

PROJECT MANUAL



REQUEST FOR PROPOSAL: 2025-02
UNIVERSITY MEDICAL CENTER PHYSICIANS
NEW WOLFFORTH CLINIC
720 DONALD PRESTON DRIVE
WOLFFORTH, TEXAS 79382

A R C H I T E C T

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LUBBOCK, TEXAS 79407
(806) 788-1883

CDG 22415

DATE:
02/07/2025



Grant Alan Koertner

02/07/2025

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NOT APPLICABLE

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NOT APPLICABLE

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NOT APPLICABLE

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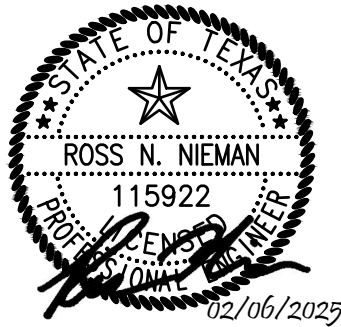
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CONSULTANT’S PROFESSIONAL RESPONSIBILITY

The specifications sections to be authenticated by my seal and signature are limited to the following:

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By: Ross Nieman, P.E.
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 Lubbock, Texas 79401
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TBPE Registration F-14148



COMcheck Software Version COMcheckWeb Envelope Compliance Certificate

Project Information

Energy Code: 2021 IECC
 Project Title: UMCP NEW WOLFFORTH CLINIC
 Location: Wolfforth, Texas
 Climate Zone: 3b
 Project Type: New Construction
 Vertical Glazing / Wall Area: 24%

Construction Site:
 720 DONALD PRESTON DRIVE
 WOLFFORTH, Texas 79382

Owner/Agent:
 UMC PHYSICIANS NETWORK
 UMC HEALTH SYSTEM
 602 INDIANA AVENUE
 LUBBOCK, Texas 79415

Designer/Contractor:
 GRANT KOERTNER
 CONDRAY DESIGN GROUP
 3708 UPLAND AVENUE
 LUBBOCK, Texas 79407
 8067486190
 WWW.CONDRAY.COM

Additional Efficiency Package(s)

Credits: 10.0 Required 12.0 Proposed
 Energy monitoring, 3.0 credit
 On-site renewable energy, 9.0 credit

Building Area

Floor Area

1-Health Care-Clinic : Nonresidential

7447

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U- Factor ^(a)
Roof: Insulation Entirely Above Deck, 3-Year-Aged Solar Reflectance Index = 65.00 (d), [Bldg. Use 1 - Health Care-Clinic]	7447	---	30.0	0.032	0.039
Floor: Unheated Slab-On-Grade, [Bldg. Use 1 - Health Care-Clinic] (c)	403	---	---	0.730	0.730
NORTH					
Ext. Wall: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Health Care-Clinic]	1322	19.0	1.1	0.098	0.064
Window: Metal Frame with Thermal Break: Fixed, Perf. Specs.: Product ID KAWNEER PUNCHED, SHGC 0.29, PF 0.55, [Bldg. Use 1 - Health Care-Clinic] (b)	52	---	---	0.350	0.420
Door: Insulated Metal, Swinging, [Bldg. Use 1 - Health Care-Clinic]	21	---	---	0.350	0.370
EAST					
Ext. Wall: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Health Care-Clinic]	1188	19.0	1.1	0.098	0.064
Window: Metal Frame with Thermal Break: Fixed, Perf. Specs.: Product ID KAWNEER CURTAIN, SHGC 0.30, PF 0.25, [Bldg. Use 1 - Health Care-Clinic] (b)	352	---	---	0.290	0.420
Window: Metal Frame with Thermal Break: Fixed, Perf. Specs.: Product ID KAWNEER, SHGC 0.29, PF 0.25, [Bldg. Use 1 - Health Care-Clinic] (b)	138	---	---	0.290	0.420
Window: Metal Frame with Thermal Break: Fixed, Perf. Specs.: Product ID KAWNEER PUNCHED, SHGC 0.29, PF 0.55, [Bldg.]	61	---	---	0.350	0.420

