water and Circulation Pump Discharge Check Valves:
  - 1. 2-inches and Smaller: Bronze body, spring loaded, lead free, lift check.
  - 2. 2-1/2-inches and Larger: Wafer style, silent lift check valve, lead free.

### 3.05 BACKFLOW PREVENTION ASSEMBLIES INSTALLATION

- A. See General Installation Requirements above.
- B. Install where indicated, and where required by code. Where practical, locate in same room as equipment being protected.
- C. Submit product cut sheets to local AHJ for approval prior to purchase and installation.
- D. Install as close to wall as possible with clearances for access and maintenance as required by AHJ.
- E. Coordinate exact location of installation and type of backflow device serving a particular piece of equipment with AHJ and Architect prior to purchase and installation.
- F. Provide wall/floor brackets that are of fully welded, hot dipped galvanized construction, fabricated to meet field conditions. Mount backflow preventer to brackets using cadmium plated "U" type bolts and nuts.
- G. Contact local water district/backflow specialist and request backflow installation requirements. Install backflow devices per UPC and local water district/backflow specialist requirements.
- H. Route waste piping from air gap waste fitting concealed within walls to point of air gap termination at indirect waste receptor.
- I. Follow local codes for installation requirements. Pipe lines should be thoroughly flushed to remove foreign material before installing the unit. Provide a strainer ahead of backflow preventer to prevent disc from unnecessary fouling. Install valve in line with arrow on valve body pointing in the direction of flow. It is important that the valve be easily accessible to facilitate testing and servicing. Do not install in a concealed location.

### 3.06 PRESSURE REGULATING VALVE - DOMESTIC WATER INSTALLATION

- A. See General Installation Requirements above.
- B. Install valve in the line with arrow on valve body pointing in the direction of flow. This valve should be installed where it is accessible with sufficient clearance for cleaning, service or adjustment. Install the reducing valve before a sill cock line if possible. Before installing the reducing valve hose bibb, flush out the line to remove loose dirt and scale which might damage valve disc and seat.
- C. Horizontal installation is recommended. However, valve can be installed in a vertical position. Regulator must be installed in an accessible location to facilitate servicing the regulator.
- D. To readjust reduced pressures, loosen adjusting screw nut and turn adjusting screw clockwise to raise reduced pressure and counterclockwise to lower reduced pressure.
- E. When reducing valve is used, it makes a closed system; therefore, pressure relief protection must be provided on the downstream side of the reducing valve to protect equipment.
- F. Provide pressure relief valve and terminate discharge to indirect waste receiver.
- G. Anytime a reducing valve is adjusted, the use of a pressure gauge is recommended to verify correct pressure setting. Do not bottom out adjusting screw or spring cage.

- H. Provide inlet and outlet ball valves, and globe valve bypass. Provide pressure gauge on valve outlet.
  - I. Provide pressure relief valve piped full size to indirect waste receiver or floor drain.
  - J. Provide factory startup on automatic control valves.
- 3.07 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED) INSTALLATION
- A. See General Installation Requirements above.
  - B. Install mixing valve per manufacturer's instruction manual.
- 3.08 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED) INSTALLATION
- A. See General Installation Requirements above.
  - B. Install mixing valve per manufacturer's instruction manual.

END OF SECTION

## SECTION 22 05 29

## HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Work Included:

1. Pipe Hangers and Supports for Plumbing Piping and Equipment
2. Wall and Floor Sleeves
3. Building Attachments
4. Flashing
5. Miscellaneous Metal and Materials

## 1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
  2. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.
  3. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
  4. Install piping per SMACNA's requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.07 PERFORMANCE REQUIREMENTS

- A. General - Provide pipe and equipment hangers and supports in accordance with the following:
1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for piping are not shown on the Drawings, the contractor is responsible for their design.
  2. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems:
1. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.

2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
- D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
- E. Provide seismic restraint hangers and supports for piping and equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

#### A. Pipe Hangers and Supports for Plumbing Piping and Equipment:

1. Pipe Hangers/Supports:
  - a. B-Line Systems Inc.
  - b. Anvil International
  - c. HOLDRITE
  - d. Erico Co. Inc.
  - e. Snappitz Thermal Pipe Shield Manufacturing
  - f. Rilco Manufacturing Co. Inc.
  - g. Nelsen-Olson Inc.
  - h. Or approved equivalent.
2. Channel Support Systems:
  - a. B-Line Systems Inc.
  - b. Anvil International, Anvit-Strut
  - c. Erico Hanger Co. Inc.; O-Strut Div.
  - d. Unistrut Corp.
  - e. HOLDRITE EZ-Strut Systems
  - f. Or approved equivalent.
3. Thermal-Hanger Shield Inserts:
  - a. Erico Hanger Co. Inc.
  - b. Pipe Shields, Inc.
  - c. Rilco Manufacturing Co. Inc.
  - d. HOLDRITE Insulation Couplings
  - e. Or approved equivalent.
4. Freestanding Roof Supports:
  - a. Miro
  - b. Nelson-Olsen Inc. / Quick "Pipe" Block
  - c. Eaton / B-Line / Dura-Blok
  - d. Mifab
  - e. Or approved equivalent.
5. Pipe Alignment and Secondary Supports:

- a. HOLDRITE
  - b. Starquick
  - c. Or approved equivalent.
- B. Wall and Floor Sleeves:
  - 1. Below Grade and High Water Table Areas:
    - a. Modular Link Sealing System at Pipe Sleeves:
      - 1) Thunderline Corporation
      - 2) Or approved equivalent.
  - 2. Pre-Engineered Firestop Pipe Penetration Systems:
    - a. HOLDRITE HydroFlame
    - b. Proset
    - c. Or approved equivalent.
- C. Building Attachments:
  - 1. Anchor-It
  - 2. Gunnebo Fastening Corp.
  - 3. ITW Ramset / Red Head
  - 4. Masterset Fastening Systems, Inc.
  - 5. Or approved equivalent.
- D. Flashing:
  - 1. Fastenal
  - 2. Or approved equivalent.
- E. Miscellaneous Metal and Materials:
  - 1. See Miscellaneous Metal and Materials article below.
  - 2. Powder-Actuated Fastener Systems:
    - a. Gunnebo Fastening Corp.
    - b. Hilti, Inc.
    - c. ITW Ramset / Red Head
    - d. Masterset Fastening Systems, Inc.
    - e. Or approved equivalent.

## 2.02 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- A. Horizontal Piping Hangers and Supports - Horizontal and Vertical Piping, and Hanger Rod Attachments:
  - 1. Factory fabricated horizontal piping hangers and supports to suit piping systems in accordance manufacturer's published product information.
  - 2. Use only one type by one manufacturer for each piping service.
  - 3. Select size of hangers and supports to exactly fit pipe size for bare piping and to exactly fit around piping insulation with saddle or shield for insulated piping.
  - 4. Provide copper-plated hangers and supports for uninsulated copper piping systems.
  - 5. Provide padded pipe hangers, clamps and supports for thermoplastic piping system.

6. Install no hub cast iron pipe and fittings per CISPI 301-09 Installation Procedures for Hubless Cast Iron Pipe and Fittings for Sanitary and Storm Drain Waste and Vent Piping Applications. Brace hubless cast iron pipe and fittings 5-inch and larger with HOLDRITE No Hub Pipe Restraints or approved equivalent.
- B. Pipe Hangers, Guides and Channel Systems:
1. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
  2. Hanger Rod Couplings: Malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
  3. Pipe Rings for Hanger Rods: Pipe sizes 2-inch and smaller, MSS SP Type 6 or Type 10, or approved equivalent. Pipe sizes 2-1/2-inches and larger, clevis type hangers with adjustable nuts on rod. MSS SP Type 1. Pipe rings to have same finish as hanger rods.
  4. Pipe Slides: Type 35 reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resist corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
  5. Pipe Guides:
    - a. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Any contact with chilled water pipe is not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
    - b. Furnish and install guides approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.
  6. Channel Type Pipe Hanging System: Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 GR33; one side of channel to have a continuous slot with in-turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
- C. Pipe Saddles and Shields:
1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
  2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).
- D. Thermal-Hanger Shield Inserts: 100-PSI (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.
1. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.
  2. Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate.
  3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
  4. For Clevis or Band Hanger: Insert and shield to cover lower 180 degrees of pipe.
  5. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.

6. Thermal Hanger Shield Inserts should be provided at the hanger points and guide locations on pipes requiring insulation. The Inserts should consist of Polyisocyanurate (urethane or phenolic insulation) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) with a living hinge and J lock and installed during the installation of the piping system.
- E. Roller Hangers:
    1. Adjustable roller hanger. Black steel yoke, cast iron roller. MSS Type 41.
  - F. Concrete Inserts:
    1. Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.
  - G. Continuous Concrete Insert:
    1. Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
  - H. Beam Clamps:
    1. MSS Type 19 and 23, wide throat, with retaining clip.
    2. Universal Side Beam Clamp: MSS Type 20.
  - I. Below Ground:
    1. Pipe Hangers: Adjustable Clevis type, Federal Specification WW-H-171 (Type 1), UL listed, stainless steel Type 316. MSS Type 1. If PVC piping to be used, provide Type 1 hanger, coated for PVC piping.
    2. Rod: 5/8-inch stainless steel Type 316.
    3. Eyebolt: Stainless steel Type 316.
    4. Nuts and Washers: Stainless steel Type 316.
  - J. Hangers for Pipe Size 2-inches and Smaller:
    1. Adjustable swivel ring hanger, UL listed, Type 6 or Type 10.
  - K. Hangers for Pipe Size 2-1/2-inches and Larger:
    1. Adjustable clevis type, UL listed, Type 1.
  - L. Riser Clamps:
    1. Steel, UL listed. MSS Type 8.
  - M. Plumbers Tape:
    1. Not permitted as pipe hangers or pipe straps.
  - N. Pipe Alignment and Secondary Support Systems:
    1. Secondary Pipe supports for general applications (Non-Acoustical).
      - a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
      - b. Supports may be used when sound and/or vibration transfer is not a concern.
    2. Secondary pipe supports for sound and vibration attenuation (Acoustical).
      - a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
      - b. Acoustical pipe supports will be manufactured and installed in compliance with International Organization for Standardization (ISO) 3822-1 with current amendments.
      - c. Supports will be used when sound and/or vibration transfer is a concern. Locations where acoustical supports will be provided and include but are not limited to partition walls between living units, tenant spaces, retail units, mechanical rooms and lobbies.
      - d. Support Products:

- 1) Support to Wall Brace and Wall Stud Penetrations: HOLDRITE #261, #262, #263, and #264, or approved equivalent.
- 2) Pipe Wrap for Pipe Clamps and Channel-Mounted Pipe Clamps: HOLDRITE #270, or approved equivalent.
- 3) Pipe Wrap for Pipe Hangers: HOLDRITE #271, #272-2, and #272-4, or approved equivalent.
- 4) Drop-Ear Fitting Support: HOLDRITE #265, or approved equivalent.
- 5) Floor Riser Isolation Pads: HOLDRITE #275-T, or approved equivalent.
- 6) Floor Isolation Pads (General Applications): HOLDRITE #274, #275, #276, and #278, or approved equivalent.

O. Freestanding Roof Pipe Supports:

1. Polyethylene high-density UV resistant block with foam pad or 100 percent UV resistant recycled rubber. With galvanized strut/channel.

## 2.03 WALL AND FLOOR SLEEVES

A. Below Grade and High Water Table Areas:

1. Modular Link Sealing System at Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal. Use a modular link sealing system at sleeves to continuously fill the annular space between the pipe and the wall opening. Provide Link-seal Type C unless otherwise noted. OS with S-316 stainless construction for continuous water/tank walls.
2. Sleeves through concrete foundation walls and floors. Ductile iron pipe. Class 50 or 51 pipe conforming to ANSI/AWWA C151/A21.51. Pipe sleeve will extend a minimum of 6-inches beyond outside perimeter of foundation. Final placement of sleeve will be confirmed with project's structural engineer. In areas with a high water table, provide AWWA C900, Class 235 plastic pipe in lieu of ductile iron pipe.

B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

C. Insulating Caulking: Eagle or Pitcher Super 66 high temperature cement.

D. Fabricated Accessories:

1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide following minimum gauges for sizes indicated:
  - a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
  - b. Sleeve Sizes 5-inches to 6-inches: 16 gauge.
  - c. Sleeve Sizes 7-inches and Larger: 14 gauge.
  - d. Fire-Rated Safing Material:
    - 1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 lbs./cu.ft. density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
    - 2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

## 2.04 BUILDING ATTACHMENTS

A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Structural Engineer. Provide anchor bolts suitable for cracked concrete.

B. Anchor Bolts:



1. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
  2. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
  3. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.
- C. Beam Clamps:
1. MSS Type 19 and 23, wide throat, with retaining clip.
  2. Universal Side Beam Clamp: MSS Type 20.
- D. Powder-Actuated Drive Pin Fasteners:
1. Powder-Actuated Drive-Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- E. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- F. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.
1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
  2. Properties: Non-staining, noncorrosive, and non-gaseous.
  3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

## 2.05 FLASHING

- A. Steel Flashing: 26 gauge galvanized steel.
- B. Safes: 8 mil thick neoprene.
- C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.
- D. Provide hot dipped galvanized components for items exposed to weather.

## 2.06 MISCELLANEOUS METAL AND MATERIALS

- A. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings, that are necessary for completion of the project. The Contractor is responsible for their design.
  1. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods and equipment required for fabrication.
- G. Provide hot dipped galvanized components for items exposed to weather.
- H. Use straps, threshold rods and wire with sizes required by SMACNA to support piping.
- I. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.
  - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
  - 2. Properties: Non-staining, noncorrosive, and non-gaseous.
  - 3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Examination:
  - 1. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.
- B. Preparation:
  - 1. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.
- C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate with project structural engineer proper placement of inserts, anchors and other building structural attachments.

### 3.02 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- A. Hangers and Supports:
  - 1. Comply with MSS SP-58. Pipe Hanger and Support Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
  - 2. Pipe Ring Diameters:
    - a. Uninsulated and Insulated Pipe, except where oversized pipe rings are specified: Ring inner diameter to suit pipe outer diameter.
    - b. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
  - 3. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.
  - 4. Pipe Support Brackets: Support pipe with pipe slides.
  - 5. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
  - 6. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
    - a. Field assemble and install according to manufacturer's written instructions.

7. Pipe Guides:
  - a. Install on continuous runs where pipe alignment must be maintained. Provide a minimum of two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Any contact with chilled water pipe should not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
  - b. Install approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.
8. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field -fabricated, heavy-duty trapezes.
  - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1
9. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers.
10. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
11. Do not support piping from other piping.
12. Fire protection piping will be supported independently of other piping.
13. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
14. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
15. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchor, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
16. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
17. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
18. Insulated Piping: (comply with the following)
  - a. Attach clamps and spacers to piping.
    - 1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - 2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - 3) Do not exceed pipe stress limits according to ASME B31.9.
  - b. Install MSS SP-58, Type 39 protection saddles, if insulation without a vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
  - c. Install MSS SP-58, Type 40 protective shields on cold piping having a vapor barrier. Shields to span arc of 180 degrees.
    - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

- d. Shield Dimensions for Pipe, not less than the following:
  - 1) NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
  - 2) NPS 4 (DN100): 12-inches long and 0.06-inch thick.
  - 3) NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
  - 4) NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
  - 5) NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
- e. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
- f. Insert Material: Length at least as long as protective shield.
- g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- 19. Equipment Clearances: Do not route equipment or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route piping or equipment above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact equipment or pipe routing to provide proper clearance with such items.
- 20. Pipe supports and hanger spacing (pipe supported from structure or floor-supported) to meet the requirements of References and Standards Article in Part 1 above.
- B. Pipe Curb Assemblies:
  - 1. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (e.g., piping, electrical power and control wiring). Meet requirements of roof warranty.
  - 2. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
  - 3. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise. At roofing applications, the adhesion mastic is to be specifically submitted to and approved by the roofing system manufacturer/installer to maintain the integrity of all warranties.
  - 4. At concrete floors, install a polyurethane mastic to the support block and adhere in place.
- C. Vertical Piping:
  - 1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
  - 2. Riser clamps to be directly under fitting or welded to pipe. Provide neoprene pads for all systems except natural gas.
  - 3. Riser to be supported at each floor penetration.
  - 4. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.
- D. Adjusting and Painting:
  - 1. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping and equipment to proper level and elevations.
  - 2. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

### 3.03 WALL AND FLOOR SLEEVES

- A. "Link-Seal" Pipe Sleeves: Install at slab on grade floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations (except for DWV piping at slab on grade). Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.
- B. Fabricated Pipe Sleeves:
  - 1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirement, and by waterproofing requirements.
  - 2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
  - 3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
  - 4. Seal each end airtight with a resilient nonhardening sealer, UL listed and fire rated per ASTM 814.

### 3.04 BUILDING ATTACHMENTS

- A. Install within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.
- B. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.
- C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.
- E. Install powder-actuated drive pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.
- F. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
- G. Anchor Bolts:
  - 1. Install anchor bolts for mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment and piping are hung.
  - 2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.
- H. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.
- I. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor wall, and through equipment room walls and floors.

- J. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
  - 1. Install fabricated pipe sleeve.
  - 2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
  - 3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814 sealant.
- K. Piping Penetrations Through Fire-Rated (1 to 3 hour) Assemblies:
  - 1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
  - 2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814. Use HOLDRITE HydroFlame or approved equivalent.
- L. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

### 3.05 FLASHING

- A. Flash and counter flash where piping passes through weather or waterproofed walls, floors and roofs.
- B. Flash vent soil pipes with flashings per Division 01, General Requirements.
- C. Flash floor drains over finished areas and roof drains, 10-inches clear on sides, minimum 36-inches by 36-inches sheet size. See Division 01, General Requirements. Fasten flashing to drain with clamping device.
- D. Install built up fixtures (mop sinks, shower stalls, shower floors) with water sealing systems/membranes to meet Code and as prescribed by Division 01, General Requirements and Section 22 00 00, Plumbing Basic Requirements. Meet all Code testing requirements. Provide drainage devices with appropriate flanges, clamps, etc. to meet these installation requirements and ensure a water-tight installation.

### 3.06 MISCELLANEOUS METAL AND MATERIALS

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.
- C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.
- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- E. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

1. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

F. Fabrication:

1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates and similar devices. Hot dip galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
2. Finishes:
  - a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas with primer of same material before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
  - b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials:
    - 1) Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
  - c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

G. Metal Fabrication:

1. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
2. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
3. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of weld and methods used in correcting welding work, and with the following:
  - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - b. Obtain fusion without undercut or overlap.
  - c. Remove welding flux immediately.
  - d. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

4. Provide hot dipped galvanized components for items exposed to weather.

END OF SECTION



## SECTION 22 05 53

## IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Work Included:

1. Plastic Nameplates
2. Tags
3. Plastic Pipe Markers

## 1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, submit Valve Schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals. Provide schedules organized as follows:
1. Equipment Type:
    - a. Identification:
    - b. Background:
      - 1) Size:
      - 2) Color:
    - c. Lettering:
      - 1) Size:
      - 2) Color:

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
  2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22, Plumbing Sections. Where more than a single type is specified for application, provide single selection for each product category.
- B. Plastic Nameplates:
  - 1. Brady Corporation
  - 2. Or approved equivalent.
- C. Tags:
  - 1. Brady Corporation
  - 2. Brimar
  - 3. Champion America Inc.
  - 4. Craftmark
  - 5. Seton Identification Products
  - 6. Or approved equivalent.
- D. Plastic Pipe Markers:
  - 1. Brady Corporation
  - 2. Brimar
  - 3. Champion America Inc.
  - 4. Craftmark
  - 5. Seton Identification Products
  - 6. Or approved equivalent.

### 2.02 PLASTIC NAMEPLATES

- A. Description: Engraving stock melamine plastic laminate 1/8-inch thick, engraved with engraver's standard letter style of the sizes and wording indicated.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/2 inch.
  - 3. Background Color: Black.
  - 4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
  - 5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.
  - 6. Signage for hot water outlets on 140 degree F hot water systems not protected by ASSE 1070 mixing valves; hose bibbs, janitor sinks, and fixtures used by trained personnel.
    - a. Manufacturer's standard 1/8-inch thick engraved plastic laminate signage 4 by 4-inches.
    - b. Letter Color: Red.
    - c. Letter Height: 1/2 inch.
    - d. Background Color: White.
    - e. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

## 2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2-inch diameter.
- B. Metal Tags: Polished Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.
- C. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.
- D. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.
- E. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.
- F. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
  - 1. Size: Approximately 4- by 7-inches.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
  - 4. Color: Yellow background with black lettering.

## 2.04 PLASTIC PIPE MARKERS

- A. Color: Conform to ASME A13.1 and ANSI Z535.1.
- B. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Lettering and Graphics:
  - 1. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
  - 2. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).
- B. Preparation: Degrease and clean surfaces to receive adhesive for identification materials.
- C. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- D. Install valve schedule at each mechanical room.

- E. Access Doors: Provide markers on each access door and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions.

### 3.02 PLASTIC NAMEPLATES

- A. Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.
- B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners.

### 3.03 TAGS

- A. Small devices, such as in-line pumps, may be identified with tags. Use metal tags on piping 3/4-inch diameter and smaller.
- B. Identify valves in main and branch piping with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.
- C. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.
- D. Tag balancing valves with balanced GPM or CFM indicated after balancing is completed and accepted.
- E. Install tags with corrosion resistant chain.

### 3.04 PLASTIC PIPE MARKERS

- A. Install plastic pipe markers in accordance with manufacturer's instructions.
- B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- C. For exterior underground piping installations, install underground plastic pipe markers with tracer wire 6- to 8-inches below finished grade directly above buried pipe.
- D. Identify piping, concealed or exposed, with plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

END OF SECTION

SECTION 22 07 00  
PLUMBING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Type 1, Glass Wool Pipe Insulation
2. Type 2, Flexible Elastomeric Insulation
3. Type 5, Glass Wool Equipment Insulation
4. Type 7, ADA Accessible Lavatory/Sink Insulation Kit
5. Accessories
6. Pipe Fitting Insulation Covers

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Piping insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Installer qualifications.
2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
5. Submit manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.

B. In addition, meet the following:

1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.

4. Installer to have minimum 5 years' experience in the business of installing insulation.

#### 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

#### 1.07 FIRE HAZARD CLASSIFICATION

- A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.
- B. Test pipe insulation in accordance with requirements of current edition of UL "Pipe and Equipment Coverings."