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U- Factor ^(a)
Use 1 - Health Care-Clinic] (b)					
SOUTH					
Ext. Wall: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Health Care-Clinic]	1380	19.0	1.1	0.098	0.064
Window: Metal Frame with Thermal Break: Fixed, Perf. Specs.: Product ID KAWNEER CURTAIN, SHGC 0.30, PF 0.25, [Bldg. Use 1 - Health Care-Clinic] (b)	418	---	---	0.290	0.420
Door: Glass (over 50% glazing): Metal Frame, Entrance Door, Perf. Specs.: Product ID STANLEY, SHGC 0.25, PF 0.44, [Bldg. Use 1 - Health Care-Clinic] (b)	98	---	---	0.350	0.680
Door: Insulated Metal, Swinging, [Bldg. Use 1 - Health Care-Clinic]	21	---	---	0.350	0.370
WEST					
Ext. Wall: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Health Care-Clinic]	980	19.0	1.1	0.098	0.064
Window: Metal Frame with Thermal Break: Fixed, Perf. Specs.: Product ID KAWNEER PUNCHED, SHGC 0.29, PF 0.55, [Bldg. Use 1 - Health Care-Clinic] (b)	27	---	---	0.290	0.420
Door: Insulated Metal, Swinging, [Bldg. Use 1 - Health Care-Clinic]	21	---	---	0.350	0.370

- (a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.
- (b) Fenestration product performance must be certified in accordance with NFRC and requires supporting documentation.
- (c) Slab-On-Grade proposed and budget U-factors shown in table are F-factors.
- (d) High albedo roof requirement options: 1) 3-year aged solar reflectance index ≥ 55.0 thermal emittance ≥ 0.75 , 2) 3-year aged solar reflectance index ≥ 64.0 , 3) Initial year aged solar reflectance ≥ 0.70 thermal emittance ≥ 0.75 , 4) Initial year aged solar reflectance index ≥ 82.0 .

Envelope PASSES: Design 7% better than code

Envelope Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed envelope systems have been designed to meet the 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Grant Koertner - Principal  02/07/2025
 Name - Title Signature Date



Inspection Checklist

Energy Code: 2021 IECC

Requirements: 0.0% 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
C103.2 [PR1] ¹	Plans and/or specifications provide all information with which compliance can be determined for the building envelope and document where exceptions to the standard are claimed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.1 [PR10] ¹	The vertical fenestration area <= 30 percent of the gross above-grade wall area.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.1 [PR11] ¹	The skylight area <= 3 percent of the gross roof area.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.2 [PR14] ¹	In enclosed spaces > 2,500 ft ² directly under a roof with ceiling heights > 15 ft. and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the following requirements apply: (a) the daylight zone under skylights is >= half the floor area; (b) the skylight area to daylight zone is >= 3 percent with a skylight VT >= 0.40; or a minimum skylight effective aperture >= 1 percent.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406 [PR9] ¹	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

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	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C303.2 [FO4] ²	Slab edge insulation installed per manufacturer's instructions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.2.1 [FO6] ¹	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C105 [FO3] ²	Installed slab-on-grade insulation type and R-value consistent with insulation specifications reported in plans and COMcheck reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<i>See the Envelope Assemblies table for values.</i>
C402.2.4 [FO7] ²	Slab edge insulation depth/length. Slab insulation extending away from building is covered by pavement or >= 10 inches of soil.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<i>See the Envelope Assemblies table for values.</i>

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	Framing / Rough-In Inspection	Complies?	Comments/Assumptions
C303.1.3 [FR12] ²	Fenestration products rated in accordance with NFRC certified and as to performance labels or certificates provided.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.3 [FR10] ¹	Vertical fenestration SHGC value.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.4.3, C402.4.3.4 [FR8] ¹	Installed vertical fenestration U-factor and SHGC consistent with label specifications and as reported in plans and COMcheck reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.4.5 [FR14] ²	U-factor of opaque swinging and nonswinging doors associated with the building thermal envelope meets requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.5.1 [FR16] ¹	The building envelope contains a continuous air barrier that is sealed in an approved manner and either constructed or tested in an approved manner. Air barrier penetrations are sealed in an approved manner.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.4 [FR18] ³	Factory-built fenestration and doors are labeled as meeting air leakage requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

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
C405.7 [EL26] ²	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.8 [EL27] ²	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.9.1, C405.9.2 [EL28] ²	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.10 [EL29] ²	Total voltage drop across the combination of feeders and branch circuits <= 5%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.1.1 [EL30] ²	At least 90% of dwelling unit permanently installed lighting shall have lamp efficacy >= 65 lm/W or luminaires with efficacy >= 45 lm/W or comply with C405.2.4 or C405.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.11, C405.11.1 [EL31] ²	50% of 15/20 amp receptacles installed in enclosed offices, conference rooms, copy rooms, break rooms, classrooms and workstations and > 25% of branch circuit feeders for modular furniture will have automatic receptacle control in accordance with C405.11.1.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

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	Insulation Inspection	Complies?	Comments/Assumptions
C303.1 [IN3] ¹	Roof insulation installed per manufacturer's instructions and is labeled with R-value or insulation certificate providing R-value and other relevant data. Blown or poured loose-fill insulation is installed only where the roof slope is ≤ 3 in 12.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.2.1 [IN20] ¹	Roof assembly meets minimal thermal resistance installed between roof framing or in a continuous fashion on the roof assembly as stipulated in Table C402.1.3. Requirements for above deck insulation, minimum thickness, suspended ceilings, staggered joints and skylight curbs will be met.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.2 [IN7] ¹	Above-grade wall insulation installed per manufacturer's instructions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C105 [IN6] ¹	Installed above-grade wall insulation type and R-value consistent with insulation specifications reported in plans and COMcheck reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.2.3 [IN8] ²	Installed floor insulation type and R-value consistent with insulation specifications reported in plans and COMcheck reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.2.6 [IN18] ³	Radiant panels and associated components, designed for heat transfer from the panel surfaces to the occupants or indoor space are insulated with a minimum of R-3.5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.3 [IN5] ³	High-albedo roofs satisfy one of the following: 3-year-aged solar reflectance ≥ 0.55 and thermal emittance ≥ 0.75 or 3-year-aged solar reflectance index ≥ 64.0 .	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C105 [IN2] ¹	Installed roof insulation type and R-value consistent with insulation specifications reported in plans and COMcheck reports. For some ceiling systems, verification may need to occur during Framing Inspection.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.5.1.1 [IN1] ¹	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed, weather stripped or wrapped with moisture vapor-permeable wrapping material to minimize air leakage.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

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
C401.3 [FI58] ¹	A thermal envelope certificate will be supplied and completed by an approved third party.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.10 [FI26] ³	Recessed luminaires in thermal envelope to limit infiltration and be IC rated and labeled. Seal between interior finish and luminaire housing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.11 [FI59] ¹	Operable openings > 40 ft2 will be interlocked with heating and cooling systems to setback setpoint temperatures within 10 minutes of opening.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.8 [FI37] ¹	Weatherseals installed on all loading dock cargo door openings and provide direct contact along the top and sides of vehicles parked in the doorway.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406.5 [FI49] ¹	On-site renewable energy credits - on-site renewable energy system supplies at least 0.86 Btuh or 0.25 watts per square foot of conditioned floor area OR provides at least 2 percent of the energy used within the building for mechanical and service water heating equipment and lighting regulated in C405.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406.10 [FI63] ¹	Energy Monitoring - the building is equipped with an energy management system to monitor, record, and report energy consumption for electrical energy, by end-use category, contain meters, a data acquisition system and employ graphical reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.1.1 [FI57] ¹	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Interior Lighting Compliance Certificate