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Type 1, Glass Wool Pipe Insulation:
  1. Johns Manville
  2. Knauf
  3. Owens-Corning
  4. Or approved equivalent.
- B. Type 2, Flexible Elastomeric Insulation:
  1. Insulation:
    - a. Armacell LLC Armaflex
    - b. K-Flex
    - c. Or approved equivalent.
  2. Glue:
    - a. Armacell LLC Armaflex Low VOC Adhesive
    - b. K-Flex
    - c. Or approved equivalent.
  3. Paint:
    - a. Armacell LLC Armaflex
    - b. K-Flex
    - c. Or approved equivalent.
- C. Type 5, Glass Wool Equipment Insulation:
  1. Knauf
  2. Owens-Corning
  3. Johns Manville
  4. Or approved equivalent.
- D. Type 7, ADA Accessible Lavatory/Sink Insulation Kit:
  1. IPS/Truebro
  2. McGuire/Pro-Wrap
  3. Plumberex/Pro-Extreme
  4. Brocar Trap Wrap
  5. Or approved equivalent.
- E. Accessories:

1. ITW Insulation Systems
  2. Or approved equivalent.
- F. Pipe Fitting Insulation Covers:
1. Zeston Johns Manville
  2. ITW Insulation Systems
  3. Or approved equivalent.
- 2.02 TYPE 1, GLASS WOOL PIPE INSULATION
- A. Glass Fiber: ASTM C547 Type I and IV; rigid molded, noncombustible.
1. Thermal Conductivity Value: 0.27 BTU\*in/(hr\*sf°F) at 75 degrees F.
  2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.
  3. Vapor Retarder Jacket: White Kraft paper reinforced with glass fiber and bonded to aluminum foil, with self-sealing longitudinal laps and butt strips or vapor barrier mastic.
- 2.03 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION
- A. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.
1. Thermal Conductivity Value: 0.25 BTU\*in/(hr\*sf°F) at 75 degrees F.
  2. Maximum Service Temperature of 220 degrees F.
  3. Maximum Flame Spread: 25.
  4. Maximum Smoke Developed: 50 (3/4-inch thick and below).
  5. Connection: Waterproof vapor retarder adhesive as needed.
  6. UV Protection: UV outdoor protective coating per manufacturer's requirements.
- B. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.
- C. Paint: Nonhardening high elasticity type, specifically manufactured as a protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.
- 2.04 TYPE 5, GLASS WOOL EQUIPMENT INSULATION
- A. Flexible Glass Wool Blanket: ASTM C612; flexible.
1. Thermal Conductivity Value: 0.24 BTU\*in/(hr\*sf°F) at 75 degrees F.
  2. Maximum Service Temperature: 450 degrees F.
- 2.05 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT
- A. P-traps, trap arms, tail pieces, hot water and cold water insulating guards meeting ASTM C1822. Molded closed cell insulation with vinyl cover and nylon fasteners, paintable. Provide accessories as required for complete installation covering all exposed waste piping, water piping, stops and supplies. Color white.
- 2.06 ACCESSORIES
- A. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- B. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have same flame and smoke component ratings as insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

## 2.07 PIPE FITTING INSULATION COVERS

- A. PVC Plastic Fitting Covers: Schuller Zeston 2000, Knauf Proto Fitting or approved equivalent. One-piece molded type fitting covers and jacketing material, gloss white. Connections: Tacks; pressure sensitive color matching vinyl tape.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION INFORMATION

- A. Verification of Conditions:
1. Do not apply insulation until pressure testing and inspection of piping has been completed.
  2. Examine areas and conditions under which insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Preparation: Clean and dry surfaces to be insulated.
- C. Installation:
1. Insulation: Continuous through walls, floors, and partitions except where noted otherwise.
  2. Piping and Equipment:
    - a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.
- D. Provide accessories as required. See Part 2 Article "Accessories" above.
- E. Protection and Replacement: Protect installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- F. Labeling and Marking: Provide labels, arrows and color coding on piping. Attach labels and flow direction arrows to jacketing per Section 22 05 53, Identification for Plumbing Piping and Equipment.
- G. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 1-1/2-inches and larger (hot and cold piping).
- H. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Pipe Size	Insulation Thickness
Hot Water Piping Above Grade (105F to 140F)	1	Runouts =<1-1/4-inch (uncirculated branches located in partitions within conditioned spaces)	1-inch
		Mains =<1-1/4-inch	1-inch
		Mains >1-1/4-inch	1-1/2-inch
Hot Water Circulation Piping Above Grade (105F to 140F)	1	Mains =<1-1/4-inch	1-inch
		Mains >1-1/4-inch	1-1/2-inch



Hot Water Piping Above Grade (141F to 200F)	1	Runouts =<1-1/4-inch (uncirculated branches located in partitions within conditioned spaces)  Mains =<1-1/4-inch  Mains >1-1/4-inch	1-inch   1-1/2-inch  2-inch
Hot Water Circulation Piping Above Grade (141F to 200F)	1	Mains =<1-1/4-inch  Mains >1-1/4-inch	1-1/2-inch  2-inch
Cold Water Piping Above Grade	1	=<1-1/2-inch  >1-1/2-inch	1/2-inch  1-inch
Hot Water Piping Below Grade	2	=<1-1/2-inch  >1-1/2-inch	1-inch  1-1/2-inch
Hot Water Circulation Piping Below Grade	2	=<1-1/2-inch  >1-1/2-inch	1-inch  1-1/2-inch
Water Piping Exposed to Weather	1, 2, 4	All	1-1/2-inch
Piping with Heat Tracing	1, 2, 4	Same as circulated hot water based on pipe size and service temperature.	
Above Grade Roof Drain/Overflow Drain Piping	1, 2	All	1/2-inch
Roof Drain Underbodies	5, 6	N/A	1-inch
Overflow Roof Drain Underbodies	5, 6	N/A	1-inch
ADA Accessible Lavatory/Sink	7	All	As Listed
Storage Tanks	3, 5	All	2-inch
Condensate Drain Piping	1, 2	All	1/2-inch
Aboveground Refrigerated Water Systems	1, 2	All	1-inch
Solar Hot Water and Glycol Piping	1,4	=<1-1/2-inch  >1-1/2-inch	1-inch  1-1/2-inch

### 3.02 TYPE 1, GLASS WOOL PIPE INSULATION

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions for below grade installation.
- C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.

- D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.
- E. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

### 3.03 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions for below grade installation.
- C. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.
- D. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.
- E. Flexible Elastomeric Tubing: Slip insulation over piping or if piping is already installed, it should be slit and snapped over piping. Joints and butt ends must be adhered with 520 adhesive.

### 3.04 TYPE 5, GLASS WOOL EQUIPMENT INSULATION

- A. See General Installation Requirements above.
- B. Apply insulation and accessories to roof drain underbodies per manufacturer's recommendations.
- C. Roof Drain/Overflow Drain Underbodies: Cover underside of drain body with glass wool insulation; attached with adhesive and supported externally with 26 gauge galvanized flat strapping anchored to structure.
- D. Storage Tanks: Cover with glass wool, 2-inches thick. Finish with canvas jacket and adhesive. Overlap joints minimum of 4-inches. Apply two coats latex paint; color selected by Architect.

### 3.05 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.
- C. Provide lavatory/sink insulation kit. Install on waste fittings, hot and cold water stops and supplies.

### 3.06 ACCESSORIES

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.
- C. Furnish and install accessories for all insulation types listed in this Section.

### 3.07 PIPE FITTING INSULATION COVERS

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.

END OF SECTION

## SECTION 22 10 00

## PLUMBING PIPING

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Work Included:

1. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Buried Within 5-feet of Building
2. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Above Grade
3. Pump Waste Pressure Piping (Pumped Discharge)
4. Water Piping, Buried Within 5-feet of Building
5. Hot and Cold Domestic Water Above Grade
6. Condensate Piping
7. Primer Piping
8. Piping Specialties
9. Cleanouts

## 1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. NSF 61, Annex G.
  2. Steel pipe to conform to ASTM and ANSI Standards as specified in this Section.
  3. Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society, (AWS).
  4. Cast Iron Piping to conform to standards of ASTM A-74, CISPI 301 and FM 1680.
  5. Manufacturer's Standards Society (MSS) for valving and support reference standard.
  6. American Water Works Association (AWWA) for Valving Assembly Standards.
  7. American Society of Sanitation Engineers (ASSE) for Valving Standards.
  8. American National Standards Institute (ANSI) for Piping Standards.
  9. NFPA Standard 51B - "Fire Prevention in Use of Cutting and Welding Processes."
  10. Crosslinked polyethylene (PEX) pipe conforming to ASTM F876, F877 and CSA B1375, or DIN 16892 and 16893.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. See component manufacturers listed in individual articles below.

B. ADS

C. American-USA

D. Cerro

E. Charlotte

F. Clamp-All

G. Conbraco/Apollo Press

H. Elkhart

I. Enfield

J. Fusesseal

K. Gruvlok

L. Husky

M. Ideal

N. Mifab

O. Mission

P. Mueller

Q. Nibco

R. Orion

S. Shurjoint Mechanical Couplings

T. Sioux Chief

U. Spears

V. Tyler

W. Uponor

X. Viega

Y. Zurn

Z. Or approved equivalent.

AA. Cleanouts:

1. J.R. Smith

2. Mifab

3. Sioux Chief

4. Wade

5. Watts

6. Zurn

7. Or approved equivalent.

BB. Firestopping Penetrations in Fire Rated Wall Floor Assemblies:

1. Hilti

2. Proset

3. Or approved equivalent.

## 2.02 GENERAL

- A. Provide pipe, tube, and fittings of the same type, fitting requirements, grade, class, and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.
- B. Manufactured materials delivered, new to the project site and stored in their original containers.
- C. Product Marking: Furnish each item with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

## 2.03 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.
  - 1. Fittings: Cast iron.
  - 2. Coupling Assembly:
    - a. Heavy Duty: ASTM C1540, Clamp-All Hi-Torq 125, Husky SD 4000, Mifab QXHUB, Mission HeavyWeight couplings.
    - b. Mechanical joint coupling for hubless pipe and fittings is to consist of an elastomeric sealing sleeve and a metallic shield that comply with CISPI 310, ASTM C or ASTM C1540. The elastomeric sealing sleeve is to conform to ASTM C564 or CSA B602 and is to be provided with a center stop. Mechanical joint couplings are to be installed in accordance with the manufacturer's instructions.
- B. PVC Pipe: ASTM D 2665 IPS Schedule 40, **SOLID WALL** piping for drainage/waste and vent (DWV).
  - 1. Fittings: PVC DWV ASTM D2665.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement, 2-step glue (primer and glue) is required.

## 2.04 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.
  - 1. Fittings: Cast iron.
  - 2. Coupling Assembly:
    - a. Standard Duty: ASTM C1277 or CISPI 310.
- B. Copper Tube: ASTM B 306, DWV
  - 1. Fittings: ASME B16.29, wrought copper.
  - 2. Joints: ASTM B32, alloy Sn50 solder.

## 2.05 PUMP WASTE PRESSURE PIPING (PUMPED DISCHARGE)

- A. Above Grade: Type "L" copper with solder joints.
- B. Below Grade: Type "L" copper with brazed joints.

## 2.06 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Copper Pipe: ASTM B88, hard drawn, Type K (A).
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
  - 2. Joints: Brazed - BCuP2.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
  - 1. Fittings: Ductile or gray iron, standard thickness.
  - 2. Joints: AWWA C111/A21.11, rubber gasket with 3/4-inch diameter rods, mega lug type.

## 2.07 HOT AND COLD DOMESTIC WATER ABOVE GRADE

- A. Copper Tube: 3-inches and above. ASTM B88 (ASTM BA88m), Type K (A), Drawn.
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
  - 2. Joints: Brazed BCuP2.
- B. Copper Tube: 2-1/2-inches and smaller. ASTM B88 (ASTM B88M), Type L (B), Drawn.
  - 1. Fittings: ASME B16.18 copper.
  - 2. Joints: ASTM B32, alloy Sn95 solder.
- C. Stainless Tube:
  - 1. Piping 3-inch and Larger: Grade H, ASTM A268/A268M-91, roll-grooved joint.
  - 2. Fittings: Schedule 10S Type 304L stainless steel fittings, ISO 9001, ASTM A-403.
  - 3. Couplings: Anvil or Gruvlok grooved system, IPS stainless steel grooved coupling with EPDM gasket, stainless steel nuts and bolts, ASTM-A351, A743 AND A744-CF-8M, ISO 9001.
- D. Copper Tube: ASTM B88 (ASTM B88M), Type L (B) for 2-1/2-inches and smaller, Type K (A) for 3-inches and larger, Drawn.
  - 1. Fittings: Fittings are to be manufactured to copper tubing sizes, with grooves designed to accept grooved end couplings of the same manufacturer. Fittings are to be wrought copper, conforming to ASTM B75 alloy C12200 or ASTM B-152 alloy C11000 and ANSI B16.22.
  - 2. Coupling: 2-inches to 8-inches for copper tubing consisting of ductile iron cast housings meeting ASTM A536, complete with a synthetic rubber gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together. Couplings to be manufactured to connect copper tubing sized tube and fittings.
- E. Cross-Linked Polyethylene Tubing - Type "A" - Engle Method - Fittings and Accessories (except exposed locations).
  - 1. Tubing:
    - a. Cross-linked polyethylene (PEX) tubing complies with requirements of ASTM F876 and F877, and cross-linking method must be Type A (hot) method.
    - b. PEX tubing to have minimum working pressure of not less than 160 PSI for water at 73.4 degrees F, 100 PSI for water at 180 degrees F and 80 PSI for water at 200 degrees F determined in accordance with Plastic Pipe Institute Technical Report TR-3/92, and listed in Plastic Pipe Institute Technical Report TR-4/95.
    - c. Co-extruded – “colored piping” (blue/red) is not to be utilized.
  - 2. Fittings:
    - a. Fittings: Engineered Plastic Fittings for above grade applications. Engineered plastic fittings for below grade applications. Serrated type with reinforcement rings.
    - b. Reinforcement Rings: Manufactured using "Engel Method" to ensure that viscoelastic stress regenerative properties are sufficient to produce pressure tight seal.
    - c. Fitting Insert: Of such dimension in that tubing must be expanded in order to facilitate insertion of fitting into tube.
    - d. Accomplish expansion of tubing and ring by an expansion tool designed expressly for that purpose.
    - e. Fittings complies with requirements of ASTM F877.
  - 3. Manifolds: Provide premanufactured copper manifolds of same manufacturer as piping.
  - 4. Stub-out Ells and Stub-out Brackets: Provide premanufactured Type L copper stub-out ell and copper stub-out brackets.

## 2.08 CONDENSATE PIPING

- A. Copper Tube: ASTM B 88 (ASTM B898M), Type K (A), L (B), or M (C).

1. Fittings: ASME B16.29, wrought copper.
2. Joints: ASTM B32, alloy Sn50 solder.
- B. Use chemical resistant piping for drainage of condensate from combustion fuel sources (such as condensing boilers and water heaters), as noted in this Section for area of application.
- C. CPVC (Chlorinated Polyvinyl Chloride) Pipe and Fittings - Except Exterior of the Building and in Plenums and Rated Assemblies:
  1. Pipe and Fittings: Schedule 40, NSF-14, ASTM 439, IAPMO IS20-96, socket fittings, solvent weld.

## 2.09 PRIMER PIPING

- A. Above Ground: Type L hard-drawn copper tubing with wrought sweat fittings and soldered joints.
- B. Below Ground: Type L soft annealed copper tubing with wrought sweat fittings and brazed joints.
- C. Below Ground: Cross-linked polyethylene (PEX) and engineered plastic fittings.

## 2.10 PIPING SPECIALTIES

- A. Pipe Escutcheons:
  1. Provide pipe escutcheons as specified with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.
  2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.
  3. Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.
- B. Low Pressure Y-Type Pipeline Strainers:
  1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 percent of the working pressure of piping system with Type 304 stainless steel screens made with 1/16-inch perforations on 4-inch and smaller strainers, and 1/8-inch perforations on 6-inch and larger strainers.
  2. Threaded Ends, 2-inch and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with plug.
  3. Flanged Ends, 2-1/2-inch and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with hose bibb.
- C. Air Vent with Valves:
  1. Install automatic air vents in all closed and open-loop water systems at high points and at any other point necessary to free system of air. Provide shut-off valve in riser to each automatic vent valve to facilitate servicing. Manual type vent may be used in lieu of automatic type, where specifically shown on the Drawings.
  2. Manufacturer: Hoffman #79.
- D. Dielectric Waterways:
  1. Provide standard products recommended by manufacturers in service indicated, which effectively isolate ferrous from non-ferrous piping (eliminating electrical conductance) to prevent galvanic action and stop corrosion.
  2. Provide dielectric waterways or brass nipple fitting for transitions between dissimilar metal piping.
- E. Unions:
  1. Unions to comply with the following schedule:

- a. Black Steel, 2-inch and smaller: 150 PSI screwed malleable iron, ground joint, brass to iron seat.
  - b. Black Steel, 2-1/2-inch and larger: 150 PSI cast iron screwed flanged, flat faced, full faced gasket.
  - c. Soldered Copper or Brass Pipe, 2-inch and smaller: 150 PSI cast bronzed or copper, ground joint, non-ferrous seat with soldered ends.
  - d. Screwed Copper or Brass Pipe, 2-inch and smaller: 150 PSI cast brass, ground joint, brass to brass seat, threaded ends.
  - e. Flanged Copper or Brass Pipe, 2-1/2-inch and larger: Two 150 PSI cast bronze flanges.
  - f. Manufacturer: EPCO, Mueller, Stanley G. Flagg, Watts, or approved equivalent.
- F. Flexible Piping Connectors - Expansion Loops or Seismic Joints:
- 1. Provide flexible expansion loops of size and material noted on Drawings. Design flexible loops to impart no thrust loads on the anchors. The loop consists of two flexible sections of hose and braid, two 90 degree elbows, and a 180 degree return. Install loops in a neutral, precompressed, or pre-extended condition as required for the application. Provide drain plug for loops installed hanging down. Loops installed straight up may be fitted with an automatic air release valve to purge air from the high point of the loop. Loops installed in any position other than hanging down must have the 180 degree return supported.
  - 2. Copper Pipe: Copper fittings, bronze hose and braid sweat solder ends, Metraloop Series MLS 8000.
  - 3. Steel Pipe: Schedule 40 carbon steel fittings, stainless steel hose and braid.
  - 4. Threaded Ends: Metraloop Series MLT 80000.
  - 5. Flanged Ends: Metraloop Series MLF 80000.
  - 6. Welded Ends: Metraloop Series MLW 80000.
  - 7. Grooved Ends: Metraloop Series MLG 80000.
  - 8. Gas Lines, CSA Approved: Metraloop - Gas MLT or MLF Series.
  - 9. Provide expansion joints by Mason, Flexionics, or Shur Fit, for vertical and horizontal straight run hot water and domestic hot water recirculation piping exceeding 1,000-feet. Install per manufacturer's installation directions.

## 2.11 CLEANOUTS

- A. Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4-inches will not be required. Plastic components not allowed, except unless specifically noted.
- B. Types:
  - 1. Tile Floor Cleanouts: J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread, ABS plug and standard screws.
  - 2. Carpeted Floor Cleanout: J. R. Smith 4020-X with carpet clamping frame, round heavy-duty nickel bronze top, taper thread, ABS plug, carpet clamping device and standard screws.
  - 3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.
  - 4. Parking, Drives and Concrete Floor Cleanouts (Heavy Load): J. R. Smith 4100 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.
  - 5. Wall Cleanout: J. R. Smith 4472-U, countersunk bronze taper thread plug, stainless steel shallow cover and vandalproof screws.
  - 6. Outside Area Walks: J. R. Smith 4020-U with round heavy-duty nickel bronze top, taper thread, ABS plug and top secured with vandalproof screws. Install in 18- by 18- by 6-inch deep concrete pad flush with grade.



## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

#### A. Underground Piping Systems:

1. Examination: Verify that excavations are to required grade, dry, and not over-excavated.
2. Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work at no expense to Owner.
3. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
4. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of testing laboratory.
5. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (muck, peat), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material. Adequate width of trench for proper installation of piping or conduit.
6. Support Foundations:
  - a. Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Specification Sections or Drawings.
  - b. Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
  - c. Foundation Material: Where native material has been removed, place and compact necessary foundation material to form base for replacement of required thickness of bedding material.

	Class A		Class B	
Material Passing	Min.	Max.	Min.	Max.
3/4-inch Square Opening	27	47	0	1

- d. Bedding Material: Full bed piping on sand, pea gravel, or 3/4-inch minus crushed rock. Place minimum 4-inch deep layer of sand, pea gravel, or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide firm foundation.
7. Backfilling:
  - a. Following installation and successful completion of required tests, backfill piping in lifts.
    - 1) In "Pipe Zone" place backfill material and compact in lifts not to exceed 6-inches in depth to height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
    - 2) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
  - b. Backfill Material:

- 1) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
  - 2) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."
8. Compaction of Trench Backfill:
- a. Where compaction of trench backfill material is required, use one of following methods or combination thereof:
    - 1) Mechanical tamper,
    - 2) Vibratory compactor, or
    - 3) Other approved methods appropriate to conditions encountered.
  - b. Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.
- B. General Installation:
1. Work performed by experienced journeyman plumbers. No exceptions.
  2. Provide access panels for concealed valves, shock arrestors, trap primers and the like.
  3. Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.
  4. Align piping accurately at connections, within 3/32-inch misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.
  5. Locate piping runs, as indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1-inch clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view by locating it in column enclosures, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.
    - a. Do not run piping through transformer vaults, telephone, elevator, electrical or electronic equipment spaces or enclosures unless indicated on Drawings.
    - b. Concealed Piping Above Suspended Ceiling: Plan and coordinate to avoid interferences; install to maintain suspended ceiling heights shown on Architectural Drawings. Allow sufficient space above removable ceiling panels for panel removal. Locate piping so that valves are visible and accessible within 24-inches horizontally and vertically from point of access to the ceiling space. Provide plenum rated materials for ceiling spaces which are being used as plenums.
    - c. Exposed Work: Run pipes parallel to the closest wall unless otherwise shown on Drawings; maintain maximum headroom; avoid light fixtures.
    - d. Insulation Space Allowance: In piping work, allow space for pipe insulation and jackets. If interferences occur, move the piping to accommodate insulation thickness specified.
    - e. Pipe Lengths: Do not use short lengths or nipples at locations where a full length of pipe will fit.
    - f. Alignment Prior to Supporting and Anchoring: Place piping in proper alignment and position prior to connection to anchors, expansion loops, and equipment. Furnish jacking devices, temporary steel structural members, and assembled structures as necessary. Remove temporary equipment and structures supplied by contractor at completion; such items to remain Contractor property.

- g. Valve and Equipment Connections: Piping not to place undue stress on flanged valves and equipment connections. Install mating flange faces true and parallel to each other and not requiring springing of piping for assembly. Pipe hangers and supports to carry the full weight of the pipe and fluid.
- h. Piping Leaks: Correct immediately; use new materials; leak-sealing compounds or peening not permitted.
- i. Pressure Ratings of Fittings, Valves, and Devices in Piping Systems: Pressure rating to be equal to, or greater than, the maximum working pressure of the system.
- j. Equipment Vents and Drains: Provide for coils and vessels which contain water. Provide isolation valves and outlet valves at piping high and low points to permit venting and draining of the vessel without venting and draining connected piping. Provide hose connections and caps on drain lines.
- k. Escutcheon Plates: Where exposed insulated and uninsulated piping passes through walls, floors or ceilings; provide spring clip type. Provide plates on both sides of wall or floor.

C. Testing:

1. General:

- a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.
- b. Notify Architect and local Plumbing Inspector 2 days before tests.
- c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- e. Send test results to Architect for review and approval and include in Operation and Maintenance Manual.

2. Testing of Pressurized Systems:

- a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
- b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

3. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

D. Corrosive Soil Conditions:

- 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's recommendations.
- 2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

3. Obtain and review project soils report for verification of requirements concerning corrosive soils.
- E. Protection:
1. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of work.
- F. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- G. Cut piping squarely, free of rough edges and reamed to full bore. Insert piping fully into fittings.
- H. Provide joints of type indicated in each piping system.
- I. Thread pipe in accordance with ANSI/ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- J. Sleeves:
1. Pipe Sleeves:
    - a. Layout work in advance of pouring concrete, furnish, and set sleeves necessary to complete work.
    - b. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with non-shrinking grout or approved caulking compound (Except DWV Piping penetrating a concrete slab set on finish grade), provide "Link-Seal" sleeve sealing system for concrete/slab penetrations which are below grade. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements
    - c. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Provide modular link sealing system for concrete penetrations which are below grade. Caulk/seal piping passing through fire-rated assemblies per local AHJ requirements.
    - d. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Indicate penetrations on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing Drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
  2. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
    - a. Install fabricated pipe sleeve.
    - b. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification.
    - c. Seal each end airtight with a resilient nonhardening seal per code.
  3. Piping penetrations through fire-rated (1 to 3 hour) assemblies:

- a. Select and install pre-engineered pipe penetration system in accordance with UL listing and manufacturer's recommendation.
- b. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E84.

### 3.02 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

#### A. Excavation and Backfill:

- 1. See General Installation Requirements above.

#### B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

#### C. Corrosive Soil Conditions:

- 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.
- 2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

#### D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

#### E. Sanitary and Storm Drainage:

- 1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
- 2. Drains:
  - a. Install drains to suit finished floor. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
  - b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.

#### F. Epoxy Coated Cast Iron Pipe and Fittings: Coat the piping terminus of any cut piping with an applied epoxy per manufacturer's instructions. Denso Protal 7200 fast-cure epoxy repair coating.

### 3.03 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

#### A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

#### B. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

- 1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

- C. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.
- D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.
- E. Sanitary and Storm Drainage:
  - 1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
  - 2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.
  - 3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00, Plumbing Fixtures.
  - 4. Drains:
    - a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
    - b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
  - 5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
  - 6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
  - 7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.

### 3.04 PUMP WASTE PRESSURE PIPING (PUMPED DISCHARGE)

- A. Excavation and Backfill:
  - 1. See General Installation Requirements above.
- B. Testing of Pressurized Systems:
  - 1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
  - 2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
- C. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
  - 1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- D. Braze copper tube and fitting socket with BCuP series filler metal without flux. Use listed brazing flux for joining of copper tube to brass or bronze fittings, meeting AWS FB3A or FB3C. "Shock" cooling is prohibited. A continuous fillet is to be visible around the completed joint. After cooling, thoroughly remove flux residue with warm water and a brush prior to testing. Do not use BCuP filler on copper alloys containing over 10 percent nickel. Cap or plug piping during construction to prevent entry of foreign material.

- E. Welders performing work under this Contract to be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators." Installation to conform to ANSI 31.1 "Power Piping."
  - 1. Submit for approval the names, identification, and welder's assigned number, letter or symbol for welders assigned to this project.
  - 2. Use the assigned identification symbol to identify the work of each welder and indelibly stamp immediately upon completion of each weld.
  - 3. Welders to be tested and certified for all positions.
  - 4. Submit identifying stenciled test coupons made by each operator.
  - 5. Welders may be required to retake welding certification tests without additional expense.
  - 6. When so requested, a welder will not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.
  - 7. Recertification of the welder to be made after the welder has taken and passed the required tests.
- F. Weld pipe joints in accordance with recognized industry practice and as follows:
  - 1. Weld pipe joints only when ambient temperature is above 0F.
  - 2. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
  - 3. Use pipe clamps or tack-weld joints with 1-inch long welds, 4 welds for pipe sizes to 10-inches, 8 welds for pipe sizes 12-inches to 20-inches.
  - 4. Build up welds with a stringer-bead pass, followed by a hot pass, followed by a cover or filler pass. Eliminate valleys at center and at edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.
  - 5. Do not weld out piping system imperfections by tack-welding procedures. Re-fabricate to comply with requirements.
  - 6. At Installer's option, install forged branch-connection fittings whenever branch pipe is indicated, or install a regular T-fitting.