Project Information

Energy Code: 2021 IECC
 Project Title: UMC New Wolfforth Clinic
 Project Type: New Construction

Construction Site:
 Donald Preston Drive & Preston
 Hollow Lane
 Wolfforth, Texas 79382

Owner/Agent:

Designer/Contractor:
 Ryan Kotulek
 Fincher Engineering
 5621 114th Street
 Lubbock, Texas 79424
 806-701-5109
 ryan@finchereng.com

Additional Efficiency Package(s)

Credits: 10.0 Required 31.0 Proposed
 Reduced lighting power, 31.0 credit

Allowed Interior Lighting Power

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts
1-Health Care Clinic (Health Care-Clinic)	11685	0.81	9465
Total Allowed Watts =			9465

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>1-Health Care Clinic (Health Care-Clinic)</u>				
LED: A&AE: 2'X4' CURVED LENS PANEL: LED Panel 40W:	1	43	40	1720
LED: B&BE: 2'X2' CURVED LENS PANEL: LED Panel 36W:	1	43	36	1548
LED: C&CE: 2'X4' TROFFER: LED Panel 38W:	1	3	38	114
LED: C2&C2E: 2'X2' TROFFER: LED Panel 19W:	1	4	17	68
LED: D: LINEAR SLOT LIGHT FIXTURE: LED Linear 33W:	1	1	42	42
LED: F&FE: 2'X2' RECESSED DOWNLIGHT: LED Other Fixture Unit 25W:	1	31	24	744
LED: G: ROD STYLE PENDANT: LED Other Fixture Unit 13W:	1	59	11	649
LED: H: SCULPT PENDANT LIGHT FIXTURE: LED Other Fixture Unit 40W:	1	1	40	40
LED: HE: SCULPT PENDANT LIGHT FIXTURE: LED Other Fixture Unit 36W:	1	1	32	32
LED: H2: SCULPT PENDANT LIGHT FIXTURE: LED Other Fixture Unit 60W:	1	1	56	56
LED: J: SCULPT SURFACE MOUNTED FIXTURE: LED Other Fixture Unit 46W:	1	3	32	96
LED: L: INDUSTRIAL WIDE WRAPAROUND FIXT: LED Other Fixture Unit 50W:	1	16	50	800
LED: M: LINEAR WALL WASH FIXTURE: LED Linear 22W:	1	1	27	27
LED: S&SE: LINEAR STRIP LIGHT: LED Linear 22W:	1	3	25	75
LED: U: UNDERCABINET LIGHT FIXTURE: LED Other Fixture Unit 16W:	1	6	17	102
LED: V: VANITY LIGHT FIXTURE: LED Other Fixture Unit 13W:	1	6	14	84
LED: X: EXIT SIGN: LED Other Fixture Unit 6.5W:	1	8	2	16
Total Proposed Watts =			6213	

Interior Lighting Compliance Statement

Compliance Statement: The proposed interior lighting design 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 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Ryan Kotulek
Name - Title


Signature

2/6/25
Date



Exterior Lighting Compliance Certificate

Project Information

Energy Code: 2021 IECC
 Project Title: UMC New Wolfforth Clinic
 Project Type: New Construction
 Exterior Lighting Zone: 2 (Light industrial area with limited nighttime use (LZ2))

Construction Site:
 Donald Preston Drive & Preston
 Hollow Lane
 Wollforth, Texas 79382

Owner/Agent:

Designer/Contractor:
 Ryan Kotulek
 Fincher Engineering
 5621 114th Street
 Lubbock, Texas 79424
 806-701-5109
 ryan@finchereng.com