### 3.05 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Excavation and Backfill:
  - 1. See General Installation Requirements above.
- B. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- C. Domestic Water:
  - 1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
  - 2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
  - 3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
  - 4. Use unions for piping connections to equipment.
  - 5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
  - 6. Use reducers or increasers. Use no bushings.

7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
  8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
  9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
  10. Make ferrous to non-ferrous connections with dielectric fittings.
  11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
  12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.
  13. Provide drain valves at base of risers and at low points on the system.
  14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.
- D. Sterilization of Domestic Water System:
1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
  2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
  3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
  4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.
- E. Buried Pre-Insulated Pipe Installation:
1. Installation and Testing: Install and test products in accordance with manufacturer's installation instructions.
  2. Manufacturer's installation instructions are to describe the following:
    - a. Storage and handling of pipes.
    - b. Trench preparation.
    - c. Installing pipe.
    - d. Installing accessories.
    - e. Installing fittings.
    - f. Building penetrations.
    - g. Field insulation kits.
    - h. Testing.

### 3.06 HOT AND COLD DOMESTIC WATER ABOVE GRADE

- A. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- B. Testing of Pressurized Systems:
1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
  2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.



- C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.
- D. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
  - 1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- E. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.
- F. Braze copper tube and fitting socket with BCuP series filler metal without flux. Use listed brazing flux for joining of copper tube to brass or bronze fittings, meeting AWS FB3A or FB3C. "Shock" cooling is prohibited. A continuous fillet is to be visible around the completed joint. After cooling, thoroughly remove flux residue with warm water and a brush prior to testing. Do not use BCuP filler on copper alloys containing over 10 percent nickel. Cap or plug piping during construction to prevent entry of foreign material.
- G. Domestic Water:
  - 1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
  - 2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
  - 3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
  - 4. Use unions for piping connections to equipment.
  - 5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
  - 6. Use reducers or increasers. Use no bushings.
  - 7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
  - 8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
  - 9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
  - 10. Make ferrous to non-ferrous connections with dielectric fittings.
  - 11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
  - 12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.
  - 13. Provide drain valves at base of risers and at low points on the system.
  - 14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.
- H. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.

### 3.07 CONDENSATE PIPING

#### A. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

### 3.08 PRIMER PIPING

#### A. Excavation and Backfill:

1. See General Installation Requirements above.

#### B. Testing:

1. See General Installation Requirements above.

### 3.09 PIPING SPECIALTIES

#### A. Excavation and Backfill:

1. See General Installation Requirements above.

#### B. Drainage, Waste, and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

#### C. Corrosive Soil Conditions:

1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.
2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

#### D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

### 3.10 CLEANOUTS

- A. Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100-feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish. Provide shop drawings to Architect to coordinate locations and types of cleanouts with Architect prior to installation.

END OF SECTION

SECTION 22 30 00  
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Emergency Stop Pushbutton Switch
2. Commercial Packaged Gas-Fired Water Heater/Storage Tank
3. Domestic Expansion Tanks Non-ASME
4. Domestic Expansion Tanks ASME
5. Domestic Circulation Pumps - Close-Coupled, In-Line
6. Domestic Circulation Pumps - Close-Coupled, Horizontally Mounted
7. Domestic Circulation Pump with Adaptive Variable Speed Drive

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Seismic anchor details and calculations signed and stamped by licensed Oregon structural engineer with equipment data.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. NSF 61, Annex G compliant.
  2. ISO 9001 Certified.
  3. IAPMO Low Lead Certification.
- C. Products approved for installation by state authorizing agency, no exceptions.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Emergency Stop Pushbutton Switch:
1. Group Schneider/Square D Class 9001 XB5 Family
  2. Eaton
  3. Siemens

4. General Electric
5. Or approved equivalent.
- B. Commercial Packaged Gas-Fired Water Heater/Storage Tank:
  1. Weben Jarco DB Series
  2. Or approved equivalent.
- C. Domestic Expansion Tanks Non-ASME:
  1. Bell and Gossett Series PT
  2. American Wheatley
  3. Amtrol
  4. Armstrong
  5. Watts
  6. Or approved equivalent.
- D. Domestic Expansion Tanks ASME:
  1. Bell and Gossett Series
  2. American Wheatley
  3. Amtrol
  4. Armstrong
  5. Watts
  6. Hansen
  7. Or approved equivalent.
- E. Domestic Circulation Pumps - Close-Coupled, In-Line:
  1. Bell and Gossett Series
  2. Armstrong
  3. Grundfos
  4. Paco
  5. Taco
  6. Or approved equivalent.
- F. Domestic Circulation Pumps - Close-Coupled, Horizontally Mounted:
  1. Bell and Gossett Series
  2. Armstrong
  3. Grundfos
  4. Paco
  5. Taco
  6. Or approved equivalent.
- G. Domestic Circulation Pump with Adaptive Variable Speed Drive:
  1. Goulds Series
  2. Grundfos
  3. Armstrong
  4. Taco
  5. Or approved equivalent.

## 2.02 GENERAL

- A. Reference Drawings for capacities and specific model numbers.

### 2.03 EMERGENCY STOP PUSHBUTTON SWITCH

- A. Provide 30mm diameter turn-to-release red pushbutton operator with contact blocks to disconnect power to the boiler burner controls and gas service when button is pushed. Contacts are mechanically latching, such that if power is lost and then restored, it is not necessary to manually reset the button to restore gas and power to the boiler. Basis-of-Design: Group Schneider/Square D Class 9001 Family XB series.

### 2.04 COMMERCIAL PACKAGED GAS-FIRED WATER HEATER/STORAGE TANK

- A. System: Domestic water.
- B. Package unit, factory-assembled to include dual two heater and ASME storage tank, pump, copper piping, wiring to controls and associated power wiring to single point connection.
- C. Heater: Design certified and bear seal of CSA. Construct heater in accordance with requirements of ASME boiler and pressure vessel code and to bear appropriate ASME label and stamp. Heater to meet local and state standards for 85 percent minimum energy efficiency. Heater coil of extruded integral copper fin construction and of continuous waterway design. Furnish heater with intermittent pilot burner ignition system with 90 second or less shutoff response to pilot failure. Equip heater with energy cutoff and high limit aquastat. Warranty heater for 5 years against failure due to defects in material and quality of work according to stipulations set forth in manufacturer's warranty.

### 2.05 DOMESTIC EXPANSION TANKS NON-ASME

- A. Welded steel, constructed, tested and stamped in accordance with IAPMO Standards for working pressure of 125 PSI. Support floor mounted tanks with steel legs or base. Provide single flexible diaphragm securely sealed into tank to separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air-charging fitting, and drain fitting. Diaphragm: Removable and replaceable in line.

### 2.06 DOMESTIC EXPANSION TANKS ASME

- A. System: Domestic water.
- B. Welded steel, constructed, tested and stamped in accordance with ASME Boiler and Pressure Vessel Code for working pressure of 125 PSI. Support floor mounted tanks with steel legs or base. Provide single flexible diaphragm securely sealed into tank to separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air-charging fitting, and drain fitting. Diaphragm: Removable and replaceable in line.

### 2.07 DOMESTIC CIRCULATION PUMPS - CLOSE-COUPLED, IN-LINE

- A. System: Domestic water
- B. Description: Factory-assembled and tested, single-stage, close-coupled, in-line, seal-less centrifugal pump.
  1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
  2. Casing: Bronze/stainless steel, with threaded companion-flange connections.
  3. Impeller: Corrosion-resistant material.
  4. Motor: Non-overloading at any point on pump curve, Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Common Motor Requirements."
- C. Capacities and Characteristics as per Drawings.
- D. See detail on Drawings for pump controls.

### 2.08 DOMESTIC CIRCULATION PUMPS - CLOSE-COUPLED, HORIZONTALLY MOUNTED

- A. System: Domestic water

- B. Description: Factory-assembled and -tested, overhung impeller, single-stage, close-coupled, horizontally mounted, in-line centrifugal pumps and designed for installation with pump and motor shafts mounted horizontally.
  - 1. Pump Construction: All bronze/stainless steel.
    - a. Casing: Radially split, cast iron, with threaded companion-flange connections for pumps.
    - b. Impeller: ASTM B 584, cast bronze or stainless steel; statically and dynamically balanced, closed, and keyed to shaft.
    - c. Shaft and Shaft Sleeve: Steel shaft.
    - d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
    - e. Bearings: Oil-lubricated; bronze-journal or ball type.
  - 2. Shaft Coupling: Rigid type if pump is provided with coupling.
  - 3. Motor: Non-overloading at any point on pump curve, Single speed, with grease-lubricated ball bearings. Comply with requirements in Division 22 Section "Common Motor Requirements."
- C. Capacities and Characteristics as per Drawings.
- D. See detail on Drawings for pump controls.

## 2.09 DOMESTIC CIRCULATION PUMP WITH ADAPTIVE VARIABLE SPEED DRIVE

- A. The pump is to be listed for domestic hot water systems and is to comply with lead free (less than or equal to 0.25 percent) products in potable/drinking water systems.
- B. Pump is to be of the in-line wet rotor design.
- C. The pump is to be a standard product of a single pump manufacturer.
- D. The enclosure to be marked "Enclosure Type 2."
- E. The pump to be certified and listed by a Nationally Recognized Test Laboratory (NRTL) for U.S. and Canada to comply with:
  - 1. UL778
  - 2. UL 60730-1A
  - 3. CAN/CSA No. 108
- F. The pump is to be labeled on the nameplate as having an Energy Efficiency Index (EEI) of no greater than 0.20.
- G. Ratings:
  - 1. Maximum Pressure: 175 PSIG
  - 2. Minimum Media Temperature: 14 degrees F
  - 3. Maximum Media Temperature: 230 degrees F
  - 4. Maximum Continuous Media Temperature: 203 degrees F
  - 5. Maximum Sound Pressure Level: 43dB(A)
  - 6. Voltage tolerance: [1x115V +/-10 percent][1x208-230V +/-10 percent]
  - 7. Maximum Energy Efficiency Index: 0.20
- H. Pump Construction:
  - 1. Pump housing: Cast Iron: EN-JGL-250 with surface treatment; Stainless Steel: 304 Stainless Composite.
  - 2. Impellers: PES 30-percent GF or stainless steel.
  - 3. Rotor Can: PPS: PPS reinforced with Carbon Fiber(Fortran MT9141L GF40)
  - 4. Rotor Cladding: 316 Stainless Steel

5. Stator Housing: Aluminum
  6. Shaft: 316L Stainless Steel
  7. Thrust Bearing: Axial: Carbon Graphite, Radial: ceramic Alumina Hilox 961
  8. O-Rings: EPDM
  9. Bearing Plate: 304 Stainless Steel
  10. Neck Ring: 304 Stainless Steel
  11. Control Box: Polycarbonate
- I. Motor:
1. Motor to be 4-pole permanent-magnet (PM motor) and tested with the pump as one unit.
  2. Each motor is to be of the integrated Variable Speed Drive design consisting of a motor and a Variable Frequency Drive (VFD) built and tested as one unit.
  3. The Motor to be self-ventilating.
  4. Minimum insulation class for the motor to be Class F.
  5. The integrated VFD control is to utilize an energy optimization algorithm to minimize energy consumption by reducing the factory-set setpoint and adjust to system characteristics.
- J. Operating Modes:
1. The pump is to have the following control mode and operating modes:
    - a. Proportional Pressure - The head delivered is to be reduced from a manual setpoint linearly in accordance with decrease in flow demand in the system
    - b. Constant Pressure - A manual set, constant head is maintained, irrespective of flow up to the maximum speed of the pump.
    - c. Constant Curve - The pump runs as an uncontrolled pump by the means of a set of pump curves. The pump curve adjustable between maximum and minimum from the control panel or through a wireless remote control.
    - d. Constant Temperature - The pump is to adjust speed to maintain a constant media temperature in the flow pipe in which the pump is installed.
    - e. Constant Differential Temperature - The pump is to adjust speed to maintain a constant temperature drop between the flow pipe in which the pump is installed and a user installed temperature sensor.
- K. Interface and Communication:
1. The pump is to have an integrated operator interface consisting of:
    - a. Minimum 2.4-inch (measured diagonally) color TFT display.
      - 1) Push buttons for navigation of menu.
      - 2) Push Buttons must be able to operate at minimum 25,000 times.
      - 3) LEDs to signal pump status for quick indication.
  2. The pump is to have a sensor integrated directly into the pump housing with 4 lines consisting of Ground, Supply, and two signals for Differential Pressure and Media Temperature.
  3. The pump module is to have one analog input configurable for either 4-20mA or 0-10VDC input signal configurable for external Temperature or Pressure sensor, or Setpoint influence.
  4. The pump module is to have two Output Relays. Each relay to be configurable for Alarm, Reading, or Operating indication.
  5. Is to be capable of accepting an optional add-on module for integration into Building Management Systems:
    - a. LonWorks
      - 1) BACnet

- 2) Modbus
- 3) Profibus

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- C. Orients so controls and devices needing service and maintenance have adequate access.
- D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- E. Connect water piping to units with shutoff valves and unions.
- F. Equipment Rigging: Heavy duty rigging eye bolts for Crosby Group swivel hoist rings installed over pump access covers for removal or maintenance.
- G. Equipment Start-Up:
  - 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
  - 2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Architect and Owner's Authorized Representative for approval.
  - 3. Remove and replace filters when start-up testing is executed.
  - 4. Manufacturer adjusts operating parameters of equipment to compensate to elevation of 500-feet above sea level.
  - 5. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
  - 6. Provide written report from manufacturer's representative on results of start-up within 48 hours.
  - 7. Technical Training of maintenance staff includes two hours minimum per each piece of equipment.
  - 8. Seismic Verification:
    - a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
    - b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

### 3.02 EMERGENCY STOP PUSHBUTTON SWITCH

- A. Boiler/Water Heater/Gas Shutdown:
  - 1. Provide CSD.1 compliant controls.
  - 2. Remote switch: Install shutdown switch to disconnect power to the boiler burner controls and gas service in room. Install pushbutton under clear, impact-resistant flip lid. Provide red phenol label "Emergency Shutdown" locate label above pushbutton. Pushbutton to be mounted by latch side of each boiler/mechanical room door within interior of the room, unless otherwise directed by AHJ. Provide electrical wiring and raceway as necessary for installation. Provide additional relays and wiring to cut power to gas solenoid valves in the room not integral to boilers. Reference drawings for gas solenoid valve locations.



### 3.03 COMMERCIAL PACKAGED GAS-FIRED WATER HEATER/STORAGE TANK

- A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- C. Orients so controls and devices needing service and maintenance have adequate access.
- D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- E. Connect water piping to units with shutoff valves and unions.
- F. Equipment Start-Up:
  - 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
  - 2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Architect and Owner's Authorized Representative for approval.
  - 3. Remove and replace filters when start-up testing is executed.
  - 4. Manufacturer adjusts operating parameters of equipment to compensate to elevation of 500-feet above sea level.
  - 5. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
  - 6. Provide written report from manufacturer's representative on results of start-up within 48 hours.
  - 7. Technical Training of maintenance staff includes two hours minimum per each piece of equipment.
  - 8. Seismic Verification:
    - a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
    - b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

### 3.04 DOMESTIC EXPANSION TANKS NON-ASME

- A. Precharge tank per manufacturers recommendation.
- B. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- D. Orients so controls and devices needing service and maintenance have adequate access.
- E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- F. Connect water piping to units with shutoff valves and unions.

### 3.05 DOMESTIC EXPANSION TANKS ASME

- A. Precharge tank per manufacturers recommendation.
- B. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

- C. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- D. Orients so controls and devices needing service and maintenance have adequate access.
- E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- F. Connect water piping to units with shutoff valves and unions.

### 3.06 DOMESTIC CIRCULATION PUMPS - CLOSE-COUPLED, IN-LINE

- A. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Orients so controls and devices needing service and maintenance have adequate access.
- C. Connect water piping to units with shutoff valves and unions.
- D. Provide lift check valves 5 diameters downstream of pump discharge for circulating pumps piped in a parallel configuration.
- E. Equipment Start-Up:
  - 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
  - 2. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
  - 3. Seismic Verification:
    - a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
    - b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

### 3.07 DOMESTIC CIRCULATION PUMPS - CLOSE-COUPLED, HORIZONTALLY MOUNTED

- A. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Orients so controls and devices needing service and maintenance have adequate access.
- C. Connect water piping to units with shutoff valves and unions.
- D. Provide lift check valves 5 diameters downstream of pump discharge for circulating pumps piped in a parallel configuration.
- E. Equipment Start-Up:
  - 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
  - 2. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
  - 3. Seismic Verification:
    - a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
    - b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

### 3.08 DOMESTIC CIRCULATION PUMP WITH ADAPTIVE VARIABLE SPEED DRIVE

- A. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Orients so controls and devices needing service and maintenance have adequate access.
- C. Connect water piping to units with shutoff valves and unions.
- D. Equipment Start-Up:
  - 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
  - 2. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
  - 3. Seismic Verification:
    - a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
    - b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

END OF SECTION

SECTION 22 40 00  
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. General Plumbing Fixtures:
  - a. China Fixtures, White Only
  - b. Enameled Steel Fixtures, White Only
  - c. Faucet Fittings
  - d. Fiberglass Fixtures, White Only
  - e. Molded Resin or Stone Fixtures
  - f. Shower Valves
  - g. Stainless Steel Fixtures
  - h. Thermostatic Mixing Valves
2. Carriers
3. Drinking Fountains
4. Electric Water Coolers
5. Fixture Trim
6. Floor and Area Drains
7. Floor Sinks
8. Flushometers - Water Closet/Urinal
9. Hose Bibbs
10. Water Closet Seats
11. Drain Boxes
12. Water Supply Boxes
13. Stainless Steel Drainage Fittings

1.02 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Comply with lead free (less than or equal to 0.25 percent) products in drinking water systems.

2. NSF 61, Annex G, Drinking Water System Components, Compliant.
3. ISO 9001, Quality Management Standard Certified.
4. IAPMO Low Lead Certification.
5. Provide fixtures, faucets and accessories to meet barrier free requirements of the governing code with respect to plumbing fixtures provided for the physically handicapped.
6. Items approved for use by State of Oregon.

#### 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. "Or approved equivalent" as defined in 22 00 00, Plumbing Basic Requirements. Substitution process requirements apply to approved equivalent products.
- B. General Plumbing Fixtures: See Schedule on Drawings for type.
  1. China Fixtures - White Only:
    - a. American Standard
    - b. Briggs
    - c. Crane
    - d. Eljer
    - e. Kohler
    - f. Universal-Rundle
    - g. Or approved equivalent.
  2. Enameled Steel Fixtures - White Only:
    - a. American Standard
    - b. Briggs
    - c. Crane
    - d. Eljer
    - e. Kohler
    - f. Universal-Rundle
    - g. Or approved equivalent.
  3. Faucet Fittings:
    - a. Private:
      - 1) Chicago
      - 2) Delta Commercial
      - 3) Moen
      - 4) Speakman
      - 5) Symmons
      - 6) T&S Brass
      - 7) Or approved equivalent.
    - b. Public:
      - 1) American Standard
      - 2) Chicago
      - 3) Delta Commercial
      - 4) Moen Commercial
      - 5) Sloan

- 6) Symmons
- 7) T & S Brass
- 8) Or approved equivalent.
- 4. Fiberglass Fixtures - White Only:
  - a. Aqua-Glass
  - b. Briggs
  - c. Crane
  - d. Comfort Designs
  - e. Florestone
  - f. Hytec
  - g. Mustee
  - h. Universal-Rundle
  - i. Or approved equivalent.
- 5. Molded Resin or Stone Fixtures:
  - a. Fiat
  - b. Mustee
  - c. Stern Williams
  - d. Or approved equivalent.
- 6. Shower Valves:
  - a. Acorn
  - b. Chicago
  - c. Delta
  - d. Moen
  - e. Powers
  - f. Symmons
  - g. Or approved equivalent.
- 7. Stainless Steel Fixtures:
  - a. Elkay
  - b. Haws
  - c. Just
  - d. Or approved equivalent.
- 8. Thermostatic Mixing Valves:
  - a. Bradley
  - b. Powers
  - c. Symmons
  - d. Holby
  - e. Or approved equivalent.
- C. Carriers:
  - 1. JR Smith
  - 2. Zurn
  - 3. Or approved equivalent.
- D. Drinking Fountain:
  - 1. Elkay

2. Halsey-Taylor
  3. Haws
  4. Murdock
  5. Oasis
  6. Sunroc
  7. Or approved equivalent.
- E. Electric Water Coolers:
1. Elkay
  2. Halsey-Taylor
  3. Haws
  4. Murdock
  5. Oasis
  6. Sunroc
  7. Or approved equivalent.
- F. Fixture Trim:
1. McGuire
  2. Dearborn Brass
  3. Oatey
  4. Or approved equivalent.
- G. Floor and Area Drains:
1. Mifab
  2. Sioux Chief
  3. Smith
  4. Wade
  5. Watts
  6. Zurn
- H. Floor Sinks:
1. Commercial Enameling
  2. Mifab
  3. Sioux Chief
  4. Smith
  5. Wade
  6. Watts
  7. Zurn
  8. Or approved equivalent.
- I. Flushometers - Water Closet/Urinal:
1. Delaney
  2. Sloan
  3. Zurn
  4. Or approved equivalent.
- J. Hose Bibbs:
1. Chicago

- 2. JR Smith
- 3. Mifab
- 4. Wade
- 5. Woodford
- 6. Zurn
- 7. Or approved equivalent.
- K. Water Closet Seats:
  - 1. Bemis
  - 2. Or approved equivalent.
- L. Drain Boxes:
  - 1. Sioux Chief
  - 2. Or approved equivalent.
- M. Water Supply Boxes:
  - 1. Sioux Chief
  - 2. Or approved equivalent.
- N. Stainless Steel Drainage Fittings:
  - 1. Blucher
  - 2. Josam
  - 3. JR Smith
  - 4. Kusel
  - 5. Zurn
  - 6. Or approved equivalent.

## 2.02 GENERAL PLUMBING FIXTURES

- A. Review substitution request requirements in Division 01, General Requirements and 22 00 00, Plumbing General Requirements.
- B. Reference Architectural Details for mounting height and location of fixtures.
- C. Provide factory fabricated fixtures of type, style and material indicated on the plumbing fixture connection schedule shown on the Drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, or required for complete installation. Where more than one type is indicated, selection is installer's option; but, fixtures of same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
- D. Provide fixtures complete with fittings, supports, fastening devices, bolt caps, faucets, valves, traps, stops and appurtenances.
- E. Plumbing Fixture Thermostatic Mixing Valves:
  - 1. Lavatories provide ASSE 1070 compliant mixing valves or multiple lavatories served by a single ASSE 1070 compliant mixing valve.
  - 2. Sinks serviced with a single ASSE 1070 mixing valve or multiple sinks served by a single ASSE 1070 mixing valve.
  - 3. Commercial kitchen handsinks provide ASSE 1070 mixing valves.
  - 4. Janitor sinks or process/maintenance type sinks do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.



5. Hot water hose bibbs do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

## 2.03 CARRIERS

### A. Wall Hung Water Closets:

1. Vertical: Zurn Z-1204-N4-X-50 or Z-1204-ND4-X-50 (JR Smith 230y-M54-M12 or 230DY-M54-M12). Adjustable vertical load siphon jet with 500 lb. capacity.
2. Horizontal: Zurn ZE-1203-N4-X-50 or ZE-1203-ND4-X-50 (JR Smith 220 R or L-Y-M54-M12 or 220DY-M54-M12). Adjustable horizontal siphon jet with 500 lb. load capacity.

### B. Wall Hung Urinal: Zurn Z-1218-WS or Z-1222-WS. (JR Smith 637). Coupling type or plate type with bearing plate 200 lb. capacity.

### C. Wall Hung Lavatory: Zurn Z-1231 (D). (JR Smith 700). Concealed arm or Plate type, 250 lb. capacity.

### D. Wall Hung Service Sink: Zurn Z-1218. (JR Smith 913/914). Coupling type. 300 lb. capacity.

### E. Wall Hung Drinking Fountain: Zurn Z-1225-BL (JR Smith 834-97-98). Plate type. 300 lb. capacity.

### F. Wall Hung Flushing Rim Clinic Sink: Zurn Z-1217 (JR Smith 0915-Y4-98). Coupling Type. 300 lb. capacity.

## 2.04 DRINKING FOUNTAINS

### A. See Schedule on Drawings for type.

## 2.05 ELECTRIC WATER COOLERS

### A. See Schedule on Drawings for type.

## 2.06 FIXTURE TRIM

### A. Traps: Provide heavy duty commercial grade traps on fixtures except fixtures with integral traps. Exposed traps will be chromium plated cast brass or 17 gauge chromium plated brass tubing.