Allowed Exterior Lighting Power

A Area/Surface Category	B Quantity	C Allowed Watts /	D Tradable Wattage	E Allowed Watts (B X C)
Parking Lot (Parking area)	58500 ft2	0.04	Yes	2340
Total Tradable Watts (a) =				2340
Total Allowed Watts =				2340
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)
<u>Parking Lot (Parking area, 58500 ft2): Tradable Wattage</u>				
LED: K&K2: CONTINOUS LED LINEAR: Other:	1	1	444	444
LED: K2E&K3E: CONTINOUS LED LINEAR: Other:	1	1	548	548
LED: W&WE: TRAPEZOIDIAL WALL PACK: LED Other Fixture Unit 25W:	1	8	25	200
LED: AA: SINGLE HEAD POLE LIGHT FIXTURE: LED Other Fixture Unit 125W:	1	4	147	588
Total Tradable Proposed Watts =				1780

Exterior Lighting PASSES: Design 35% better than code

Exterior Lighting Compliance Statement

Compliance Statement: The proposed exterior lighting design 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 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Ryan Kotulek
 Name - Title


 Signature

2/6/25
 Date



Inspection Checklist

Energy Code: 2021 IECC

Requirements: 18.0% 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
C103.2 [PR4] ¹	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 type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C103.2 [PR8] ¹	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 type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406 [PR9] ¹	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

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
C405.2.3.1 [EL22] ¹	Spaces required to have light-reduction controls have a manual control that allows the occupant to reduce the connected lighting load in a reasonably uniform illumination pattern ≥ 50 percent.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.2.1, C405.2.1.1 [EL18] ¹	Occupancy sensors installed in classrooms/lecture/training rooms, conference/meeting/multipurpose rooms, copy/print rooms, lounges/breakrooms, enclosed offices, open plan office areas, restrooms, storage rooms, locker rooms, corridors, warehouse storage areas, and other spaces ≤ 300 sqft that are enclosed by floor-to-ceiling height partitions. Reference section language C405.2.1.2 for control function in warehouses and section C405.2.1.3 for open plan office spaces.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Lighting that is related to means of egress in stairways, ramps, corridors.
C405.2.1.2 [EL19] ¹	Occupancy sensors control function in warehouses: In warehouses, the lighting in aiseways and open areas is controlled with occupant sensors that automatically reduce lighting power by 50% or more within 20 minutes of when the areas are unoccupied. The occupant sensors control lighting in each aisleway independently and do not control lighting beyond the aisleway being controlled by the sensor. Lights not turned off by occupant sensors is done so by time-switch.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
C405.2.1.3 [EL20] ¹	Occupant sensor control function in open plan office areas: Occupant sensor controls in open office spaces ≥ 300 sq.ft. have controls 1) configured so that general lighting can be controlled separately in control zones with floor areas ≤ 600 sq.ft. within the space, 2) general lighting in each zone permitted to turn on upon occupancy in control zone, 3) automatically turn off general lighting in all control zones within 20 minutes after all occupants have left the space, 4) are configured so that general lighting power in each control zone is reduced by $\geq 80\%$ of the full zone general lighting power within 20 minutes of all occupants leaving that control zone.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
C405.2.2, C405.2.2.1 [EL21] ²	Each area not served by occupancy sensors (per C405.2.1.1) have time-switch controls and functions detailed in sections C405.2.2.1.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Lighting that is related to means of egress in stairways, ramps, corridors, or emergency routes.

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
C405.2.4, C405.2.4.1, C405.2.4.2 [EL23] ²	Daylight zones provided with individual controls that control the lights independent of general area lighting. See code section C405.2.3 Daylight-responsive controls for applicable spaces, C405.2.3.1 Daylight responsive control function and section C405.2.3.2 Sidelit zone.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.2.5 [EL27] ¹	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.2.7 [EL28] ¹	Automatic lighting controls for exterior lighting installed. Controls will be daylight controlled, set based on business operation time-of-day, or reduce connected lighting > 30%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.7 [EL26] ²	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.8 [EL27] ²	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.9.1, C405.9.2 [EL28] ²	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
C405.10 [EL29] ²	Total voltage drop across the combination of feeders and branch circuits <= 5%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.1.1 [EL30] ²	At least 90% of dwelling unit permanently installed lighting shall have lamp efficacy >= 65 lm/W or luminaires with efficacy >= 45 lm/W or comply with C405.2.4 or C405.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
C405.11, C405.11.1 [EL31] ²	50% of 15/20 amp receptacles installed in enclosed offices, conference rooms, copy rooms, break rooms, classrooms and workstations and > 25% of branch circuit feeders for modular furniture will have automatic receptacle control in accordance with C405.11.1.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: 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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Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3, C408.2.5.2 [FI17] ³	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	
C405.5.1 [FI19] ¹	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 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.
C406.3 [FI67] ¹	Reduced lighting power - this credit specifies that the connected lighting power is >= 10% more efficient than 2021 IECC requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.1.1 [FI57] ¹	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.5 [FI16] ³	Furnished as-built drawings for electric power systems within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.3 [FI33] ¹	Lighting systems have been tested to ensure proper calibration, adjustment, programming, and operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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COMcheck Software Version COMcheckWeb Mechanical Compliance Certificate

Project Information

Energy Code: 2021 IECC
Project Title: UMC New Wolfforth Clinic
Location: Wolfforth, Texas
Climate Zone: 3b
Project Type: New Construction

Construction Site:
Donald Preston Drive & Preston
Hollow Lane
Wolfforth, Texas 79382

Owner/Agent:

Designer/Contractor:
Cory Cotton
Fincher Engineering
5621 114th Street
Lubbock, Texas 79424
806-701-5109
cory@finchereng.com

Additional Efficiency Package(s)

Credits: 10.0 Required 31.0 Proposed
Reduced lighting power, 31.0 credit

Mechanical Systems List

Quantity System Type & Description

- 3 RTU-1,3,5 (Single Zone):
Heating: 1 each - Central Furnace, Gas, Capacity = 65 kBtu/h
Proposed Efficiency = 81.00% Et, Required Efficiency: 80.00 % Et or 80% AFUE
Cooling: 1 each - Single Package DX Unit, Capacity = 36 kBtu/h, Air-Cooled Condenser, Air Economizer
Proposed Efficiency = 17.50 SEER2, Required Efficiency = 13.40 SEER2
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: 1200 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
1200 Supply, Constant Volume, 1200 CFM, 0.5 motor nameplate hp, 1.00 fan energy index
- 1 RTU-2 (Single Zone):
Heating: 1 each - Central Furnace, Gas, Capacity = 108 kBtu/h
Proposed Efficiency = 81.00% Et, Required Efficiency: 80.00 % Et or 80% AFUE
Cooling: 1 each - Single Package DX Unit, Capacity = 48 kBtu/h, Air-Cooled Condenser, Unknown Economizer
Proposed Efficiency = 17.30 SEER2, Required Efficiency = 13.40 SEER2
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: 1700 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
1700 Supply, Constant Volume, 1700 CFM, 1.0 motor nameplate hp, 1.00 fan energy index
- 1 RTU-4 (Single Zone):
Heating: 1 each - Central Furnace, Gas, Capacity = 240 kBtu/h
Proposed Efficiency = 81.00% Et, Required Efficiency: 81.00 % Et
Cooling: 1 each - Single Package DX Unit, Capacity = 150 kBtu/h, Air-Cooled Condenser, Air Economizer
Proposed Efficiency = 10.80 EER, Required Efficiency = 10.80 EER
Proposed Part Load Efficiency = 15.40 IEER, Required Part Load Efficiency = 14.00 IEER
Fan System: 5000 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
5000 Supply, Constant Volume, 5000 CFM, 3.8 motor nameplate hp, 1.00 fan energy index
- 1 MS-1 (Single Zone):
Split System Heat Pump
Heating Mode: Capacity = 26 kBtu/h,
Proposed Efficiency = 9.50 HSPF2, Required Efficiency = 7.50 HSPF2
Cooling Mode: Capacity = 22 kBtu/h,