#### 1. Sink: McGuire 8912CDF.

#### 2. Lavatory: McGuire 8902CDF.

### B. Supplies and Stops: Lead free heavy duty commercial grade, chrome plated with brass stems. Stops: T-handle or Loose Key type.

#### 1. Lavatory: McGuire LFH2165LK.

#### 2. Sink: McGuire LFH2167LK.

#### 3. Water Closets: McGuire.

### C. Lavatory Grid Strainer: McGuire 155A.

### D. Sink Grid Strainer: McGuire 152N.

### E. Shower Grid Strainer: McGuire 1266.

### F. Sink Basket Strainer: McGuire 151.

### G. Trim barrier-free wrap for P-traps and supplies by McGuire, Pro-Wrap, Plumberex or Truebro.

### H. Escutcheons: McGuire wrought brass deep bell.

### I. Wax Rings and Toilet Bolts: WM Harvey No Seep No. 1 053065-N.

## 2.07 FLOOR AND AREA DRAINS

### A. See Schedule on Drawings for types.

## 2.08 FLOOR SINKS

### A. See Schedule on Drawings for types.

### B. Plastic components are not allowed.

## 2.09 FLUSHOMETERS - WATER CLOSET/URINAL

- A. See Schedule on Drawings for types.

## 2.10 HOSE BIBBS

- A. See Schedule on Drawings for types.

## 2.11 WATER CLOSET SEATS

- A. See Schedule on Drawings for type.

## 2.12 DRAIN BOXES

- A. See Schedule on Drawings for type.
- B. Provide fire rated ASTM E-84 rated boxes where required by building construction.

## 2.13 WATER SUPPLY BOXES

- A. See Schedule on Drawings for type.
- B. Provide fire rated ASTM E-84 rated boxes where required by building construction.

## 2.14 STAINLESS STEEL DRAINAGE FITTINGS

- A. Austenitic Stainless Steel of Material type (304/316) and gauge as listed in the plumbing fixture schedule.

# PART 3 - EXECUTION

## 3.01 GENERAL PLUMBING FIXTURE INSTALLATION INFORMATION

### A. Verification of Conditions:

1. Examine rough-in work of water supply and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.
2. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.
3. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings and pertinent codes and regulations, design and referenced standards.
4. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
5. Install a stop valve in a readily accessible location in water connection to each fixture.
6. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Seal fixtures to walls and floors using silicone sealant Dow Corning No. 780 or approved equivalent. Match sealant color to fixture color.
8. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
9. Inspect each unit for damage prior to installation. Replace damaged fixtures.
10. Replace washers or cartridges of leaking or dripping faucets and stops.
11. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.
12. During construction, cover installed fixtures, drains, sinks and water coolers with cardboard and wrap with sheet plastic.
13. Provide trap primers for floor drains, floor sinks, trench drains and hub drains.
14. Install roof and overflow roof drains per architectural details. Cover drains during roof construction to protect drain. Provide offsets or expansion joints at each roof/overflow drain.

- 15. Do not use lead flashing.
- B. Owner Furnished Equipment:
  - 1. Rough-in and make final connections to Owner furnished equipment. Provide necessary items to complete installation.
  - 2. Comply with requirements of this Section and Drawings for installation procedures.
- C. Adjusting and Cleaning: Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation. Adjust water pressure at drinking fountains, faucets, shower valves and flush valves to provide proper flow stream and specified GPM. Repair leaks at faucets and stops.
- D. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner.
- E. Field Quality Control: Upon completion of installation of plumbing fixtures, test fixtures to demonstrate capability and compliance with Specifications. Correct or replace malfunctioning units at site, then retest to demonstrate compliance.
- F. Protection: Protect fixtures and equipment from damage. Cover finished fixtures with cardboard and sheet plastic. Fixtures are not to be used during construction. Replace damaged items with new.
- G. Signage: For fixtures that do not have ASSE 1070 mixing valve protection for hot water temperature, provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

### 3.02 CARRIERS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.
- C. Coordinate wall thickness so carrier has adequate depth to be concealed.

### 3.03 DRINKING FOUNTAINS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

### 3.04 ELECTRIC WATER COOLERS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

### 3.05 FIXTURE TRIM INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

### 3.06 FLOOR AND AREA DRAINS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

### 3.07 FLOOR SINKS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid. Set fixture rim/grate flush with surrounding finish surface unless specifically noted otherwise.

3.08 FLUSHOMETERS - WATER CLOSET/URINAL INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.09 HOSE BIBBS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.10 WATER CLOSET SEATS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.11 DRAIN BOXES INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.12 WATER SUPPLY BOXES INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.13 STAINLESS STEEL DRAINAGE FITTINGS

- A. Install components in accordance with manufacturers instructions and approved product data submittals.
- B. Set plumb, level and flush to surrounding surfaces unless specifically noted otherwise.
- C. As applicable install clamping devices-flanges to receive surface finish products (flooring, membranes etc.).

END OF SECTION

## SECTION 23 00 00

## HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

## PART 1 - GENERAL

## 1.01 SECTION INCLUDES

- A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of heating, ventilating and air conditioning systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
  - 1. Provide: To furnish and install, complete and ready for intended use.
  - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
  - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.
  - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
  - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

## 1.02 RELATED SECTIONS

- A. Contents of Section applies to Division 23, HVAC Contract Documents.
- B. Related Work:
  - 1. Additional conditions apply to this Division including, but not limited to:
    - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
    - b. Drawings
    - c. Addenda
    - d. Owner/Architect Agreement
    - e. Owner/Contractor Agreement
    - f. Codes, Standards, Public Ordinances and Permits

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards per Division 01, General Requirements, individual Division 23, HVAC Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, off/from:

1. State of Oregon:
  - a. OAR - Oregon Administrative Rules
  - b. 2023 OESC - Oregon Electrical Specialty Code
  - c. 2022 OFC - Oregon Fire Code
  - d. 2022 OMSC - Oregon Mechanical Specialty Code
  - e. 2023 OPSC - Oregon Plumbing Specialty Code
  - f. 2022 OSSC - Oregon Structural Specialty Code
  - g. 2021 OEESC - Oregon Energy Efficiency Specialty Code
  - h. 2011 Oregon Elevator Specialty Code
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
  1. ABA - Architectural Barriers Act
  2. ABMA - American Bearing Manufacturers Association
  3. ADA - Americans with Disabilities Act
  4. AHRI - Air-Conditioning Heating & Refrigeration Institute
  5. AMCA - Air Movement and Control Association
  6. ANSI - American National Standards Institute
  7. ASCE - American Society of Civil Engineers
  8. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers
  9. ASHRAE Guideline 0, The Commissioning Process
  10. ASME - American Society of Mechanical Engineers
  11. ASPE - American Society of Plumbing Engineers
  12. ASSE - American Society of Sanitary Engineering
  13. ASTM - ASTM International
  14. AWWA - American Water Works Association
  15. CFR - Code of Federal Regulations
  16. CGA - Compressed Gas Association
  17. CISPI - Cast Iron Soil Pipe Institute
  18. EPA - Environmental Protection Agency
  19. ETL - Electrical Testing Laboratories
  20. FM - FM Global
  21. GAMA - Gas Appliance Manufacturers Association
  22. HI - Hydraulic Institute Standards
  23. IAPMO - International Association of Plumbing & Mechanical Officials
  24. IFGC - International Fuel Gas Code
  25. ISO - International Organization for Standardization
  26. MSS - Manufacturers Standardization Society
  27. NEC - National Electric Code
  28. NEMA - National Electrical Manufacturers Association
  29. NFPA - National Fire Protection Association
  30. NFGC - National Fuel Gas Code

31. NRCA - National Roofing Contractors Association
32. NSF - National Sanitation Foundation
33. OSHA - Occupational Safety and Health Administration
34. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
35. TEMA - Tubular Exchanger Manufacturers Association
36. TIMA - Thermal Insulation Manufacturers Association
37. UL - Underwriters Laboratories, Inc.

D. See Division 23, HVAC individual Sections for additional references.

#### 1.04 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 23, HVAC Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
  1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
  2. Provide product submittals and shop drawings in electronic format only. Electronic format must be posted to ftp site and be native/searchable PDF format. Scanned copies are not acceptable. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
  3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.
  4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
    - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
    - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.
    - c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.

- d. For vibration isolation of equipment, list make and model selected with operating load and deflection.
- e. See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.
- 5. Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
- 6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
- 7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
- 8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
- 9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
- 10. Substitutions and Variation from Basis of Design:
  - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
  - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties proposing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Engineer for approval prior to bid.
- 11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements for shop drawings outside of these requirements.
  - a. Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.
- 12. Samples: Provide samples when requested by individual Sections.
- 13. Resubmission Requirements:



- a. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
    - 1) Resubmit for review until review indicates no exception taken or make "corrections as noted."
    - 2) When submitting drawings for Engineer's re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Owner's Instructions:
- a. Submit, at one time, electronic files (native/searchable PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
    - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
    - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
    - 3) Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Sections.
    - 4) Include product certificates of warranties and guarantees.
    - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
    - 6) Include copy of startup and test reports specific to each piece of equipment.
    - 7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.
    - 8) Include commissioning reports.
    - 9) Include copy of valve charts/schedules.
    - 10) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
  - b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration."
  - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:

- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
- b. Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.
- c. At completion of project, input changes to original project CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
- d. See Division 23, HVAC individual Sections for additional items to include in record drawings.

#### 1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturers' written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL and CSA listed.
- G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
- H. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- I. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

## 1.06 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

## 1.07 COORDINATION DOCUMENTS

- A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Prepare Drawings as follows:
  - 1. Drawings in CAD format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size, and elevation above finished floor of equipment and distribution systems.
  - 2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
  - 3. Indicate hydronic and air distribution system piping including fittings, hangers, access panels, valves, and bottom of pipe and duct elevations above finished floor.
  - 4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible items. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork and piping.
  - 5. Incorporate Addenda items and change orders.
  - 6. Distribute drawings to trades and provide additional coordination as requested by other trades.
- C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

### 2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or CSA listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.

- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
  - 1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
  - 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
  - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

### PART 3 - EXECUTION

#### 3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Owner. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.
- D. Firestopping:
  - 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
    - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- E. Pipe Installation:
  - 1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building, as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, seismic flexible joints, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
  - 2. Include provisions for servicing and removal of equipment without dismantling piping.
- F. Plenums:

1. Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Architect/Engineer of any discrepancy.
- G. Provide miscellaneous supports/metals required for installation of equipment, piping, and ductwork.

### 3.02 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Section 23 0548, Vibration and Seismic Controls for HVAC Equipment, and individual Division 23 HVAC Sections.
- B. Equipment Importance Factor: 1.0.
- C. Seismic Design Category: D.
- D. Building Occupancy Category: II.

### 3.03 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
  1. Underground system installation prior to backfilling.
  2. Prior to covering walls.
  3. Prior to ceiling cover/installation.
  4. After major equipment is installed.
  5. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch:
  1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the mechanical systems are ready for final punch.
  2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

### 3.04 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
  1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
  2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping and ductwork, and wiring to point of connection. Where existing systems are being utilized, clean existing distribution systems (ductwork, piping, fans, air handlers) prior to connecting new ductwork or piping.
  3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
    - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4. Organize work to minimize duration of power interruption.

### 3.05 CUTTING AND PATCHING

- A. Confirm Cutting and Patching requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
  1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
  2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.
  3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
  4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
  5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

### 3.06 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.
- B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Owner.

### 3.07 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
  1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.
  2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
  3. Protect bright finished shafts, bearing housings and similar items until in service.

### 3.08 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

### 3.09 CLEANING

- A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

### 3.10 START UP

- A. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
  - 1. Do not place equipment in sustained operation prior to initial balancing of HVAC systems.

### 3.11 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
  - 1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
  - 2. After acceptance by Authority Having Jurisdiction (AHJ), In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
  - 3. See individual equipment Specifications for other painting.
  - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
  - 5. Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
  - 6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

### 3.12 DEMOLITION

- A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
  - 1. Scope:

- a. It is the intent of these documents to provide necessary information and adjustments to the HVAC system required to meet code, and accommodate installation of new work.
- b. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.
- c. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.
- 2. Equipment: Unless otherwise directed, equipment, fixtures, or fittings being removed as part of demolition process are Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.
- 3. Unless specifically indicated on Drawings, remove exposed, unused ductwork and piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap and patch surfaces to match surrounding finish.
- 4. Unless specifically indicated on Drawings, remove unused equipment, fixtures, fittings, rough-ins, and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).

### 3.13 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
  - 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
    - a. Testing and Balancing Reports
    - b. Cleaning
    - c. Operation and Maintenance Manuals
    - d. Training of Operating Personnel
    - e. Record Drawings
    - f. Warranty and Guaranty Certificates
    - g. Start-up/Test Document
    - h. Commissioning Reports

### 3.14 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Tests:
  - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.
  - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.



### 3.15 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that HVAC items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

### 3.16 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

### 3.17 TEMPORARY HEATING, COOLING AND HUMIDITY CONTROL

- A. Provide temporary heating, cooling, controls, humidification and dehumidification as required to facilitate the construction of the project. Size and select temporary system based on the requirements of the various trades during construction. This includes, but is not limited to, drywall, case work, wood flooring and wood finishes that are subject to warping. Size and install system to prevent mold growth. Coordinate the location of the temporary system. The house system can be used. Develop a procedure for how the house system will be used including a sketch depicting the house system, how filtration will be used to prevent construction debris from entering the system and how often the filters will be changed, how the ductwork will be cleaned after use to ensure a clean system is turned over to the Owner and how the units are sized. Submit this procedure to the Mechanical Engineer for review. Follow National Air Duct Cleaners Association (NADCA) duct cleaning procedures and guidelines. Warranties for the house system, if new, to commence when the Owner moves in if house system is used as the means to maintain the climate within the building during construction. Include this warranty requirement in the original bid or proposal amount. Coordinate and provide any temporary power, controls, ductwork, piping, plumbing anchorage, miscellaneous steel and structural supports required to support the temporary system. Installation of the system to comply with all applicable codes and be acceptable to the Authority Having Jurisdiction (AHJ).

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Hangers and Supports for HVAC Piping, Ductwork and Equipment
2. Building Attachments
3. Flashing
4. Miscellaneous Metal and Materials

1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
  2. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
  3. Install ductwork and piping per SMACNA's requirements.
  4. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Welding:
    - a. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  2. Welding for Hangers:
    - a. Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.
  3. Engineering Responsibility:
    - a. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support, equipment hangers/supports, support from floor structure, roof structure or from structure above, and seismic restraint by a qualified Structural Professional Engineer.

- 1) Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.
4. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
5. Support systems to be supplied by a single manufacturer.

#### 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

#### 1.07 PERFORMANCE REQUIREMENTS

- A. Provide pipe, ductwork and equipment hangers and supports in accordance with the following:
  1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.
  2. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems:
  1. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
  2. Equipment, ductwork and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- E. Provide seismic restraint hangers and supports for piping, ductwork and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Hangers and Supports for HVAC Piping, Ductwork and Equipment:
  1. Anvil International
  2. B-Line Systems, Inc.
  3. Erico Company, Inc.
  4. Nelson-Olsen Inc.
  5. Rilco Manufacturing Company, Inc.
  6. Snappitz Thermal Pipe Shield Manufacturing
  7. Unistrut Corporation
- B. Building Attachments:
  1. Anchor-It

2. Gunnebo Fastening Corporation
3. Hilti Corporation
4. ITW Ramset/Red Head
5. Masterset Fastening Systems, Inc.

## 2.02 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

- A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
- B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or approved equivalent; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
- C. Channel Hanging System:
  1. Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 Grade 33, one side of channel to have a continuous slot within turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
  2. Concrete Inserts: Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.

## 2.03 BUILDING ATTACHMENTS

- A. Beam Clamps:
  1. MSS Type 19 and 23, wide throat, with retaining clip.
  2. Universal Side Beam Clamp: MSS Type 20.
- B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Anchor Bolts:
  1. Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
  2. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
  3. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
  4. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

## 2.04 FLASHING

- A. Steel Flashing: 26 gauge galvanized steel.
- B. Safes: 8 mil thick neoprene.
- C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

## 2.05 MISCELLANEOUS METAL AND MATERIALS

- A. General:

1. Provide miscellaneous supports and metal items, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.
  2. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- C. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- D. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- E. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.
- F. Provide hot dipped galvanized components for items exposed to weather. Cold galvanize field-welded joints and components. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).
- G. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.
- H. Grout:
1. ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
  2. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
  3. Properties: Nonstaining, noncorrosive, and non gaseous.
  4. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.
- B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.
- C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.

- D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms, IT rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-foot lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

### 3.02 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

- A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.
- B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.
- C. Design hangers and supports to allow for expansion and contraction.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install flexible ductwork per the more stringent of SMACNA HVAC Duct Construction Standards or the following:
  - 1. Support horizontal duct runs at not more than 4 feet intervals.
  - 2. Support vertical risers at not more than 6 feet intervals.
  - 3. Limit sag between support hangers to 1/2-inch per foot of spacing support.
  - 4. Supports shall be rigid and shall be not less than 1.5-inches wide at point of contact with the duct surface.
  - 5. Duct bends shall be not less than 1.5 duct diameter bend radius.
- F. Use double nuts and lock washers on threaded rod supports.
- G. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps directly to roof deck. Do not support ducts from other ducts, piping or equipment.
- H. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.
- I. Channel Support System Installation:
  - 1. Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
  - 2. Field assemble and install according to manufacturer's written instructions.
- J. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- K. 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.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.
- N. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

### 3.03 BUILDING ATTACHMENTS

- A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.
- B. Select size of building attachments to suit hanger rods.
- C. Space attachments within maximum piping span length indicated in MSS SP-58.
- D. Install building attachments within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
- E. Attachment to Wood Structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.
- H. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.
- I. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
- J. Anchor Bolts:
  - 1. Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.
  - 2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

### 3.04 FLASHING

- A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.
- B. Provide 12-inch minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

### 3.05 MISCELLANEOUS METAL AND MATERIALS

- A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
- B. Finishes:

1. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
  2. Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
  3. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.
- E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.
- F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- G. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
- I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- L. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.



3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
- M. Provide galvanized components for items exposed to weather.

END OF SECTION

## SECTION 23 05 48

## VIBRATION AND SEISMIC CONTROLS FOR HVAC EQUIPMENT

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Work Included:
  - 1. Vibration Isolation
  - 2. Seismic Restraint Devices
  - 3. Factory Finishes
  - 4. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork
- B. General:
  - 1. Vibration isolation for mechanical ductwork, piping and equipment.
  - 2. Seismic restraint for mechanical ductwork, piping and equipment.
  - 3. Seismic Certification for equipment, hangers and systems.
  - 4. Special inspections for systems.
- C. Scope of Work:
  - 1. Vibration isolation and seismic restraint of new equipment and systems within project boundary defined in architectural drawings.
  - 2. Vibration isolation and seismic restraint of new equipment and systems in existing buildings to points of connection with existing systems.
  - 3. Provide supplementary structural steel for seismic restraint systems. No hanging from roof deck is permitted on this project, unless specifically allowed by Structural Engineer of Record in writing prior to bid.

## 1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  - 1. Vibration Isolation:
    - a. Product Data: Provide catalog data indicating size, type, load and deflection of each isolator; and percent of vibration transmitted based on lowest disturbing frequency of equipment.
    - b. Shop Drawings: Showing complete details of construction for steel and concrete bases including:
      - 1) Fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment and cantilever loads.
      - 2) Equipment mounting holes.
      - 3) Dimensions.

- 4) Size and location of concrete and steel bases and curbs.
- 5) Isolation selected for each support point.
- 6) Details of mounting brackets for isolator.
- 7) Weight distribution for each isolator.
- 8) Details of seismic snubbers.
- 9) Code number assigned to each isolator.
- c. Design calculations: Provide calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Seismic Restraint:
  - a. Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop drawings to be stamped by a professional Structural Engineer licensed in State of Oregon.
  - b. Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details and indicate quantity, diameter and depth of penetration of anchors. Calculations certified by professional Structural Engineer licensed in State of Oregon.
4. Seismic Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter and depth of penetration of anchors.
5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y and z planes.
6. Welding certificates.
7. Equipment Certification: Provide seismic certification for equipment as noted in Seismic Design Summary or schedules on Drawings.

#### 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. Vibration Isolation:
    - a. Except for packaged equipment with integral isolators, single manufacturer selects and furnishes isolation required.
    - b. Deflections indicated on drawings are minimum actual static deflections for specific equipment supported.
    - c. Isolator Stability:
      - 1) Size springs of sufficient diameter to maintain stability of equipment being supported. Spring diameters not less than 0.8 of compressed height at rated load.
      - 2) Springs have minimum additional travel to solid equal to 50 percent of rated deflection.
      - 3) Springs support 200 percent of rated load, fully compressed, without deformation or failure.
    - d. Maximum Allowable Vibration Levels: Peak vibration velocities not exceed 0.08 in/sec. Correct equipment operating at vibration velocities that exceed this criteria.
  2. Seismic Restraint:
    - a. Code and Standard Requirements:

- 1) Seismic restraint of equipment, piping and ductwork to be in accordance with latest enacted version of ASCE 7-16.
- b. Confirm Seismic Control requirements in Division 01, General Requirements and Structural documents.
- c. Certification: See Seismic Design Table or schedules on Drawings for equipment, systems and seismic-restraint devices designated to have seismic certification/qualification. Horizontal and vertical load testing and analysis performed according to ASCE 7-16. Anchorage systems to bear anchorage preapproval number from an agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing or calculations, if preapproved ratings are not available. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be sealed by qualified licensed professional engineer in State of Oregon. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to weakest mode.
- d. Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure be designed to resist total design seismic force prescribed in local building code:
  - 1) Floor- or roof-mounted equipment weighing 400 pounds or greater.
  - 2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.
  - 3) In-line duct devices connected to ductwork weighing 75 pounds or greater.
  - 4) Housekeeping slabs: provide reinforcement and anchorage to building structure.
- e. Where required, seismic sway bracing of suspended duct and piping meet following:
  - 1) Pipe and duct runs requiring seismic bracing have minimum of two traverse braces and one longitudinal brace. Longitudinal (or traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.
  - 2) Seismic bracing may not pass through seismic separation joint. Pipe or duct runs that pass through seismic separation joint must be restrained within 5-feet of both sides of separation.
  - 3) Seismic brace assembly spacing not to exceed 40-feet transverse and 80-feet longitudinal.
- f. Seismic restraints may be omitted from suspended piping and duct if following conditions are satisfied:
  - 1) For piping or ducts supported by rod hangers 12-inches or less in length from top of duct to bottom of structural support. Top connections to structure have swivel joints, eye bolts, or vibration isolation hangers for entire length of system run.
  - 2) Lateral motion of system will not cause damaging impact with surrounding systems or cause loss of system vertical support.
  - 3) System must be welded steel pipe, brazed copper pipe, sheet metal duct or similar ductile material with ductile connections.
- C. Seismic restraints, including anchors to building structure, be designed by registered professional Structural Engineer licensed in State of Oregon. Design includes:
  1. Number, size, capacity and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.
  2. Number, size, capacity and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations and test data verifying horizontal and vertical ratings of seismic restraint devices.
  3. Number, size, capacity and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.

4. Maximum seismic loads to be indicated on drawings at each brace location. Drawings bear stamp and signature of registered professional Structural Engineer who designed layout of braces.

#### 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

#### 1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Seismic Snubber Units: Furnish replacement neoprene inserts for snubbers.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Vibration Isolation:
  1. The VMC Group
  2. B-Line Systems, Inc.
  3. Kinetics Noise Control, Inc.
  4. Mason Industries, Inc.
  5. M.W. Saussé - Vibrex
  6. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.
- B. Seismic Restraint Devices:
  1. The VMC Group
  2. B-Line Systems, Inc.
  3. Kinetics Noise Control, Inc.
  4. Mason Industries, Inc.
  5. M.W. Saussé - Vibrex
  6. California Dynamics Corporation
  7. Cooper B-Line Tolco
  8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
  9. Hilti, Inc.
- C. Factory Finishes:
  1. Kynar 500 Fluoropolymer Coating
  2. Or approved equivalent.
- D. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork:
  1. The VMC Group
  2. Kinetics Noise Control, Inc.
  3. Mason Industries, Inc.
  4. Hilti, Inc.
  5. Cooper B-Line, Inc.
  6. California Dynamics Corporation
  7. Unistrut

8. ISAT, Inc.
9. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

## 2.02 VIBRATION ISOLATION

- A. Type 5B - Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
  1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
  3. Minimum Additional Travel: 50 percent of required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
  7. Mason Type: 30N.
- B. Type 5C - Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
  1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
  3. Minimum Additional Travel: 50 percent of required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
  8. Mason Type: RW30.
- C. Type FC-1, Flexible Duct Connectors. See Specification Section 23 33 00, Air Duct Accessories.
- D. Type FC-2C, Flexible Pipe Connector, Gas:
  1. Inner Hose: 304 stainless steel.
  2. Exterior Sleeve: Braided, 304 stainless steel.
  3. Minimum Allowable Pressure Rating: 150 PSI at 70 degrees F up to 4-inch pipe.
  4. Joint: Threaded carbon steel.
  5. Minimum Allowable Offset: 3/4-inch on each side of installed center line.
  6. Basis of Design: Metraflex GASCT.

### 2.03 SEISMIC RESTRAINT DEVICES

- A. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.
- B. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts and replaceable resilient isolation washers and bushings. Snubber load rating to match equipment size. Mason Type: Z-1011 or Z-1225.
  - 1. Anchor bolts for attaching to concrete be seismic-rated, drill-in and stud-wedge or female-wedge type.
  - 2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.
- C. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Mason Type: SCB.
- D. Anchor Bolts: Seismic-rated, drill-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

### 2.04 FACTORY FINISHES

- A. Provide manufacturer's standard prime-coat finish ready for field painting. Units mounted outdoors exposed to weather: Epoxy powder coated, with 1000 hour salt spray rating per ASTM B-117. For high levels of corrosion protection utilize:
  - 1. Conform to AAMA 605.2.
  - 2. Apply coating following cleaning and pretreatment.
  - 3. Cleaning: AA-C12C42R1X.
  - 4. Dry system before final finish application.
  - 5. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees F for 10 minutes.
- B. Finish:
  - 1. Manufacturer's standard paint applied to factory-assembled and factory-tested equipment before shipping.
  - 2. Powder coating on springs and housings.
  - 3. Hardware be electrogalvanized. Hot-dip galvanize metal components for exterior use.
  - 4. Baked enamel for metal components on isolators for interior use.
  - 5. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

### 2.05 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

- A. General Requirements for Restraint Components: Rated strengths, features and applications to be as defined in reports by agency acceptable to authorities having jurisdiction.
- B. Structural Safety Factor: Allowable strength in tension, shear and pullout force of components be at least four times maximum seismic forces to which they will be subjected.
- C. Anchor bolts for attaching to concrete to be seismic-rated, drill-in and stud-wedge or female-wedge type.
- D. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
- E. Maximum 1/4-inch air gap and minimum 1/4-inch thick resilient cushion.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.
- B. Building Penetrations: Isolate water piping and ductwork penetrating wall, ceilings, floors or shafts from structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe or duct at equipment room wall.
- C. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalignment shafts or bearings. Isolated equipment is to be level and in proper alignment with connecting ducts and pipes.
- D. Examination:
  - 1. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances and other conditions affecting performance.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Testing: Perform following field quality-control testing:
  - 1. Isolator seismic-restraint clearance.
  - 2. Isolator deflection.
  - 3. Snubber minimum clearances.
- F. Adjusting:
  - 1. Adjust snubbers according to manufacturer's written recommendations.
  - 2. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.
- G. Cleaning: After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt and debris.

### 3.02 VIBRATION ISOLATION

- A. Reference General Installation Requirements above.
- B. Install per manufacturer's instructions and recommendations.
- C. Vibration isolators must be installed in strict accordance with manufacturer's written instructions and certified submittal data.
- D. Install isolation as indicated on Drawings by type and location and where indicated below.
- E. Equipment Vibration Isolation Schedule:

Equipment	Size	Vibration Isolator Type	Minimum Deflection (in)
Ceiling Fans, Inline Fans	0 to 23.5-inch diameter	Type 5B or 5C, FC-1	0.75

- F. Isolating Hangers:
  - 1. Position isolating hanger elements as high as possible in hanger rod assembly, but not in contact with building structure. Install hangers so that hanger housing may rotate full 360 degrees about rod axis without contacting any object.
  - 2. Install limit stops so they are out of contact during normal operation.



## G. Adjusting:

1. Adjust isolators after piping systems have been filled and equipment is at operating weight.
2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
3. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

## 3.03 SEISMIC RESTRAINT DEVICES

- A. Reference General Installation Requirements above.
- B. Install in strict accordance with manufacturer's written instructions and certified submittal data.
- C. Install and adjust seismic restraints so equipment, piping and ductwork supports are not degraded by restraints.
- D. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- E. Install restraining cables at each trapeze, individual pipe hanger and hanging vibration isolated equipment. Provide restraining cables in each of the four directions of movement. Install restraining cables no less than 45 degrees from vertical. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- F. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

## 3.04 FACTORY FINISHES

- A. Reference General Installation Requirements above.
- B. Install per manufacturer's instructions and recommendations.
- C. Finishes to be factory-applied. No field patching or holidays allowed.

## 3.05 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

- A. Reference General Installation Requirements above.
- B. Install per manufacturer's instructions and recommendations.
- C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

## SECTION 23 05 53

## IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Work Included:

1. Plastic Nameplates

## 1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  1. Schedules:
    - a. Submit valve schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.
  2. Submit schedule of identification type, including material, for each class of tagged item.
  3. Submit locations at which Valve Schedules will be installed.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
  2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## PART 2 - PRODUCTS

## 2.01 PLASTIC NAMEPLATES

## A. Manufacturers:

1. Brady Corporation
2. Brimar

3. Champion America
  4. Craftmark
  5. Seton
- B. Description: Engraving stock melamine plastic laminate in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Provide 1/8-inch thick material.
1. Letter Color: White.
  2. Letter Height: 1/2-inch.
  3. Background Color: Black.
  4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
  5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

### PART 3 - EXECUTION

#### 3.01 GENERAL INSTALLATION

- A. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.
- B. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
- C. Degrease and clean surfaces to receive adhesive for identification materials.
- D. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- E. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.
- F. Install all products in accordance with manufacturer's instructions.
- G. Manual Balancing Dampers: Provide 12-inch long orange marker ribbon to end of balancing damper handle.

#### 3.02 PLASTIC NAMEPLATES

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners.
- B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.
- C. Identify thermostats with nameplates.

END OF SECTION

## SECTION 23 05 93

## TESTING, ADJUSTING, AND BALANCING FOR HVAC

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Work Included:

1. General Requirements and Procedures
2. Pre-Construction Balance (Existing Systems)
3. Fundamental Air Systems Balancing Procedures
4. Constant Volume Air Systems Balancing Procedures
5. Pre-Balance Reporting
6. Final Reports:
  - a. Report Requirements
  - b. General Report Data
  - c. System Diagrams
  - d. Air Handling Units
  - e. Fans
  - f. Duct Traverses
  - g. Diffusers/Registers/Grilles
  - h. Instrument Calibration
7. Additional Tests

## 1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Quality-Assurance Submittals: Submit two copies of evidence that the Testing, Adjusting, and Balancing (TAB) Agent and Project's TAB team members meet the qualifications specified in the "Quality Assurance" Article below.
  2. Pre-Construction Phase Report:
    - a. Provide a pre-construction phase TAB Plan at least two weeks prior to the commencement of TAB work. This report is to include:
      - 1) A complete set of report forms intended for use on the Project, with data filled in except for the field readings. Forms to be Project-specific.
      - 2) Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
      - 3) Identification of the type, manufacturer, and model of the actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications to be included.

- 4) A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems to which they apply.
3. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit two copies of the Contract Documents review report as specified in Part 3 of this Section.
4. Strategies and Procedures Plan: Submit two copies of the TAB strategies and step-by-step procedures as specified in Part 3 of this Section. Include a complete set of report forms intended for use on this Project.
5. Specify reports required because of editing procedures in Part 3 of this Section.
6. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by the TAB Agent.
7. Sample Report Forms: Submit two sets of sample TAB report forms.
8. Test Instrument Calibration: Submit proof of calibration within the last 6 months.
9. Final Report.
10. Provide additional submittals to commissioning authority as dictated in Commissioning Specifications.

#### 1.05 QUALITY ASSURANCE

- A. Quality Assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. Acceptable TAB Agencies:
    - a. Oregon:
      - 1) Air Introduction and Regulations Inc.
      - 2) Accurate Air Balance, Inc.
      - 3) Neudorfer Engineers
      - 4) Northwest Engineering Services
      - 5) Air Balancing Specialty Inc.
      - 6) Precision Test & Balance, Inc.
      - 7) Testcomm
      - 8) American Commissioning and LEED Consultants, Inc.
  2. Balance Firm Qualifications:
    - a. General:
      - 1) Procure services of independent TAB agency to balance, adjust and test water circulating and air moving equipment and air distribution or exhaust systems. Minimum experience: 5 years.
      - 2) Provide proof of testing agency having successfully completed at least five projects of similar size and scope.
    - b. Testing and Balancing firm is certified by NEBB or AABC and has a NEBB Certified Professional (CP) or a AABC Test and Balancer Engineer (TBE) on staff.
    - c. Industry Standards: Testing and Balancing will conform to NEBB or AABC, and American National Standards Institute (ANSI) as follows:
      - 1) NEBB: Comply with Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
      - 2) AABC: Comply with National Standards for Total System Balance.
      - 3) ANSI:
        - (a) S1.4 Specifications for sound level meters.
        - (b) S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.
        - (c) ANSI S1.13 Methods for the Measurement of Sound Pressure Levels.

- d. Test Observation: If requested, conduct tests in the presence of the Commissioning Authority, AHJ, Architect or the Architect's representative.
- 3. Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).
- 4. Owner Witness: Perform tests in the presence of the Commissioning Authority, Architect, Architect's Representative, or Owner's representative.
- 5. Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.
- 6. Simultaneous Testing: Test observations by the AHJ, the Owner's Authorized Representative and the engineer's representative need not occur simultaneously.
- 7. Do not perform TAB work until heating, ventilating, and air conditioning equipment has been completely installed and is operating continuously as required.
- 8. Conduct air testing and balancing with clean filters in place. Clean strainers prior to performing hydronic testing and balancing.
- 9. TAB Conference: Meet with the Commissioning Authority, Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.
  - a. Agenda Items: Include at least the following:
    - 1) Submittal distribution requirements.
    - 2) Contract Documents examination report.
    - 3) TAB plan.
    - 4) Work schedule and Project site access requirements.
    - 5) Coordination and cooperation of trades and subcontractors.
    - 6) Coordination of documentation and communication flow.
- 10. Certification of TAB Reports: This certification includes the following:
  - a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- 11. TAB Reports: Use standard forms from NEBB or AABC.
- 12. Instrumentation Type, Quantity, and Accuracy: As described in NEBB or AABC.
- 13. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

#### 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  - 1. TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10 percent of total number of terminals, or resetting of outlet, coil, or device listed in the final TAB report.
  - 2. Guarantee: Meet the requirements of the following programs:
    - a. Provide a guarantee on NEBB or AABC forms stating that the agency will assist in completing the requirements of the Contract Documents if the TAB Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
      - 1) The certified Agent has tested, adjusted, and balanced systems according to the Contract Documents.

- 2) Systems are balanced to optimum performance capabilities within design and installation limits.

#### 1.07 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. TAB: Testing, Adjusting, and Balancing.
- G. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- H. Test: A procedure to determine quantitative performance of a system or equipment.
- I. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.
- J. AABC: Associated Air Balance Council.
- K. NEBB: National Environmental Balancing Bureau.
- L. AMCA: Air Movement and Control Association.
- M. CTI: Cooling Tower Institute.
- N. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

#### 1.08 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.
- C. Witness leakage and pressure tests carried out by Section 23 31 00, HVAC Ducts and Casings.
- D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

### PART 2 - PRODUCTS - NOT USED

### PART 3 - EXECUTION

#### 3.01 GENERAL REQUIREMENTS AND PROCEDURES

- A. Project Conditions:
  - 1. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.
- B. General Requirements:
  - 1. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and controls, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

2. Perform TAB work with doors, closed windows, and ceilings installed etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for TAB are clean and free from debris, dirt and discarded building materials.
3. Where Owner occupies building during the testing period, cooperate with Owner to minimize conflicts with Owner's operations.

C. Examination:

1. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
  - a. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
  - b. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
2. Examine approved submittal data of HVAC systems and equipment.
3. Examine Project record documents described in Division 01, General Requirements.
4. Examine Architect's and Engineer's design data, including Basis of Design, HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
5. Examine equipment performance data, including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
6. Coordinate requirements in system and equipment with this Section.
7. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
8. Examine system and equipment test reports.
9. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
10. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
11. Examine equipment for installation and for properly operating safety interlocks and controls.
12. Report deficiencies discovered before and during performance of TAB procedures.

D. Preparation:

1. Prepare a TAB plan that includes strategies and step-by-step procedures.



2. Complete system readiness checks and prepare system readiness reports. Verify the following:
    - a. Permanent electrical power wiring is complete.
    - b. Hydronic systems are filled, clean, and free of air.
    - c. Automatic temperature-control systems are operational.
    - d. Equipment and duct access doors are securely closed.
    - e. Balance, smoke, and fire dampers are open.
    - f. Isolating and balancing valves are open and control valves are operational.
    - g. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
    - h. Windows, doors and other portions of the building envelope can be closed so design conditions for system operations can be met.
  3. Hold a pre-balancing meeting at least one week prior to starting TAB work.
    - a. Attendance is required by installers whose work will be tested, adjusted, or balanced.
  4. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.
- E. General TAB Procedures:
1. Perform TAB procedures on each system according to the procedures contained in NEBB or AABC and this Section.
  2. Coordinate location of test probes prior to start of TAB procedures and make test probes available for Owner's tests after start of occupancy. Where required, cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
  3. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- F. Adjustment Tolerances:
1. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
  2. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
  3. Adjust supply, return, and exhaust air quantities to maintain pressurization in spaces indicated on Drawings. Note and document room-to-room pressurization and maintain these relationships. Adjust pressure controlled spaces to within plus or minus 0.01 in WC.
- G. Recording and Adjusting:
1. Field Logs: Maintain written logs including:
    - a. Running log of events and issues.
    - b. Discrepancies, deficient or uncompleted work by others.
    - c. Contract interpretation requests.
    - d. Lists of completed tests.
  2. Ensure recorded data represents actual measured or observed conditions.
  3. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

4. Mark on drawings locations where traverse and other critical measurements were taken and cross reference location in final report.
5. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
6. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
7. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner's Authorized Representative, or Commissioning Agent.

### 3.02 PRE-CONSTRUCTION BALANCE (EXISTING SYSTEMS)

#### A. Pre-Construction Balance - Air Systems

1. Prior to start of construction or demolition; read and record supply and return duct main airflows for two existing rooftop AC units to establish "as-found" conditions.
2. Read and record static pressure conditions across existing filters, coils and fans of two existing rooftop AC units.
3. Read and record amp draw and motor data from two existing rooftop AC units.

#### B. Report data and observations to Architect.

### 3.03 FUNDAMENTAL AIR SYSTEMS BALANCING PROCEDURES

- A. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- B. Prepare test reports for both fans and inlets and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with required fan volumes.
- C. Prepare schematic diagrams of systems' "as-built" duct layouts.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check the airflow patterns from the outside-air louvers and dampers and the return-air and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with thermal protection, sized for the connected load.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check that condensate drains are installed, trapped and primed and routed to drain.
- K. Check for readily observable leaks in air-handling unit components and ductwork.
- L. Use sheaves and pulleys to adjust the speed of belt drive fans to achieve design flow with motors running at 60 Hertz unless noted otherwise.

### 3.04 CONSTANT VOLUME AIR SYSTEMS BALANCING PROCEDURES

- A. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer. Adjust fans to deliver design airflow at the lowest possible speed.
  1. Measure fan static pressures to determine actual static pressure as follows:
    - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

- d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
2. Measure static pressure across each air-handling unit component under final balanced condition.
3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Recommend corrective action to align design and actual conditions.
4. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
5. Do not make fan-speed adjustments that result in motor loading greater than full load amps. Do not increase fan speed beyond fan class rating. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
6. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
7. Calibrate airflow measuring stations.

### 3.05 PRE-BALANCE REPORTING

#### A. Pre-Construction Phase Report:

1. Provide a pre-construction phase TAB Plan at least 2 weeks prior to the commencement of TAB work. This report is to include:
  - a. A complete set of report forms intended for use on the Project, with all data filled in except for the field readings. Forms to be Project-specific.
  - b. Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
  - c. Identification of the type, manufacturer, and model of actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.
  - d. A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.

#### B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

#### C. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced.

### 3.06 FINAL REPORTS

#### A. Report Requirements:

1. General:
  - a. Computer generated in PDF format and tabulated, divided, and bookmarked into sections by tested and balanced systems.
  - b. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.
    - 1) Include a list of the instruments used for procedures, along with proof of calibration.
  - c. Final Report Contents: In addition to the certified field report data, include the following:
    - 1) Fan Curves

- 2) Manufacturers Test Data
- 3) Field test reports prepared by system and equipment installers
- 4) Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data

B. General Report Data:

1. In addition to the form titles and entries, include the following data in the final report, as applicable:
  - a. Title Page
  - b. Name and Address of TAB Agent
  - c. Project Name
  - d. Project Location
  - e. Architect's Name and Address
  - f. Engineer's Name and Address
  - g. Contractor's Name and Address
  - h. Report Date
  - i. Signature of TAB Agent who Certifies the Report
  - j. Summary of Contents, Including the Following:
    - 1) Design versus Final Performance
    - 2) Notable Characteristics of Systems
    - 3) Description of System Operation Sequence if it varies from the Contract Documents
  - k. Nomenclature Sheets for Each Item of Equipment
  - l. Data for Terminal Units, including Manufacturer, Type Size, and Fittings
  - m. Notes to explain why certain final data in the body of reports vary from design values.
  - n. Test Conditions for Fans and Pump Performance Forms, Including the Following:
    - 1) Settings for Outside-, Return-, and Exhaust-Air Dampers
    - 2) Conditions of Filters
    - 3) Cooling Coil, Wet- and Dry-bulb Conditions
    - 4) Fan Drive Settings, including Settings and Percentage of Maximum Pitch Diameter
    - 5) Other System Operating Conditions that affect Performance

C. System Diagrams:

1. Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
  - a. Quantities of Outside, Supply, Return, and Exhaust Airflows
  - b. Duct, Outlet, and Inlet Sizes
  - c. Balancing Stations

D. Air Handling Units:

1. For air-handling units, split systems, fan coils, pumps, and evaporator units with coils, include the following:
  - a. Unit Data: Include the following:
    - 1) Unit Identification
    - 2) Location
    - 3) Make and Type
    - 4) Model Number and Unit Size
    - 5) Manufacturer's Serial Number
    - 6) Discharge Arrangement
    - 7) Number of Filters, Type, and Size

- b. Motor Data: Include the following:
  - 1) Make and Frame Type and Size
  - 2) Horsepower and rpm
  - 3) Volts, Phase, and Hertz
  - 4) Full-load Amperage and Service Factor
- c. Test Data: Include design and actual values for the following:
  - 1) Total Airflow Rate in cfm (L/s)
  - 2) Total System Static Pressure in Inches wg (Pa)
  - 3) Fan rpm
  - 4) Discharge Static Pressure in Inches wg (Pa)
  - 5) Outside Airflow in cfm (L/s)
  - 6) Return Airflow in cfm (L/s)
  - 7) Outside-air Damper Position
  - 8) Return-air Damper Position

E. Fans:

- 1. Fan Test Reports: For supply, return, and exhaust fans, include the following:
  - a. Fan Data: Include the following:
    - 1) System Identification
    - 2) Location
    - 3) Make and Type
    - 4) Model Number and Size
    - 5) Manufacturer's Serial Number
  - b. Motor Data: Include the following:
    - 1) Make and Frame Type and Size
    - 2) Horsepower and rpm
    - 3) Volts, Phase, and Hertz
    - 4) Full-load Amperage and Service Factor
  - c. Test Data: Include design and actual values for the following:
    - 1) Total Airflow Rate in cfm
    - 2) Total System Static Pressure in Inches wg
    - 3) Fan rpm
    - 4) Discharge Static Pressure in Inches wg
    - 5) Suction Static Pressure in Inches wg

F. Duct Traverses:

- 1. Include a diagram with a grid representing the duct cross-section and record the following:
  - a. Report Data: Include the following:
    - 1) System and Air-handling Unit Number
    - 2) Location and Zone
    - 3) Duct Static Pressure in Inches wg
    - 4) Duct Size in Inches
    - 5) Duct Area in SF
    - 6) Design Airflow Rate in cfm
    - 7) Design Velocity in fpm
    - 8) Actual Airflow Rate in cfm
    - 9) Actual Average Velocity in fpm

G. Diffusers/Registers/Grilles:

- 1. For diffusers, registers and grilles, include the following:
  - a. Unit Data: Include the following:
    - 1) System and Air-handling Unit Identification
    - 2) Location and Zone
    - 3) Test Apparatus Used

- 4) Area Served
  - 5) Air-terminal-device Make
  - 6) Air-terminal-device Number from System Diagram
  - 7) Air-terminal-device Type and Model Number
  - 8) Air-terminal-device Size
  - 9) Air-terminal-device Effective Area in SF
  - b. Test Data: Include design and actual values for the following:
    - 1) Airflow Rate in cfm
    - 2) Air Velocity in fpm
    - 3) Final Airflow Rate in cfm
    - 4) Final Velocity in fpm
    - 5) Space Temperature in Degrees F
  - H. Instrument Calibration:
    1. For instrument calibration, include the following:
      - a. Report Data: Include the following:
        - 1) Instrument Type and Make
        - 2) Serial Number
        - 3) Application
        - 4) Dates of Use
      - b. Dates of Calibration
- 3.07 ADDITIONAL TESTS
- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
  - B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

## SECTION 23 07 00

## HVAC INSULATION

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Work Included:
  - 1. Type A, Flexible Glass Wool Blanket
  - 2. Type B, Duct Liner
  - 3. Accessories
  - 4. Duct Insulation Accessories
  - 5. Duct Insulation Compounds

## 1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  - 1. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  - 1. Installer qualifications.
  - 2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
    - a. Where indicated R-values/ratings cannot be achieved by a single layer of insulation, describe how performance requirements will be achieved.
  - 3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
  - 4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
  - 5. Submit manufacturer's installation instructions.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  - 1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
  - 2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.

3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
4. Installer to have minimum 5 years' experience in the business of installing insulation.

#### 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

#### 1.07 FIRE HAZARD CLASSIFICATION

- A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.
- B. Test duct insulation in accordance with current edition of ASTM E84, UL 723, NFPA 255, NFPA 90A and NFPA 90B.

### PART 2 - PRODUCTS

#### 2.01 TYPE A, FLEXIBLE GLASS WOOL BLANKET

- A. Acceptable Manufacturers:
  1. Certainteed
  2. Johns Manville
  3. Knauf
  4. Owens-Corning
- B. ASTM C553, Type 1, Class B-2; flexible blanket.
- C. 'K' Value: 0.27 BTU\*in/(hr\*sf°F) at 75 degrees F installed, maximum service temperature: 250 degrees F.
- D. Density: 0.75 pounds per cubic foot.
- E. DBDE-free. UL/E validated to be formaldehyde-free.
- F. Vapor Barrier Jacket: FSK aluminum foil reinforced with glass wool yarn and laminated to fire resistant Kraft, secured with UL listed pressure sensitive tape or outward clinched expanded staples and vapor barrier mastic as needed.

#### 2.02 TYPE B, DUCT LINER

- A. Acceptable Manufacturers:
  1. Certainteed
  2. Johns Manville
  3. Knauf
  4. Owens-Corning
- B. ASTM C1071; flexible blanket.
- C. 'K' Value: ASTM C518, 0.25 BTU\*in/(hr\*sf°F) at 75 degrees F, maximum service temperature: 250 degrees F.
- D. Noise Reduction Coefficient: 0.65 or higher based on ASTM C 423 "Type A mounting."
- E. Maximum Velocity on Mat or Coated Air Side: 5,000 FPM.
- F. Adhesive: UL listed waterproof type.
- G. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
- H. Erosion-Resistant Surfaces: UL 181.
- I. ASTM G21 and ASTM G22 Microbial Growth Resistance.



- J. UL GREENGUARD Certified does not support the growth of mold, fungi, or bacteria per ASTM C 1338 and meets UL Environment GREENGUARD Microbial Resistance Listing per UL 2824 - "GREENGUARD Certification Program Method for Measuring Microbial Resistance." DBDE-free. UL/E validated to be formaldehyde-free.

### 2.03 ACCESSORIES

- A. Acceptable Manufacturers:
  - 1. ITW Insulation Systems
  - 2. Or approved equivalent.
- B. Equipment Insulation Jacketing: Presized glass cloth, not less than 7.8 ounces/sq.yd., except as otherwise indicated. Coat with gypsum based cement.
- C. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- D. General: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have the same flame and smoke component ratings as the insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water-soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

### 2.04 DUCT INSULATION ACCESSORIES

- A. Acceptable Manufacturers:
  - 1. Certainteed
  - 2. Johns Manville
  - 3. Owens-Corning
- B. Staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

### 2.05 DUCT INSULATION COMPOUNDS

- A. Acceptable Manufacturers:
  - 1. Certainteed
  - 2. Johns Manville
  - 3. Owens-Corning
- B. Cements, adhesives, coatings, sealers, protective finishes and similar accessories as recommended by insulation manufacturer for applications indicated. Comply with South Coast Air Quality Management District (SCAQMD) Rule #1168 in accordance with LLE EQ 4.1.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Verification of Conditions:
  - 1. Do not apply insulation until pressure testing and inspection of ducts and piping has been completed.
  - 2. Examine areas and conditions under which duct and pipe insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Preparation: Clean and dry surfaces to be insulated.
- C. Installation:
  - 1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
- D. Provide accessories as required. See Part 2 Article "Accessories" above.

E. Protection and Replacement: Installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

F. Ductwork:

1. Install insulation in conformance with manufacturer's recommendations to completely cover duct.
2. Butt insulation joints firmly together and install jackets and tapes smoothly and securely.
3. Apply duct insulation continuously through sleeves and prepared openings, except as otherwise specified. Apply vapor barrier materials to form complete unbroken vapor seal over insulation.
4. Coat staples and seals with vapor barrier coating.
5. Cover breaks in jacket materials with patches of same material as vapor barrier. Extend patches not less than 3-inches beyond break or penetration on all directions and secure with adhesive and staples. Seal staples and joints with vapor barrier coating.
6. Fill jacket penetrations, i.e., hangers, thermometers and damper operating rods, and other voids in insulation, with vapor barrier coating. Seal penetration with vapor barrier coating. Insulate hangers and supports for cold duct in un-conditioned spaces to extent to prevent condensation on surfaces.
7. Seal and flash insulation terminations and pin punctures with reinforced vapor barrier coating.
8. Continue insulation at fire dampers and fire/smoke dampers up to and including those portions of damper frame visible at outside of the rated fire barrier. Insulating terminations at fire dampers in accordance with this Section.
9. Do not conceal duct access doors with insulation. Install insulation terminations at access door in accordance with this Section.

G. Ductwork Surfaces to be Insulated: Climate Zone 4

Item to be Insulated	System Insulation Type	Duct Size	Minimum Installed R-Value
Supply ductwork inside building thermal envelope, where duct is not specified to be lined.	A	All	R-4
Return ductwork inside building thermal envelope, where duct is not specified to be lined.	--	All	None
Exhaust ducts within building thermal envelope between exterior and automatic shutoff damper.	A	All	R-16

1. Note: Insulation R-value shown is a minimum. If state codes require higher R-value, then provide insulation per code requirements.

### 3.02 TYPE A, FLEXIBLE GLASS WOOL BLANKET

- A. Install insulation in conformance with manufacturer's recommendations and requirements.
- B. Duct Wrap: Cover air ducts per insulation table except ducts internally lined where internal duct lining is adequate to achieve adequate insulating values to meet local Energy Codes (indicate on shop drawings, locations where duct wrap is planned to be omitted and indicate internal duct lining insulating values to confirm they will meet the Energy Code). Wrap tightly with circumferential joints butted and longitudinal joints overlapped minimum of 2-inches. On ducts over 24-inches wide, additionally secure insulation with suitable mechanical fasteners at 18-inches on center. Circumferential and longitudinal joints stapled with flare staples 6-inches on center and covered with 3-inch wide, foil reinforced tape.

### 3.03 TYPE B, DUCT LINER

- A. Install insulation in conformance with manufacturer's recommendations and requirements.
- B. Duct Liners: Mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with continuous (minimum 90) percent coat of adhesive. Secure liner with mechanical fasteners 15-inches on center or per manufacturer requirements. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation overlap sides. Factory/field coat exposed edges. Metal nosing for exposed leading or transverse edges and when velocity exceeds 3500 FPM or manufacturer rating on exposed edges. Keep duct liner clean and free from dust. At completion of Project, vacuum duct liner if it is dirty or dusty. Do not use small pieces. If insulation is installed without horizontal, longitudinal, and end joints butted together, installation will be rejected and work removed and replaced with work that conforms to this Specification.

### 3.04 ACCESSORIES

- A. Install insulation in conformance with manufacturer's instructions, recommendations and requirements.
- B. See General Installation Requirements above.
- C. Furnish and install accessories for all insulation types listed in this Section.

### 3.05 DUCT INSULATION ACCESSORIES

- A. Install insulation in conformance with manufacturer's recommendations and requirements.

### 3.06 DUCT INSULATION COMPOUNDS

- A. Install insulation in conformance with manufacturer's recommendations and requirements.

END OF SECTION

## SECTION 23 09 33

## ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Work Included:
  - 1. Room Thermostats
  - 2. Time Switches
  - 3. Relays and Contactors
  - 4. Transformers
  - 5. Wiring

## 1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
  - 1. Power wiring per Division 26, Electrical.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  - 1. Drawings: complete control diagram, including written description of control sequences.
  - 2. Operation and Maintenance Manual: Include record wiring drawings showing installed condition and operating changes made during start-up.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as outlined in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  - 1. Within 30 days prior to warranty expiration date, control supplier to visit job site and check calibration, operation, and adjustment of temperature, pressure and humidity sensors, valves, dampers, thermostats and other devices installed by control supplier. Make repair or replacement of defective control equipment as required at no charge to Owner.
  - 2. Submit letter to Architect certifying that this work has been completed.
  - 3. Attach copy of service report signed by Owner's Authorized Representative.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

- A. Room Thermostats:

1. Honeywell
2. Siemens
3. Johnson Controls
4. Reliable Controls
5. Alerton

B. Time Switches:

1. Paragon
2. Tork
3. Intermatic
4. Or approved equivalent.

## 2.02 ROOM THERMOSTATS

A. Electronic Thermostat (Existing Rooftop AC Units):

1. Seven day programmable, PI control.
2. Occupied/unoccupied heat and cool setpoints.
3. Automatic heat/cool changeover and fan control.
4. Touch screen display.
5. Cooling Stages: Provide as required to match in air conditioner.
6. Basis of Design: Honeywell RTH 7600D.

B. Line Voltage, Cooling Thermostat (EF-6): Wall mounted thermostat, non-programmable, dial adjustment between 44 degrees F and 86 degrees F, gold color. Basis of Design: Honeywell T65.

## 2.03 TIME SWITCHES

- A. Programmable electronic 1 channel seven-day, 24-hour-a-day, skip-a-day feature. Battery backup. 120V, 1-phase. Clock subject to being overridden by night low limit stat. Minimum 2-line, 14-character per line display.

## 2.04 RELAYS AND CONTACTORS

- A. Provide relays and contactors where required or as shown on Drawing to meet operating sequence where not internal to manufacturer's equipment.
- B. Furnish relays or contactors with required coil voltage and contact amperage rating for use specified on Drawing and in manufacturer's equipment.
- C. Mount relays in single control cabinet with hinge door and latch.
- D. Control cabinet contains relays and numbered terminal strips for connection of relays and field wiring. Mount cabinet on painted plywood panel securely attached to wall framing. Mount time clock, transformer and motor contactors (if required) on plywood adjacent to control panel.

## 2.05 TRANSFORMERS

- A. Transformers selected and sized for appropriate VAC capacity and installed and fused according to applicable codes. Provide wiring to nearest suitable power source as required.

## 2.06 WIRING

- A. In accordance with Division 26, Electrical and applicable codes.
- B. Provide line and low voltage wiring relating to control system. Includes wiring of contactors, relays, circuits, and incidental power wiring: operation power for time clock, power when run through stat/timelock/relay, transformers.

## PART 3 - EXECUTION

### 3.01 SEQUENCE OF OPERATION

- A. Two (2) Existing AC Units: Room programmable thermostats to modulate economizer cycle, cooling and heating in sequence to maintain setpoint. Provide motorized low leakage outside air dampers. Dampers to be closed on fan shutdown and during NLL operation. Program thermostats to time schedule coordinated with Owner.
- B. Night Low Limit: Provide night low limit thermostat to bypass system clock to maintain night setting of 60 degrees F.
- C. Exhaust Fans:
  - 1. IT Exhaust Fan (EF-6): Controlled from line voltage thermostat.
  - 2. Janitor and Laundry Exhaust Fans (EF-3 & 4): Controlled from ventilation time clock .
  - 3. Restroom Exhaust Fans (EF-1, 2 & 5): Controlled from light switch.

### 3.02 INSTALLATION OF AUXILIARY CONTROL DEVICES

- A. General:
  - 1. Install sensors and thermostats in accordance with manufacturer's recommendations.
  - 2. Room sensors and thermostats installed at 48-inches AFF to midline of sensor on concealed junction boxes properly supported by wall framing at the locations shown on the Drawings.

END OF SECTION

SECTION 23 31 00  
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
  - 1. Ductwork, Joints, and Fittings
  - 2. Laundry Clothes Dryer Vent
  - 3. Insulated Flexible Duct
  - 4. Ductwork Joint Sealers and Sealants

1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
  - 1. Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.
  - 2. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  - 1. Welding Certificates.
  - 2. Field Quality Control Reports.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  - 1. NFPA Compliance:
    - a. NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
    - b. NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
  - 2. Comply with NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, Ch. 3, Duct System for range hood ducts, unless otherwise indicated.
  - 3. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Provide sheet metal materials free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## 1.07 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Duct design is generally diagrammatic and is not meant to be scaled. Major changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

## PART 2 - PRODUCTS

### 2.01 DUCTWORK, JOINTS, AND FITTINGS

- A. Materials:
  - 1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, lock-forming quality, ASTM A 653/A 653M FS Type B, with G90/Z275 coating, minimum 26 gauge except where heavier material is specified. Ducts to have mill phosphatized finish for surfaces exposed to view.
  - 2. Aluminum Ducts: ASTM B 209 (ASTM B 209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Minimum 24 gauge except where heavier material is specified; alloy 6061-T651 or of equivalent strength with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts with liquid-tight joints when containing condensate vapor or liquids in suspension.
- B. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
  - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
  - 2. Deflection: Duct systems not-to-exceed deflection limits according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
  - 3. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- C. Formed-On Flanges: construct according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 1-4, using corner, bolt, cleat, and gasket details.
  - 1. Duct Size: Maximum 30-inches wide and up to 2-inch wg pressure class.
  - 2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
  - 3. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19-inches and larger and 0.0359-inch thick or less, with more than 10 SF of nonbraced panel area unless ducts are lined.
- D. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of material specified in this Section according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
  - 1. Ducts up to 20-inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
  - 2. Ducts 21- to 72-inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
  - 3. Ducts Larger than 72-inches in Diameter: Companion angle flanged joints per SMACNA HVAC Duct Construction Standards-Metal and Flexible, Figure 3-2.
  - 4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.



- E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's HVAC Duct Construction Standards-Metal and Flexible, with metal thicknesses specified for longitudinal-seam straight ducts.
- F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows to be 1.5 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
  - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's HVAC Duct Construction Standards-Metal and flexible, unless otherwise indicated.
  - 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
    - a. Ducts 3- to 36-inches in Diameter: 0.034-inch.
    - b. Ducts 37- to 50-inches in Diameter: 0.040-inch.
    - c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
    - d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
  - 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
    - a. Ducts 3- to 26-inches in Diameter: 0.034-inch.
    - b. Ducts 27- to 50-inches in Diameter: 0.040-inch.
    - c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
    - d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
  - 4. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
  - 5. Round Elbows:
    - a. 8-inches and Less in Diameter: Fabricate die-formed elbows for 45 and 90-degree elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate nonstandard bend-angle configurations or non-standard diameter elbows with gored construction.
    - b. 9 through 14-inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60 and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
    - c. Larger than 14-inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
  - 6. Die-Formed Elbows for Sizes through 8-inches in Diameter and Pressures 0.040-inch thick with two-piece welded construction.
  - 7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
  - 8. Pleated Elbows for Sizes through 14-inches in Diameter and Pressures through 10-inch wg (2500 Pa): 0.022-inch.
  - 9. Not acceptable:
    - a. Corrugated or flexible metal duct.
    - b. Adjustable elbows.

## 2.02 LAUNDRY CLOTHES DRYER VENT

- A. Aluminum sheet metal, minimum 24 gauge. Substantially airtight duct except for openings required for operation and maintenance. Duct to have smooth interior surface. Do not assemble with sheet metal screens or other devices that extend into the airstream.

## 2.03 INSULATED FLEXIBLE DUCT

- A. Manufacturers:
  - 1. ATCO
  - 2. Flexmaster
  - 3. J.P. Lamborn Co.
  - 4. Hart and Cooley
- B. Construction: Standard factory fabricated product. Inner wall: Impervious vinyl or chlorinated polyethylene, permanently bonded to a vinyl or zinc-coated spring steel helix.
- C. Insulation: Fiberglass blanket insulation covered by an outer wall of vinyl or fiberglass-reinforced metalized vapor barrier.
- D. Listing: UL 181 listed Class 1 flexible air duct material. Overall thermal transmission: No more than 0.25 BTU/in or hr/sq. degrees F at 75 degrees F differential, per ASTM C335.
- E. Vapor transmission value no more than 0.10 perm, per ASTM E96.
- F. Pressure Rating: 4-inch wg positive pressure and 1-inch wg negative pressure.
- G. Performance Air Friction Correction Factor: 1.3 maximum at 95 percent extension. Working air velocity: Minimum 2000 FPM.
- H. Flame Spread Rating: No more than 25.
- I. Smoke Development Rating: No more than 50 as tested per ASTM E84.
- J. Insertion Loss: Minimum attenuation of 29 DB for 10-foot straight length at 8-inch diameter at 500 Hz.

## 2.04 DUCTWORK JOINT SEALERS AND SEALANTS

- A. Manufacturers:
  - 1. Ductmate
  - 2. Duro Dyne
  - 3. Hardcast
  - 4. United McGill Corporation
  - 5. Vulkem
  - 6. Foster
  - 7. Childer
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
- C. Low Emitting Materials Requirement: Adhesives, sealants and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.
- D. Type: Heavy mastic or liquid, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure and leakage class of ducts.
- E. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
- F. Water Based Sealant for Brush-On Application: Flexible, adhesive sealant, resistant to UV light, UL-181A, and UL-181-B listed, complying with NFPA requirements for Class 1 ducts. Min. 69 percent solids, nonflammable. Hardcast Versa-Grip 181; Childers CP-146; Foster 32-19 for SMACNA 1/2, 1, 2, 3, 4, 6, and 10-inch WG duct classes, and SMACNA Seal Class A, B, or C.
- G. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.
- H. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
- I. Polyurethane Sealant: General-purpose, exterior use, non-brittle sealant for gunned application. Vulkem 616 or equal.

## PART 3 - EXECUTION

## 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. General: Use the following pressure seal, and leakage class(es) in design of ductwork specified in this section unless otherwise noted on Drawings.

SYSTEM	PRESSURE CLASS (Inches of Water)	SEAL CLASS	LEAKAGE CLASS ROUND DUCTS	LEAKAGE CLASS RECTANGULAR DUCTS
Low Pressure	+ 1-inch	A	2	4
Return and Exhaust	0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.	A	2	4

- B. Ductwork Installation:

- General: Install entire duct system in accordance with drawings, Specifications, and latest issues of local Mechanical Code, NFPA 90A, and SMACNA Duct Construction Manual. At Contractor's option, rectangular ductwork may be resized to maintain an equivalent air velocity and friction rate, while maintaining a maximum aspect ratio of 3. Remove markings and tagging from ductwork exterior surface in mechanical rooms and other locations where ductwork is exposed.
- The duct layout shown on the Contract Drawings is diagrammatic in nature. Coordinate the ductwork routing and layout, and make alterations to the ductwork routing and layout to eliminate physical interferences. Where deviations in the ductwork routing as shown in the Contract Drawings are required, alterations may be made so as not to compromise the air flow, pressure drop, and sound characteristics of the duct fitting or duct run as shown on the Contract Drawings. In the event Architect determines that the installed ductwork is inconsistent with the above mentioned criteria, remove and replace at no additional cost to the Owner.
- Install ducts with fewest possible joints.
- Install fabricated fittings for changes in directions, size, shape, and for connections.
- Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches, with a minimum of 3 screws in each coupling.
- Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- Install ducts with a clearance of 1-inch, plus allowance for insulation thickness. Allow for easy removal of ceiling tile.
- Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- Coordinate layout with suspended ceiling, air duct accessories, lighting layouts, and similar finish work.
- Electrical and IT Equipment Spaces: Route ducts to avoid passing through transformer vaults, electrical equipment spaces, IDF/MPOE rooms, and enclosures.

12. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2-inches.
13. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Reference SMACNA's Seismic Restraint Manual: Guidelines for Mechanical Systems, Mason Seismic Restraint and Support Systems.
14. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's Duct Cleanliness for New Construction Advanced Level.
15. Paint interiors of metal ducts, that do not have duct liner, for 24-inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible duct material.
16. Install ductwork in the location and manner shown and detailed. Review deviations required by job conditions with Architect prior to any fabrication. Provide fittings for construction per SMACNA.
17. Install flexible ductwork to limit sag between support hangers to 1/2-inch per foot of spacing support.

C. Flanged Take-Offs:

1. Install at branch takeoffs to outlets using round or flex duct.
2. Flanged take-offs secured with minimum 8-inch screw spacing (three screws minimum).
3. Provide ductwork taps and branches off of main ducts at 45 degrees whether shown on Drawings or not (drawings are diagrammatic).

D. Cleaning:

1. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.
2. Grille and Exposed Duct Cleaning:
  - a. After completion of ductwork installation, operate each fan system (excluding exhaust fans) for a minimum of 30 minutes prior to installation of ceiling grilles and diffusers. After grilles and diffusers are installed, clean out accumulation of particles from grilles and diffusers prior to acceptance.
  - b. Clean exterior surface of ducts exposed to public view of chalk, pencil and pen marks, labels, sizing tags, dirt, dust, etc., so that upon completion of installation, ducts are left in clean and unblemished manufactured conditions.
  - c. Exposed duct and grilles to remain free of dust entrained streaks due to leakage at joints and grille connections during warranty period. Clean leaks, seal and refinish to match existing if visible streaks develop.

### 3.02 DUCTWORK, JOINTS, AND FITTINGS INSTALLATION

A. Duct Materials - Applied Locations:

1. General: Use the following materials in design of ductwork specified in this Section unless otherwise noted on the Drawings.

Location or Application	Material
Supply, Return, Transfer, and Exhaust - Low Pressure	Single Wall, Galvanized Steel
General Exhaust Branch Serving Air Inlet in Shower Room or Toilet Room with Shower	Single Wall, Aluminum

B. Ductwork Installation:

1. Fabricate radius elbows with centerline radius not less than 1-1/2 duct diameters.
2. Do not install duct size transition pitch angles which exceed 30 degrees for reductions in duct size in the direction of airflow, and 15 degrees for expansions in duct size in the direction of airflow.
3. Install fixed turning vanes in square throat rectangular elbows and in tees.
4. Fabricate duct turns with the inside (smallest) radius at least equal to the duct width (supply ducts) and 1.5 times radius (return and exhaust ducts). Where necessary, square elbows may be used, with maximum available inside radius and with fixed turning vanes. In healthcare settings such as hospitals and medical office buildings, square elbows and turning vanes allowed on supply ductwork only.

### 3.03 LAUNDRY CLOTHES DRYER VENT INSTALLATION

- A. Install vent in accordance with manufacturer's instructions and recommendations.

### 3.04 INSULATED FLEXIBLE DUCT INSTALLATION

- A. Provide sheet metal plenum or rigid elbow and connect to diffusers and grilles with ductwork connections. Refer to Drawings for more information. Provide straight section of flexible duct with minimum length of 2-feet and maximum length of 5-feet and connect to sheet metal plenums and rigid elbows connected to diffusers and grilles, unless noted otherwise.
  1. Provide round neck grilles/diffusers or square-to-round transitions. Flexible duct connections directly to diffuser and grilles is not allowed.
  2. Flexible duct allowed in concealed spaces above lay-in ceilings only.

### 3.05 DUCTWORK JOINT SEALERS AND SEALANTS INSTALLATION

- A. Joints and Seam Joint Sealing:
  1. Seal duct seams and joints according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, for duct pressure class indicated.
  2. Seal transverse joints, longitudinal seams and duct wall penetrations including screw, fastener, pipe, rod, and wire.
  3. Seal ducts before external insulation is applied.
  4. Fasteners such as sheet-metal screws, machine screws or rivets to be cadmium plated.
  5. Rectangular Ductwork: Where intermediate joint reinforcement is required for duct of negative pressure class, pre-drill stiffening flange and provide fastener maximum 8-inches on center. Where retaining flanges are welded to duct wall, paint welds with zinc coating.
  6. Single Wall Round Ductwork: Joint to incorporate beaded slip collar with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
  7. Seal joints and seams. Apply sealant to make end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
  8. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
  9. Provide openings in ductwork where required to accommodate thermometers and control devices. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
  10. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities as well as Code required clearances.

END OF SECTION

SECTION 23 33 00  
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
1. Sheet Metal Materials
  2. Backdraft Dampers
  3. Turning Vanes
  4. Flexible Connectors

1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Manufacturer's catalog data and fabrication/installation drawings for each factory fabricated duct accessory. Include leakage, pressure drop and maximum back pressure data.
  2. Shop Drawings: Indicate air duct accessories.
  3. Manufacturer's installation instructions: Provide instructions for each factory fabricated duct accessory.
  4. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    - a. See Division 01, General Requirements, Product Requirements for additional provisions.
    - b. Extra Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum five years of documented experience.
  2. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
  3. AMCA 511 - Certified Ratings Program for Air Control Devices.
  4. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## PART 2 - PRODUCTS

### 2.01 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M. Galvanizing: 1-1/4 ounces per square foot total both sides; ducts to have mill-phosphatized finish for surfaces exposed to view.
- C. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063, temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36-inches or less; 3/8-inch minimum diameter for lengths longer than 36-inches.

### 2.02 BACKDRAFT DAMPERS

- A. Manufacturers:
  - 1. Air Balance
  - 2. Cesco
  - 3. Greenheck
  - 4. Nailor
  - 5. Ruskin
- B. Basis-of-Design: Ruskin CB D6.
- C. Description: Multiple-blade gravity balanced with center pivoted blades with sealed edges, assembled in rattle free manner with 90-degree stop, adjustment device to permit setting for varying differential static pressure.
- D. Frame: 0.125-inch thick 6063-T5 extruded aluminum channel with galvanized steel braces at mitered corners. Provide mounting flange.
- E. Blades: Single piece, overlap frame, parallel action, horizontal orientation, minimum 0.07-inch 6063-T5 extruded aluminum material, maximum 6-inch width.
- F. Bearings: Corrosion-resistant synthetic, formed as single piece with axles.
- G. Blade Seals: Extruded vinyl, mechanically attached to blade edge.
- H. Blade Axles: Corrosion-resistant, synthetic formed as single piece with bearings, locked to blade.
- I. Tie Bars and Brackets: Galvanized steel.
- J. Return Spring: Adjustable tension.
- K. Damper Capacity:
  - 1. Closed Position: Maximum back pressure of 16-inches water gauge.
  - 2. Open Position: Maximum air velocity of 2,500-feet per minute.
- L. Counterbalances: Adjustable zinc plated steel weights mechanically attached to blade. Must be capable of operating over wide range of pressures.
- M. Finish: Mill aluminum.
- N. Temperature Rating: -40 degrees F to 200 degrees F.
- O. Operation of Blade:
  - 1. Start to Open: 0.01-inch wg

- 2. Fully Open: 0.05-inch.
- P. Pressure Drop: Maximum 0.15-inch wg at 1,500-feet per minute through 24-inch by 24-inch damper.
- Q. Factory Sleeve: Minimum 20 gauge thickness, 12-inches in length.
- R. Screen: At outdoor intake or discharge. 1/4-inch aluminum.

## 2.03 TURNING VANES

- A. Manufacturers:
  - 1. Aerodyne
  - 2. Ductmate Industries
  - 3. Duro Dyno Corp.
  - 4. Metalaire Inc.
- B. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners to automatically align vanes.
- C. Manufactured Turning Vanes: For medium pressure ductwork, ductwork upstream of terminal units, and in ductwork with equal inlet width and height dimensions and outlet width and height dimension, provide double thickness airfoil turning vanes. Low pressure ductwork and ductwork downstream of terminal units use either single thickness or double thickness turning vanes. For mitered rectangular elbows with changes in size from inlet to outlet, only use single thickness turning vanes. Use 2-inch radius vanes spaced on centers of 1.5-inches for single thickness. Use 2-inch radius vanes spaced on centers of 2.125-inches for double thickness.

## 2.04 FLEXIBLE CONNECTORS

- A. Manufacturers:
  - 1. Duro Dyne Corp.
  - 2. Ventfabrics Inc.
  - 3. Ductmate Industries
  - 4. Hardcast
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 4-inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Select metal compatible with ducts.
- D. Provide a spring and bracket assembly to reinforce the fabric with sufficient tension to prevent connector collapse under negative or positive pressure. Number and positioning of spring-link fixture to be determined by the manufacturer to maintain straight axis and without kinks between two sections of duct, or between duct and the moving element. Hardcast Spring-Link SL-200, or equal.
- E. Indoor System, Flexible Connector Fabric (FC-I): Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 30 ounces per square yard.
  - 2. Tensile Strength: 395 pounds of force per inch in the warp and 255 pounds of force per inch in the filling.
  - 3. Service Temperature: -40 degrees F to 200 degrees F.

## PART 3 - EXECUTION

### 3.01 DUCT ACCESSORIES GENERAL INSTALLATION

- A. Inspect areas to receive air duct accessories. Notify Engineer of conditions that would adversely affect the installation of the dampers. Do not proceed until conditions are corrected.



- B. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- C. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- D. Do not compress or stretch damper frames into duct or opening.
- E. Handle dampers using sleeve or frame. Do not lift dampers using blades, actuators, or jack shafts.
- F. Adjust duct accessories for proper settings.

### 3.02 SHEET METAL MATERIALS INSTALLATION

- A. Install bracing for multiple sections to support assembly weights and hold against system pressure. Install bracing as needed.

### 3.03 BACKDRAFT DAMPERS INSTALLATION

- A. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Provide at outside air intakes where motorized dampers are not shown on drawings.

### 3.04 TURNING VANES INSTALLATION

- A. Vanes must be installed, eliminating every other vane is not allowed.
- B. Single thickness vanes cannot be over 36-inches long without intermediate vane runner.
- C. Install per SMACNA and fasten/support to prevent vibration, noise, and to maintain proper alignment at design velocity.

### 3.05 FLEXIBLE CONNECTORS INSTALLATION

- A. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. Provide sheet metal weather cover over flexible connections located outdoors. Attach sheet metal to either equipment side or ductwork side, but not both.
- B. Per NFPA, do not use flexible connectors on grease exhaust fans.
- C. Securely attach spring-lock brackets to the metal strips of the connector collar using No. 8 sheet metal screws.
- D. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- E. Adjust the following types in the following locations:
  - 1. FC-I: Indoors.

END OF SECTION

## SECTION 23 34 00

## HVAC FANS

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Work Included:
  - 1. Cabinet Fans
  - 2. Ceiling Exhaust Fans

## 1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material gauges and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. For belt-driven fans, indicate the number of belts provided for design duty.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  - 1. Motors: Premium efficiency. Electrically Commutated Motors (ECM) where scheduled on Drawings.
  - 2. Sound power levels as scheduled on Drawings. If not scheduled, within 5 percent of Basis of Design at design flow.
  - 3. Project Altitude: Base air ratings on sea-level conditions for project sites below 2,000 feet in elevation. Base air ratings on actual site elevations for project sites above 2,000 feet in elevation.
  - 4. Operating Limits: Classify according to AMCA 99.
  - 5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 6. AMCA Compliance: Products are to comply with performance requirements and are to be licensed to use the AMCA-Certified Ratings Seal.
  - 7. NEMA Compliance: Motors and electrical accessories are to comply with NEMA standards.
  - 8. UL Standard: HVAC Fans are to comply with UL 705. Fans used in grease exhaust applications are to be UL 762 listed for grease exhaust. Fans used for smoke control applications are to be UL listed for Power Ventilators for Smoke Control.

9. Belt-driven fans used for smoke control applications are to have 1.5 times the number of belts required for the design duty, with the minimum number of belts being two.

#### 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

#### 1.08 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

#### 1.09 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Belts: One set for each belt-driven unit.

### PART 2 - PRODUCTS

#### 2.01 CABINET FANS

- A. Manufacturers:
  1. Greenheck
  2. Cook
  3. Twin City
- B. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.
- C. Wheel:
  1. Double width, double inlet, forward curved blades.
  2. Spun inlet cones.
  3. Statically and dynamically balanced within its own bearings.
- D. Housing: Acoustically insulated steel casing, factory standard finish, bottom and side access, ducted inlet and outlet, backdraft damper.
- E. Bearings and Drives:
  1. Bearings: Heavy duty pillow block type, self greasing ball bearings with ABMA 9 life at 50,000 hours.
  2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.
  3. Drive: Direct drive matched to fan loads with speed controller.
- F. Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings. ODP for motors located indoors and TEFC for motors exposed to moisture.
  1. Electrically Commutated Motor (ECM) where indicated on Fan Schedule on Drawings.
- G. Accessories:

1. Discharge Dampers: Parallel blade for mixing or open/close applications and opposed blade for modulating . Heavy duty steel or aluminum, where scheduled. Damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever. Motorized where indicated and gravity actuated with counterweight, where motorized is not indicated.
2. Variable Speed Controller: Where scheduled on Drawings, provide solid-state control to reduce speed from 100 percent to less than 50 percent.
3. Variable Speed Controller: Provide ECM motor where indicated on Drawings.
4. Disconnect Switch: Where not shown on Division 26, Electrical Drawings, provide nonfusible type, with thermal-overload protection mounted inside fan housing factory wired through an internal aluminum conduit.
5. Factory hooded wall cap where scheduled.

## 2.02 CEILING EXHAUST FANS

- A. Manufacturers:
  1. Greenheck
  2. Cook
  3. Broan
  4. Twin City
  5. Panasonic
- B. Description: Centrifugal fan, direct drive, cabinet and exhaust grille. AMCA rated. Sound level as scheduled. Fan shrouds, motor, and fan wheel are to be removable for service.
- C. Wheel: Double width, double inlet, forward curved blades:
- D. Housing: Acoustically insulated steel casing, factory standard finish, bottom access through grille, ducted outlet, egg crate inlet grille. Provide stainless steel grille where scheduled.
- E. Drives: Direct drive.
- F. Back draft damper.
- G. Accessories:
  1. Disconnect plug.
  2. Factory hooded wall cap where scheduled.
- H. Motor: Integrally mounted with pre-lubricated sealed ball bearings. Engineered and rated to run continuously.
  1. Variable-Speed Controller: Where scheduled on Drawings, provide solid-state control to reduce speed from 100 percent to less than 50 percent.
  2. Disconnect Switch: Where not shown on Division 26, Electrical Drawings, provide nonfusible type, with thermal-overload protection mounted inside fan housing factory wired through an internal aluminum conduit.
- I. Isolation: Rubber-in-shear vibration isolators.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with manufacturer's instructions.
- B. Install power ventilators level and plumb.
- C. Fans used for exhaust of moist air are to be constructed of aluminum construction and be warranted for their application in moist conditions.
- D. Support suspended units from structure threaded steel rods and vibration isolation device scheduled on Drawings.

- E. In seismic zones, restrain support units.
- F. Install units with clearances for service and maintenance.
- G. Provide safety screen where inlet or outlet is exposed.
- H. Provide backdraft dampers on discharge of exhaust fans and as indicated on Drawings.
- I. Duct installation and connection requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors per Section 23 33 00, Air Duct Accessories.
- J. Install ducts adjacent to power ventilators to allow service and maintenance.
- K. Ground equipment.
- L. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- M. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
- N. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- O. Shut unit down and reconnect automatic temperature-control operators.
- P. Replace fan and motor pulleys as required to achieve design airflow.
- Q. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- R. Adjust damper linkages for proper damper operation.
- S. Lubricate bearings.
- T. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
- U. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

### 3.02 CEILING EXHAUST FANS

- A. Suspend units from structure; use steel wire or metal straps.

END OF SECTION

## SECTION 23 37 00

## AIR OUTLETS AND INLETS

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Work Included:

1. Grilles, Registers, Diffusers

## 1.02 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

## 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## 1.04 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
  2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
  3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size and accessories furnished.

## 1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. Air Distribution Diffuser, Register, and Grille Schedule lists Basis of Design, with any specialty accessories, construction, finish or other criteria noted on schedule. Submitted air distribution must match criteria of Basis of Design:
    - a. Construction materials and appearance.
    - b. Frame/installation method.
    - c. Isothermal throw plus or minus 5 percent at design flows shown on drawings.
    - d. Noise Criteria: NC value plus or minus 1 at design flows shown on drawings.
    - e. Accessories: Equal to Basis of Design.

## 1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23, HVAC sections, where more than a single type is specified for the application, provide single selection for each product category.
- B. Grilles, Registers, Diffusers:

1. Anemostat
2. Carnes
3. Environmental Air Products
4. Krueger
5. Metalaire
6. Nailor
7. Price Co.
8. Shoemaker
9. Titus
10. Tuttle & Bailey
11. Seiho
12. Or approved equivalent.

## 2.02 GRILLES, REGISTERS, DIFFUSERS

- A. Diffuser, Register and Grille Schedule lists Basis of Design, with specialty accessories, construction, finish or other criteria noted on schedule. Submitted air distribution must match criteria of Basis of Design, including accessories and finish:
  1. Matching construction materials and appearance. Equal installation method/frame.
  2. Pressure drop equal to or less than Basis of Design at CFM on Drawings.
  3. Throw: Isothermal jet throw plus or minus 5 percent of Basis of Design at CFM listed on Drawings.
  4. Noise Criteria: Plus or minus 1 NC of Basis of Design at CFM listed on Drawings. If Basis of Design NC is below registered level, submitted must match. NC rating with 10 dB room factor or less.
- B. Provide 1-, 2-, 3-, or 4-way deflection as indicated on Drawings.
- C. Provide pattern controllers for linear supply air diffusers.
- D. Register Dampers: Dampers utilized with grilles. Opposed blade dampers utilizing a side operated worm drive which provides external duct operation. Slot the end of the shaft to receive a screwdriver. Factory assembled side operator. Construct of the same material as the grille. Manufacturer same as grilles/diffuser.
- E. Coordinate mounting frames with ceiling construction type. Verify per reflected ceiling plans.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION

- A. Install in accordance with manufacturer's instructions. Provide seismic supports, clips, and bracing per local code. Coordinate installation of framing. Provide complete coverage of rough openings by integral device flanges or auxiliary frames. Where above ceiling location is unconditioned space, caulk rough openings; repair and re-paint locations where dust entrainment streaks develop due to unsealed openings.
- B. Damp locations, such as lockers, restrooms, showers, natatoriums, whirlpool/spas, to have aluminum construction even if scheduled otherwise; mounting hardware to be stainless steel.
- C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- D. Unless otherwise shown on drawings, for ceiling mounted air outlets with adjustable airflow pattern controllers mounted at a height of 12 feet or less, adjust the air outlets for horizontal air distribution, and adjust to vertical air distribution for ceiling height above 12 feet.
- E. Exterior color of grilles per Architect. White finish if not otherwise scheduled or noted by Architect. Paint ductwork visible behind air outlets and inlets matte black.

- F. Ceiling Membrane: Protect ceiling membrane per code. Fire caulk around openings. Provide listed radiation damper in rated roof/ceiling or floor/ceiling assemblies as required per code.
- G. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

### 3.02 GRILLES, REGISTERS, DIFFUSERS INSTALLATION

- A. Coordinate with Architectural Reflected Ceiling Plan(s). Reflected ceiling plans determine final locations.
- B. Install diffusers to ductwork with air tight connection. 18-inch straight duct section or acoustic plenum at connection. Provide square to round adapters where required for connection to round ducts.
- C. Provide integral balancing dampers for diffusers, and grilles and registers where duct manual balancing dampers are not shown or specified.

END OF SECTION



## SECTION 28 00 01

## ELECTRONIC SAFETY BASIC REQUIREMENTS

## PART 1 - GENERAL

## 1.01 DESIGN-BUILD SUMMARY

- A. Work included in 28 00 01 applies to Division 28, Electronic Safety work to provide materials, labor, tools, permits and incidentals to make electronic safety systems ready for Owner's use for proposed project.

## 1.02 DESIGN-BUILD INSTRUCTIONS

- A. This document is issued to give Bidders a basis for preparing a proposal to design and install a complete Electronic Safety system for this project.
- B. Alternates to this Document may be offered as a separate proposal.

## 1.03 DESIGN-BUILD APPROACH

- A. Use this Specification for design/engineering requirements, workmanship and materials or construction. Utilize design-build concept throughout construction phase of project.
- B. Investigate and be apprised of applicable codes, rules, and regulations as enforced by AHJ.
- C. Visit the Site of the proposed construction. Verify and inspect the existing site to determine conditions that affect this work.

## 1.04 DESIGN-BUILD CRITERIA

- A. Related Work Specified Elsewhere: Contents of Section apply to Division 28, Electronic Safety Specifications. Requirements of Section are a minimum for Division 28, Electronic Safety Sections, unless otherwise stated in each Section, in which case that Section's requirements take precedence.
- B. Reference Basis of Design narrative document.
- C. Fire Alarm Design Criteria: Refer to Section 28 31 00, Fire Detection and Alarm, for fire alarm system design criteria.
- D. Fire Alarm Equipment: Refer to Section 28 31 00, Fire Detection and Alarm, for fire alarm equipment requirements.

## 1.05 SECTION INCLUDES

- A. Work included in 28 00 01, Electronic Safety Basic Requirements applies to Division 28, Electronic Safety work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electronic safety systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
  - 1. Provide: To furnish and install, complete and ready for intended use.
  - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
  - 3. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.

4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities having jurisdiction, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

#### 1.06 RELATED SECTIONS

- A. Contents of Section apply to Division 28, Electronic Safety Contract Documents.
- B. Related Work:
  1. Additional conditions apply to this Division including, but not limited to:
    - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
    - b. Drawings
    - c. Addenda
    - d. Owner/Architect Agreement
    - e. Owner/Contractor Agreement
    - f. Codes, Standards, Public Ordinances and Permits
- C. Contents of Division 26, Electrical apply to this Section.

#### 1.07 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 28, Electronic Safety Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
  1. State of Oregon:
    - a. OAR - Oregon Administrative Rules
    - b. 2023 OESC - Oregon Electrical Specialty Code
    - c. 2022 OFC - Oregon Fire Code
    - d. 2022 OMSC - Oregon Mechanical Specialty Code
    - e. 2023 OPSC - Oregon Plumbing Specialty Code
    - f. 2022 OSSC - Oregon Structural Specialty Code
    - g. 2021 OEESC - Oregon Energy Efficiency Specialty Code
    - h. 2011 Oregon Elevator Specialty Code
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
  1. ABA - Architectural Barriers Act
  2. ADA - Americans with Disabilities Act
  3. ANSI - American National Standards Institute
  4. ASCE - American Society of Civil Engineers
  5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
  6. ASHRAE Guideline 0, the Commissioning Process

7. ASME - American Society of Mechanical Engineers
8. ASTM - ASTM International
9. CFR - Code of Federal Regulations
10. EPA - Environmental Protection Agency
11. ETL - Electrical Testing Laboratories
12. FM - FM Global
13. ISO - International Organization for Standardization
14. NEC - National Electric Code
15. NEMA - National Electrical Manufacturers Association
16. NFPA - National Fire Protection Association
17. OSHA - Occupational Safety and Health Administration
18. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association
19. UL - Underwriters Laboratories Inc.

D. See Division 28, Electronic Safety individual Sections for additional references.

#### 1.08 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
- D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.
- E. Product Data: Provide manufacturer's descriptive literature for products specified in Division 28, Electronic Safety Sections.
- F. Identify/mark each submittal in detail. Note what difference, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
  1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
  2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference individual Division 28, Electronic Safety specification Sections for specific items required in product data submittal outside of these requirements.
  3. See Division 28, Electronic Safety individual Sections for additional submittal requirements outside of these requirements.

- G. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
- H. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
- I. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
- J. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 28, Electronic Safety Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety submittals.
- K. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
- L. Substitutions and Variation from Basis of Design:
  - 1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
  - 2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor are required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
  - 3. Where manufacturer equipment or model numbers are indicated with no exceptions, substitutions will be rejected.
- M. Shop Drawings:
  - 1. Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 28, Electronic Safety specification Sections for additional requirements for shop drawings outside of these requirements.
  - 2. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
- N. Samples: Provide samples when requested by individual Sections.
- O. Resubmission Requirements:
  - 1. Make any corrections or change in submittals when required by Architect/Engineer review comments. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

2. Resubmit for review until review indicates no exception taken or "make corrections noted."
  3. When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
- P. Operation and Maintenance Manuals, Owner's Instructions:
1. Reference individual Division 28, Electronic Safety Specification Sections for additional requirements for operations and maintenance manuals.
  2. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
    - a. Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
    - b. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes and quantities relevant to each piece of equipment.
    - c. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
    - d. Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Sections.
    - e. Include product certificates of warranties and guarantees.
    - f. Include copy of start-up and test reports specific to each piece of equipment.
    - g. Include commissioning reports.
    - h. Engineer will return incomplete documentation without review.
    - i. Engineer will provide one set of review comments in Submittal Review format. Arrange for additional reviews; Bear costs for additional reviews at Engineer's hourly rates.
  3. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 28 00 01, Electronic Safety Basic Requirements Article titled "Demonstration."
  4. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
- Q. Record Drawings:
1. Maintain at site at least one set of drawings for recording "as-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements and location of concealed items. Include items changed by addenda, field orders, supplemental instructions, and constructed conditions.
  2. Record Drawings are to include equipment locations, calculations, and schedules that accurately reflect "as constructed or installed" for project.
  3. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
  4. See Division 28, Electronic Safety individual Sections for additional items to include in Record Drawings.

## 1.09 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (e.g. cable tray, panels, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.

## 1.10 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

## 1.11 COORDINATION DOCUMENTS

- A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Prepare Drawings as follows:
  - 1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
  - 2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
  - 3. Indicate fittings, hangers, access panels, and elevation of bottom of cable tray above finished floor.

4. Drawings to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork.
5. Incorporate Addenda items and change orders.
6. Provide additional coordination as requested by other trades.
- C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacture, including but not limited to panels, devices and equipment unless otherwise specified in individual Division 28, Electronic Safety Sections.

### 2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL, ETL, or FM listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
  1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
  2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
  3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

## PART 3 - EXECUTION

### 3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.
- B. Install equipment having components requiring access (i.e., devices, equipment, electrical boxes, panels, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.
- D. Earthwork:
  1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:

- a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
  - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
  - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
- 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.
  - 2. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around conduit, raceway and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- F. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums.

### 3.02 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 28 Electronic Safety Sections.
- B. Earthquake resistant designs for Electronic Safety (Division 28) systems and equipment to conform to regulations of jurisdiction having authority.
- C. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
- D. Provide means to prohibit excessive motion of safety equipment during earthquake.

### 3.03 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
  - 1. Underground conduit and wire installation prior to backfilling.
  - 2. Prior to covering walls when electronic safety systems installation is started.
  - 3. Prior to ceiling cover/installation.
  - 4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

### 3.04 CUTTING AND PATCHING

- A. Confirm Cutting and Patching Requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:



1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, repair, refinish and leave in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

### 3.05 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

### 3.06 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with the individual Division 28, Electronic Safety Sections and the following:
  1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust.
  2. Protect equipment and pipe to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
  3. Protect devices, panels and similar items until in service.
  4. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

### 3.07 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.
- B. Upon completion of work and adjustment of equipment, test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Staff as specified in Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified factory certified instructor at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

### 3.08 CLEANING

- A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28 Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

### 3.09 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.
- B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to building structure. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports required for installation of equipment, conduit and wiring.

### 3.10 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:
  - 1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e. hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
  - 2. In electrical and mechanical room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
  - 3. See individual equipment Specifications for other painting.
  - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
  - 5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Architect.

### 3.11 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:
  - 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
    - a. Cleaning
    - b. Operation and Maintenance Manuals
    - c. Training of Operating Personnel
    - d. Record Drawings
    - e. Warranty and Guaranty Certificates
    - f. Start-up/Test Documents and Commissioning Reports

### 3.12 FIELD QUALITY CONTROL

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:
  - 1. Tests:
    - a. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Closeout Documents.
    - b. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

### 3.13 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement in letter that electronic safety systems were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in operating and maintenance manuals.

END OF SECTION

SECTION 28 31 00  
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Fire Alarm Control Panel
2. Notification Appliance Circuit Panels
3. Fire Alarm Transmitters
4. Fire Alarm Annunciators
5. Manual Pull Stations
6. Fixed Temperature Heat Detectors
7. Rate-of-Rise and Fixed Temperature Heat Detectors
8. Photoelectric Type Detectors
9. Duct-Mounted Smoke Detectors
10. Relay Modules
11. Control Modules
12. Input Modules
13. Fault Isolation Modules
14. Combination Horn/Strobes
15. Strobes
16. Horns
17. Weatherproof/Surface Backboxes
18. Protective Guards
19. Circuit Conductors
20. Surge Protection
21. Batteries
22. Locks and Keys
23. Document Storage Cabinet
24. Instruction Charts
25. Framed Floor Map

B. Scope:

1. Provide a new fire alarm system throughout the entire building.
2. Provide a new fire alarm transmitter communication system.

C. In addition, provide design for the following as required in these Contract Documents:

1. Fire Alarm System
2. Fire Alarm Transmitter Communication System

D. System Design:

1. Design Criteria:
  - a. These are Contractor designed systems. Contact AHJ prior to bid to verify systems' requirements. Design systems in compliance with code as interpreted by the AHJ.

- b. Fire Alarm Sequence of Operation: Activation of manual fire alarm box, automatic fire detector, or fire extinguishing system causes system to enter "alarm" mode including the following operations:
    - 1) Local English language annunciation of device location, address and condition and audible and visual alarm signal at control panel and remote annunciators.
    - 2) Manual "acknowledge" function at control panel and remote annunciators to silence audible alarm signal, visual signal remains displayed until initiating alarm is cleared.
    - 3) Transmit "alarm" signal to off-premises equipment, i.e., to local fire department or Owner's selected vendor. Provide necessary connections to transmitter.
    - 4) Activate fire alarm notification appliances.
    - 5) Activate Emergency Control Functions as required by code.
      - (a) Transmit signal to fire/smoke dampers.
      - (b) Transmit signal to initiate shutdown of air handling equipment.
      - (c) Transmit signal to release fire doors.
  - c. Supervisory Sequence of Operation: Fire sprinkler tamper or supervisory pressure switch activation, or duct-mounted smoke detector activation causes system to enter "supervisory" mode including the following operations:
    - 1) Local English language annunciation of device location, address and condition and audible and visual supervisory signal at control panel and remote annunciators.
    - 2) Manual "acknowledge" function at control panel and remote annunciators to silence audible supervisory signal, visual signal remains displayed until initiating supervisory is cleared.
    - 3) Transmit "supervisory" signal to off-premises equipment.
    - 4) Transmit signal to fire/smoke dampers (duct detector only).
    - 5) Transmit signal to initiate shutdown of air handling equipment (duct detector only).
  - d. Trouble Sequence of Operation: System trouble, including single ground or open of supervised circuit, or power or system failure, causes system to enter "trouble" mode including the following operations:
    - 1) Local English language annunciation of device location, address and condition and audible and visual trouble signal at control panel and remote annunciators.
    - 2) Manual "acknowledge" function at control panel and remote annunciators to silence audible trouble signal, visual signal remains displayed until initiating trouble is cleared.
    - 3) Transmit "trouble" signal to off-premises equipment.
2. Design of Fire Alarm Transmitter Communication System: Provide design of the fire alarm transmitter communication system as required by code.

#### 1.02 RELATED SECTIONS

- A. Contents of Division 28, Electronic Safety and Division 01, General Requirements apply to this Section.
- B. Division 26, Electrical requirements apply to this section.

#### 1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Division 28, Electronic Safety and Division 01, General Requirements.
- B. In addition, meet the following:
  - 1. NFPA 72, National Fire Alarm and Signaling Code, adopted edition.
  - 2. NFPA 70, National Electrical Code, adopted edition.

#### 1.04 SUBMITTALS

- A. Submittals as required by Division 28, Electronic Safety and Division 01, General Requirements.
- B. Shop Drawings:

1. Submit shop drawings which include documentation required per NFPA 72; Shop Drawings.
  2. In addition, provide the following:
    - a. Provide system designer NICET certification number or Engineer's signature and seal on shop drawings.
    - b. Identification of system designer and evidence of qualification or certification of designer as required by AHJ.
  - C. Operation and Maintenance Manuals:
    1. Provide manuals containing the documentation required in NFPA 72; Completion Documentation.
    2. In addition, provide the following:
      - a. One year warranty agreement including parts and labor. Warranty period begins upon date of substantial completion.
      - b. Instruction chart.
- 1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Division 28, Electronic Safety and Division 01, General Requirements.
  - B. In addition, meet City of Klamath Falls, Oregon requirements, ordinances and amendments.
- 1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Division 01, General Requirements.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Fire Alarm Control Panel:
  1. Silent Knight
  2. Or approved equivalent.
- B. Notification Appliance Circuit Panels:
  1. Same manufacturer as fire alarm control equipment.
  2. Or approved equivalent.
- C. Fire Alarm Transmitters:
  1. Same manufacturer as fire alarm control equipment.
  2. AES Corporation
  3. DSC
  4. Telguard
  5. Or approved equivalent.
- D. Fire Alarm Annunciators:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- E. Manual Pull Stations:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- F. Fixed Temperature Heat Detectors:
  1. Same manufacturer as fire alarm control equipment.

2. No substitutions permitted.
- G. Rate-of-Rise and Fixed Temperature Heat Detectors:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- H. Photoelectric Type Detectors:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- I. Duct-Mounted Smoke Detectors:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- J. Relay Modules:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- K. Control Modules:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- L. Input Modules:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- M. Fault Isolation Modules:
  1. Same manufacturer as fire alarm control equipment.
  2. No substitutions permitted.
- N. Combination Horn/Strobes:
  1. Same manufacturer as fire alarm control equipment.
  2. System Sensor
  3. Or approved equivalent.
- O. Strobes:
  1. Same manufacturer as fire alarm control equipment.
  2. System Sensor
  3. Or approved equivalent.
- P. Horns:
  1. Same manufacturer as fire alarm control equipment.
  2. System Sensor
  3. Or approved equivalent.
- Q. Weatherproof/Surface Backboxes:
  1. Same manufacturer as fire alarm detection devices or notification appliances.
  2. Or approved equivalent.
- R. Protective Guards:
  1. Wire Guard:
    - a. Same manufacturer as fire alarm control equipment.
    - b. American Wire Guards
    - c. Chase Security Systems

- d. Safety Technology International
  - e. Shaw-Perkins
  - f. Or approved equivalent.
- 2. Protective Cover:
  - a. Safety Technology International
  - b. SIGCOM
  - c. Or approved equivalent.
- S. Circuit Conductors:
  - 1. Allied Wire and Cable
  - 2. Belden
  - 3. CCI
  - 4. West Penn Wire
  - 5. Or approved equivalent.
- T. Surge Protection:
  - 1. Ditek
  - 2. Transtector
  - 3. Or approved equivalent.
- U. Batteries:
  - 1. Same manufacturer as fire alarm control equipment.
  - 2. Power-Sonic
  - 3. Werker
  - 4. Or approved equivalent.
- V. Locks and Keys:
  - 1. Same manufacturer as fire alarm control equipment.
  - 2. Or approved equivalent.
- W. Document Storage Cabinet:
  - 1. Same manufacturer as fire alarm control equipment.
  - 2. Meir Products
  - 3. Space Age
  - 4. Or approved equivalent.
- X. Instruction Charts: Confirm make and model with architect prior to ordering.
- Y. Framed Floor Map: Confirm make and model with architect prior to ordering.
- Z. Substitutions:
  - 1. For other acceptable manufacturers of specified control units, submit product data showing equivalent features and compliance with Contract Documents.
  - 2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.
- AA. Equipment to be supplied by a certified manufacturer representative.
- 2.02 FIRE ALARM CONTROL PANEL
  - A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
  - B. Multiprocessor Based: Configurable as an addressable, point identified system.
  - C. Central Processing Unit (CPU):



1. CPU continuously monitors the communications and data processing cycles of microprocessor. CPU failure generates an audible and visual trouble signal on control panel and remote annunciators.
  2. House the CPU in fire alarm cabinet with sufficient space to allow maximum system expansion and to enclose alphanumeric display.
  3. Retain basic life safety software in field programmable non-volatile memory. Provide CPU with minimum capacity of 50 addressable points.
  4. Equip CPU with software to provide a control-by-event feature, whereby receipt of an alarm point is programmed to operate control points within system. Provide control-by-event actions for life safety functions in programmable non-volatile memory. CPU software programming for control of systems defined in this Section is installed as part of this Section.
- D. System Capabilities:
1. System capable of addressing and operating smoke detectors, manual pull stations, open contact devices and addressable auxiliary control relays on the same communication loop.
  2. System capable of displaying sensitivity of each smoke detector, address and condition of fire alarm monitoring points.
- E. Program Software:
1. Field configuration program provides programmable operating instructions for system. Store resident program in non-volatile memory.
  2. Devices meet criterion specified under materials.
  3. Verification and display of sensitivity of each addressable smoke detector can be read using the operating software.
- F. Control Panel Display Modules:
1. Provide keyboard display module with minimum 80-character backlit LCD. Each alarm/trouble condition appears in English language with description and location of alarm/supervisory/trouble.
  2. Alarm/supervisory/trouble may be acknowledged, silenced and system reset from control panel or remote annunciator(s).
- G. Power Supply: Provide power supply(s), adequate to serve control panel modules, remote annunciators, addressable devices, notification appliances and other connected devices.
- H. Power Requirements:
1. Loss of 120VAC power automatically causes system to transfer to secondary power. Indicate battery power operation by yellow lamp and audible annunciation at control panel and remote annunciator panels. Upon return of 120VAC power, unit recharges batteries to full capacity and maintains battery on float charge. Provide trickle charge adequate capacity to maintain battery fully charged with automatic rate charge.
  2. Provide batteries in locking cabinet manufactured for purpose.
- I. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each function in this portion of the Specifications and for equipment interconnections required under electrical and mechanical specifications.
- J. Auxiliary Switches: Provide auxiliary equipment control switches with labeled status indicating lights for each switch.
- K. System Reset:
1. Key-accessible control function returns system to normal, non-alarm state, if initiating circuits have cleared.
  2. Provide reset on both main fire alarm control panel and remote annunciators.
- L. Addressing: Provide each initiating device with its own discrete address.

**2.03 NOTIFICATION APPLIANCE CIRCUIT PANELS**

- A. Provide power supply(s), adequate to serve modules, remote annunciators, initiating devices, notification appliances and other connected devices or appliances.
- B. Provide batteries in locking cabinet manufactured for purpose.

**2.04 FIRE ALARM TRANSMITTERS**

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Electrically supervised, capable of transmitting alarm, supervisory and trouble signals over Radio Alarm Transmitter (RAT), Cellular, or Ethernet lines to off-premises receiver. Signal transmitter interfaces fully with receiver station of local fire department or Owner's selected vendor.
- C. For radio and cellular transmitters, provide exterior antenna where required to facilitate communication with supervising station.

**2.05 FIRE ALARM ANNUNCIATORS**

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Alphanumeric Remote Annunciator with Controls: Back lit LCD alphanumeric annunciator minimum 80 characters long. Provide under locking cover test switch, alarm and trouble buzzer, buzzer silence switch and buzzer silence message and reset switch, flush mount with finished cover, vandal-resistant UV stabilized Lexan (or approved equivalent) overlay and required modules, control panel, etc., to drive annunciator. Self-contained, suitable for wet location where located exterior.

**2.06 MANUAL PULL STATIONS**

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Semi-flush, red finish, nongrasping operation; maximum pull strength as allowed per ADA criteria.
- C. Stations do not allow closure without keyed reset.

**2.07 FIXED TEMPERATURE HEAT DETECTORS**

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Rated 135 degrees F or 190 degrees F as required by space use.
- C. Provide off-white, low-profile detectors.

**2.08 RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS**

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Responding to 15 degrees F temperature rise per minute and to 135 degrees F fixed temperature as required by space use.
- C. Provide off-white, low-profile detectors.

**2.09 PHOTOELECTRIC TYPE DETECTORS**

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Panel adjustable sensitivity, LED source, multiple cell, 360 degree smoke entry, visual latching operation indicator, insect screen, functional test switch, two-wire operation and vandal-resistant locking feature.

## 2.10 DUCT-MOUNTED SMOKE DETECTORS

- A. Photoelectric type. Duct sampling tubes extending width of duct, visual indication of detector actuation, direct housing mount. Detector powered from control panel, power on indicator light. Detector rated for air velocity, humidity and temperature of duct and environment where installed.

## 2.11 RELAY MODULES

- A. Signaling line circuit interface module that connects to other building systems for control of fire/life safety functions, e.g., air-handler shutdown, fire/smoke damper closure, elevator recall.
- B. Module powered from control panel.

## 2.12 CONTROL MODULES

- A. Signaling line circuit interface module that provides notification appliance circuits or system control outputs.
- B. Module powered from control panel.

## 2.13 INPUT MODULES

- A. Signaling line circuit interface module that provides initiating device circuits for connection to contact closure initiating devices.
- B. Module powered from control panel.

## 2.14 FAULT ISOLATION MODULES

- A. Signaling line circuit interface modules that provide isolation of wire-to-wire shorts on a signaling line circuit with automatic reconnection upon correction of short circuit.
- B. Provide module with status indicator LED.

## 2.15 COMBINATION HORN/STROBES

- A. Multi-candela, flush wall and ceiling mount, white finish, insect-proof.
- B. Provide horn/strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating as required by NFPA 72.
- C. Must be compatible with fire alarm control equipment and notification appliance circuit panels.

## 2.16 STROBES

- A. Multi-candela, flush wall and ceiling mount, white finish, insect-proof.
- B. Provide strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating as required by NFPA 72.
- C. Must be compatible with fire alarm control equipment and notification appliance circuit panels.

## 2.17 HORNS

- A. Flush wall and ceiling mount, white finish, insect-proof.
- B. Provide horns that meet the latest requirements of NFPA 72.
- C. Must be compatible with fire alarm control equipment and notification appliance circuit panels.

## 2.18 PROTECTIVE GUARDS

- A. Wire Guard: Steel wire guard.
- B. Protective Cover: Polycarbonate construction.

## 2.19 CIRCUIT CONDUCTORS

- A. Copper or optical fiber; color code and label. Type FPL, FPLR and FPLP. Cable type as required by the NEC and the manufacturer.
- B. Minimum signaling line circuit and initiating device circuit wire size: AWG18.
- C. Minimum notification appliance circuit wire size: AWG14, or as approved by Engineer.
- D. Fiber optic cable as required by manufacturer.

## 2.20 SURGE PROTECTION

- A. Install in accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.
- B. Provide for alternating current circuits powering fire alarm equipment.
- C. Initiating Device Circuits, Notification Appliance Circuits and Communications Circuits: Rated to protect applicable equipment; for 24V(dc) maximum dc clamping voltage of 36V(dc), line-to-ground and 72V(dc), line-to-line.

## 2.21 BATTERIES

- A. Provide additional cabinet, if required due to space limitations in control panels.

## 2.22 LOCKS AND KEYS

- A. Deliver keys to Owner.
- B. Provide same standard lock and key for each key operated switch and lockable panel and cabinet; provide five keys of each type.

## 2.23 DOCUMENT STORAGE CABINET

- A. Suitable for as-built drawings, operation and maintenance manual, system data file disk and tools.
- B. Constructed from steel with baked enamel finish; size adequate for full size drawings, operation and maintenance manual, spare parts and tools.

## 2.24 INSTRUCTION CHARTS

- A. Printed instruction chart for operators, showing steps to be taken when signal is received (normal, alarm, supervisory and trouble); easily readable from normal operator's station.
- B. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

## 2.25 FRAMED FLOOR MAP

- A. Provide framed floor plan of facility.
- B. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

# PART 3 - EXECUTION

## 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Provide a complete and operable system compliant with all applicable codes and standards.
- B. Obtain Architect's approval of locations of devices, appliances and annunciators before installation.
- C. Circuits:
  - 1. Signaling Line Circuits (SLC): Class B
  - 2. Notification Appliance Circuits (NAC): Class B.
- D. Spare Capacity:
  - 1. New Notification Appliance Circuits:
    - a. Minimum 25 percent spare current capacity.
    - b. Maximum 10 percent voltage drop.
    - c. Utilize UL maximum current draw value for notification appliances in calculations.
  - 2. New Signaling Line Circuit: Minimum 25 percent spare device capacity.
- E. Power Sources:
  - 1. Primary: Dedicated branch circuits of facility power distribution system.
  - 2. Secondary: Storage batteries.

3. Capacity: Sufficient to operate fire alarm system under normal supervisory condition for 24 hours and operate alarm signals for five minutes at end of standby period.
- F. Obtain approval of system design from AHJ prior to installation. Do not begin installation without approval from AHJ and submittal review comments from Engineer.
- G. Install in accordance with applicable codes, NFPA 72, NFPA 70 and the Contract Documents.
- H. In accordance with manufacturer's instructions, provide wiring, conduit and outlet boxes required for the erection of a complete system as described in these specifications, as shown on Drawings and as required by AHJ.
- I. Conceal wiring, conduit, boxes and supports where installed in finished areas.
- J. Provide raceway system for cabling concealed in walls and hard ceilings and in locations where cabling is exposed. Where exposed, provide surface raceway in finished areas and surface mounted EMT in non-finished areas.
- K. Provide cabling and conduits system suitable for wet locations for below grade systems.
- L. At junction boxes and termination points, provide identification tags on wires and cables.
- M. Route wiring to avoid blocking access to equipment requiring service, access, or adjustment.
- N. Fire Safety Systems Interfaces:
  1. Fire Safety Functions: Provide power and control conduit, wiring, boxes and terminations to power devices and interface to fire alarm system.
    - a. Doors:
      - 1) Provide smoke detectors and addressable control relays to release magnetic hold open devices and roll-down fire doors and door locks. Verify requirements and quantities prior to bidding.
      - 2) Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door.
      - 3) Electronic Locks or Electromagnetic Door Locks on Egress Doors: Unlock smoke zone egress doors upon activation of any alarm initiating device or suppression system in smoke zone.
      - 4) Overhead Coiling Fire Doors: Release upon activation of smoke detectors on either side of door.
    - b. HVAC Systems:
      - 1) Fire/Smoke Dampers and Smoke Dampers:
        - (a) Provide required smoke detectors, relays, wiring and the like.
        - (b) Connect control and power wiring to dampers per manufacturer's instructions.
        - (c) Verify quantities, location and requirements of dampers with Division 23, HVAC Drawings and Specifications and mechanical system installer.
      - 2) Air Moving Systems:
        - (a) Provide duct-mounted smoke detector for air systems with air flow rates exceeding 2000 CFM. Coordinate with Division 23, HVAC.
        - (b) Install duct-mounted smoke detector(s) on return side of air system.
        - (c) Provide control wiring from addressable relay contacts to air handling equipment controller.
        - (d) Provide duct-mounted smoke detectors rated for air velocity, temperature and humidity of duct. Verify quantities, locations and requirements with Division 23, HVAC Drawings and mechanical system installer.
        - (e) Where duct-mounted smoke detectors are mounted in inaccessible building void spaces provide access hatch. Provide access hatch with fire rating equivalent to rating of wall, ceiling, or shaft being penetrated.
- O. Inspection and Testing for Completion:
  1. System testing and commissioning to be performed by a certified manufacturer representative.

2. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
3. Document audibility measurements and verify intelligibility for each space on record drawings.
4. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction and adjustments.
5. Provide tools, software and supplies required to accomplish inspection and testing.
6. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required to test system.
7. Correct defective work, adjust for proper operation and retest until entire system complies with Contract Documents.
8. Notify Owner seven days prior to beginning completion inspections and tests.
9. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
10. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
  - a. Record all system operations and malfunctions.
  - b. If a malfunction occurs, start diagnostic period over after correction of malfunction.
  - c. Replace devices with readings outside of allowed value at time of system check out.
  - d. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
  - e. At end of successful diagnostic period, complete and submit NFPA 72 "Inspection and Testing Form."

P. Owner Personnel Instruction:

1. Provide the following instruction to designated Owner personnel:
  - a. Hands-On Instruction: On-site, using operational system.
  - b. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
2. Basic Operation: One-hour sessions for attendant personnel, security officers and engineering staff; combination of classroom and hands-on:
  - a. Initial Training: One session pre-closeout.
  - b. Refresher Training: One session post-occupancy.
3. Detailed Operation: Two-hour sessions for engineering and maintenance staff; combination of classroom and hands-on:
  - a. Initial Training: One session pre-closeout.
  - b. Refresher Training: One session post-occupancy.
4. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data and record drawings available during instruction.
5. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

Q. Closeout:

1. Closeout Demonstration:
  - a. Demonstrate proper operation of functions to Owner.
  - b. Be prepared to conduct any of the required tests.
  - c. Have at least one copy of operation and maintenance data, copy of project record drawings, input/output matrix and operator instruction chart(s) available during demonstration.

- d. Have authorized technical representative of control unit manufacturer present during demonstration.
  - e. Demonstration may be combined with inspection and testing required by AHJ. Notify AHJ in time to schedule demonstration.
  - f. Repeat demonstration until successful.
2. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
- a. Specified diagnostic period without malfunction has been completed.
  - b. Approved operating and maintenance data has been delivered.
  - c. Spare parts, extra materials and tools have been delivered.
  - d. All aspects of operation have been demonstrated to Architect.
  - e. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
  - f. Occupancy permit has been granted.
  - g. Specified pre-closeout instruction is complete.
3. Perform post-occupancy instruction within three months after date of occupancy.

### 3.02 FIRE ALARM CONTROL PANEL

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide control panels with 120VAC dedicated circuit per NFPA requirements.
- D. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.
- E. Provide instruction charts at each control panel where system operations are performed. Obtain approval from the Architect prior to mounting.
- F. Perform system programming at the fire alarm control panel. Program the system without shutting the system down. Programming is done off line. Provide copy of site-specific program on electronic storage media. Locate in document enclosure.
- G. Room Name Labeling: Control panel schedules, programming and labeling for electrical equipment, to use the room names and room numbers that the Architect adopts at the date of substantial completion of construction. This work is to be done at no added cost to the Owner.
- H. Programmable Function Keys: Provide control panel accessible function keys for the notification bypass, fire drill, fire door bypass, and supervising station bypass.
- I. Programmed control point activation includes selective control of HVAC, fire door release, and other fire safety and auxiliary functions.
- J. Provide machine printed labels on switches and indicators.

### 3.03 NOTIFICATION APPLIANCE CIRCUIT PANELS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide notification appliance circuit panel power supplies with 120VAC dedicated circuit per NFPA requirements.
- D. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

### 3.04 FIRE ALARM TRANSMITTERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

- C. Provide conduit and wiring for connections to the transmitter as required for fire alarm system off site supervision.
- D. Verify and provide call sequence and message as directed by Owner and the AHJ.

### 3.05 FIRE ALARM ANNUNCIATORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. When required by the manufacturer, provide fire alarm annunciator with 120VAC dedicated circuit per NFPA requirements.
- D. Provide machine printed labels on switches and indicators.
- E. Verify location with AHJ before installation.

### 3.06 MANUAL PULL STATIONS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices.
- D. Provide protective guard where device is subject to abuse and where required by AHJ.

### 3.07 FIXED TEMPERATURE HEAT DETECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by AHJ.

### 3.08 RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by AHJ.

### 3.09 PHOTOELECTRIC TYPE DETECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by AHJ.

### 3.10 DUCT-MOUNTED SMOKE DETECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

### 3.11 RELAY MODULES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification. Labels to include description of controlled function.



### 3.12 CONTROL MODULES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification. Labels to include description of controlled function.

### 3.13 INPUT MODULES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification. Labels to include description of monitored input.

### 3.14 FAULT ISOLATION MODULES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide Fault Isolator Modules for signaling line circuit per code requirements and manufacturer instructions.

### 3.15 COMBINATION HORN/STROBES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by AHJ.

### 3.16 STROBES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by AHJ.

### 3.17 HORNS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by AHJ.

### 3.18 WEATHERPROOF/SURFACE BACKBOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide manufacturer's weatherproof backbox listed for use in areas where the device or appliance is subject to humidity in excess of listed rating. Provide manufacturer surface backboxes where devices cannot be installed recessed.

### 3.19 PROTECTIVE GUARDS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

- C. Wire Guard.
- D. Protective Cover.

### 3.20 CIRCUIT CONDUCTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide wiring to meet the requirements of national, state and local electrical codes. Provide color coded wiring as recommended and specified by the fire alarm and detection system manufacturer. Provide Type FPLR cable when in a riser application or FPLP cable when installed in plenums.

### 3.21 SURGE PROTECTIONS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

### 3.22 BATTERIES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed label with installation date, and date of month and year of battery manufacture (MM/YYYY).

### 3.23 LOCKS AND KEYS

- A. Deliver to Owner.

### 3.24 DOCUMENT STORAGE CABINET

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide document storage cabinet adjacent to fire alarm control panel.

### 3.25 INSTRUCTION CHARTS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Install chart adjacent to fire control panel.

### 3.26 FRAMED FLOOR MAP

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide framed floor plan of facility adjacent to the annunciator panel identifying room names/numbers, device/addresses or fire zone number and description as utilized on the annunciator panel, as required by local AHJ. Check with the local fire department for size and approved mounting location.

END OF SECTION



COMcheck Software Version COMcheckWeb

# Interior Lighting Compliance Certificate

**Project Information**

Energy Code:

90.1 (2019) Standard

Project Title:

Applied Behavioral Analysis Clinic

Project Type:

Alteration

Construction Site:

200 Commercial St  
Klamath Falls, Oregon 97601

Owner/Agent:

Oregon Institute of Technology  
Oregon

Designer/Contractor:

Cody Bargholz  
Interface Engineering  
1600, 100 SW Main St.  
Portland, Oregon 97204  
5033822738  
codyb@interfaceeng.com

**Allowed Interior Lighting Power**

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts
1-Health Care-Clinic	5229	0.81	4235
Total Allowed Watts =			4235

**Proposed Interior Lighting Power**

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixture	D Fixture Watt.	E (C X D)
<u>Health Care-Clinic (5229 sq.ft.)</u>				
Type A2: A2: 2x2 LED: Other:	1	3	29	88
Type A4: A4: 2x4 LED: Other:	1	56	41	2302
Type B: B: Downlight: Other:	1	13	10	130
Type C: C: Strip Light: Other:	1	1	30	30
Total Proposed Watts =				2549

**Interior Lighting PASSES**

**Interior Lighting Compliance Statement**

*Compliance Statement:* The proposed interior lighting alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed interior lighting systems have been designed to meet the 90.1 (2019) Standard requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Cody Bargholz - Electrical Engineer

Signature

3/22/2024

Date



COMcheck Software Version COMcheckWeb

# Exterior Lighting Compliance Certificate

Project Information

Energy Code:90.1 (2019) Standard

Project Title:Applied Behavioral Analysis Clinic

Project Type:Alteration

Exterior Lighting Zone2 (Light industrial area with limited nighttime use (LZ2))

Construction Site:200 Commercial St  
Klamath Falls, Oregon 97601

Owner/Agent:Oregon Institute of Technology  
Oregon

Designer/Contractor:Cody Bargholz  
Interface Engineering  
1600, 100 SW Main St.  
Portland, Oregon 97204  
5033822738  
codyb@interfaceeng.com

Allowed Exterior Lighting Power

A Area/Surface Category	B Quantity	C Allowed Watts /	D Tradable Wattage	E Allowed Watts (B X C)
Entry canopy	450 ft2	0.25	Yes	112
Total Tradable Watts (a) =				112
Total Allowed Watts =				112
Total Allowed Supplemental Watts (b) =				400

- (a) Wattage tradeoffs are only allowed between tradable areas/surfaces.
- (b) A supplemental allowance equal to 400 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Proposed Exterior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixture	D Fixture Watt.	E (C X D)
Entry canopy (450 ft2): Tradable Wattage				
Type SA: SA: Wall Mounted: Other:	1	7	10	70
Total Tradable Proposed Watts =				70

Exterior Lighting PASSES

Exterior Lighting Compliance Statement

Compliance Statement: The proposed exterior lighting alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed exterior lighting systems have been designed to meet the 90.1 (2019) Standard requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Cody Bargholz - Electrical Engineer

Signature

3/22/2024

Name - Title

Date



# Inspection Checklist

Energy Code: 90.1 (2019) Standard

Requirements: 100.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
4.2.2, 8.4.1.1, 8.4.1.2, 8.7 [PR6] <sup>2</sup>	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the electrical systems and equipment and document where exceptions are claimed. Feeder connectors sized in accordance with approved plans and branch circuits sized for maximum drop of 3%.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E301
4.2.2, 9.4.3, 9.7 [PR4] <sup>1</sup>	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the interior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include interior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E002
9.7 [PR8] <sup>1</sup>	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the exterior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E201

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
8.4.2 [EL10] <sup>2</sup>	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E301
8.4.3 [EL11] <sup>2</sup>	New buildings have electrical energy use measurement devices installed. Where tenant spaces exist, each tenant is monitored separately. In buildings with a digital control system the energy use is transmitted to to control system and displayed graphically.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input checked="" type="checkbox"/> Not Applicable	<b>Exception:</b> Buildings 25,000 ft <sup>2</sup> .
9.4.1.1 [EL1] <sup>2</sup>	Automatic control requirements prescribed in Table 9.6.1, for the appropriate space type, are installed. Mandatory lighting controls (labeled as 'REQ') and optional choice controls (labeled as 'ADD1' and 'ADD2') are implemented.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E002
9.4.1.1 [EL2] <sup>2</sup>	Independent lighting controls installed per approved lighting plans and all manual controls readily accessible and visible to occupants.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E002
9.4.1.1f [EL13] <sup>1</sup>	Daylight areas under skylights and roof monitors that have more than 150 W combined input power for general lighting are controlled by photocontrols.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E002
9.4.1.4 [EL3] <sup>2</sup>	Automatic lighting controls for exterior lighting installed.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E002
9.4.1.3 [EL4] <sup>1</sup>	Separate lighting control devices for specific uses installed per approved lighting plans.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E201
9.6.2 [EL8] <sup>1</sup>	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. <b>Location on plans/spec:</b> E201

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
8.7.1 [FI16] <sup>3</sup>	Furnished as-built drawings for electric power systems within 30 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
8.7.2 [FI17] <sup>3</sup>	Furnished O&M instructions for systems and equipment to the building owner or designated representative.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
9.2.2.3 [FI18] <sup>1</sup>	Interior installed lamp and fixture lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Interior Lighting fixture schedule for values.
9.4.2 [FI19] <sup>1</sup>	Exterior lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.	<input checked="" type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Exterior Lighting fixture schedule for values.
9.4.4 [FI20] <sup>1</sup>	At least 75% of all permanently installed lighting fixtures in dwelling units have $\geq 55$ lm/W efficacy or a $\geq 45$ lm/W total luminaire efficacy.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input checked="" type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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