Quantity System Type & Description

Proposed Efficiency = 22.00 SEER2, Required Efficiency = 14.30 SEER2

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: 919 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

919 Supply, Constant Volume, 919 CFM, 0.1 motor nameplate hp, 1.00 fan energy index

1 UH-1 (Unknown w/ PerimeterSystem):

Heating: 1 each - Unit Heater, Electric, Capacity = 17 kBtu/h

No minimum efficiency requirement applies

Fan System: 350 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

350 Supply, Constant Volume, 350 CFM, 0.1 motor nameplate hp, 1.00 fan energy index

2 RH-1,2 (Single Zone w/ PerimeterSystem):

Heating: 1 each - Radiant Heater, Gas, Capacity = 75 kBtu/h

No minimum efficiency requirement applies

1 Water Heater:

Gas Storage Water Heater, Capacity: 129 gallons, Input Rating: 100 kBtu/h w/ Circulation Pump

Proposed Efficiency: 96.00 % Et, Required Efficiency: 80.00 % Et

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Cory Cotton - Mechanical Designer

Name - Title

Cory Cotton

Signature

02/06/2025

Date



Inspection Checklist

Energy Code: 2021 IECC

Requirements: 18.0% 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
C103.2 [PR2] ¹	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical and service water heating systems and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks. Hot water system sized per manufacturer's sizing guide.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406 [PR9] ¹	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

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	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 [PL6] ³	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.1, C404.6.2 [PL3] ¹	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.3 [PL7] ³	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.1, C404.6.1.1 [PL8] ³	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

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	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 [ME41] ³	Thermally ineffective panel surfaces of sensible heating panels have insulation $\geq R-3.5$.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.12.3 [ME61] ²	HVAC piping insulation insulated in accordance with Table C403.11.3. Insulation exposed to weather is protected from damage and is provided with shielding from solar radiation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.8.1 [ME65] ³	HVAC fan systems at design conditions do not exceed allowable fan system motor nameplate hp or fan system bhp.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<i>See the Mechanical Systems list for values.</i>
C403.8.3 [ME117] ²	Fans have a fan energy index (FEI) ≥ 1.00 . Variable volume fans will have an FEI ≥ 0.95 .	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.8.4 [ME142] ²	Motors for fans that are not less than 1/12 hp and less than 1 hp are electronically commutated motors or have a minimum motor efficiency of 70 percent. These motors have the means to adjust motor speed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.8.6 [ME143] ²	Each DX cooling system > 65 kBtu and chiller water/evaporative cooling system with fans $> 1/4$ hp are designed to vary the indoor fan airflow as a function of load and comply with detailed requirements of this section.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.9 [ME144] ²	Large diameter fans where installed shall be tested and labeled in accordance with AMCA 230.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.13.1 [ME71] ²	Systems that heat outside the building envelope are radiant heat systems controlled by an occupancy sensing device or timer switch.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.3 [ME55] ²	HVAC equipment efficiency verified.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<i>See the Mechanical Systems list for values.</i>
C403.5.5 [ME113] ²	Fault detection and diagnostics installed with air-cooled unitary DX units or VRF units having economizers.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.2 [ME59] ¹	Natural or mechanical ventilation is provided in accordance with International Mechanical Code Chapter 4. Mechanical ventilation has capability to reduce outdoor air supply to minimum per IMC Chapter 4.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.7.1 [ME59] ¹	Demand control ventilation provided for spaces >500 ft ² and >15 people/1000 ft ² occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.7.2 [ME115] ³	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.7.6 [ME141] ³	HVAC systems serving guestrooms in Group R-1 buildings with > 50 guestrooms: Each guestroom is provided with controls that automatically manage temperature setpoint and ventilation (see sections C403.7.6.1 and C403.7.6.2).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.7.4 [ME57] ¹	Exhaust air energy recovery on systems meeting Table C403.7.4(1) and C403.7.4(2).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.7.5 [ME116] ³	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.12.1 , C403.12.2 [ME60] ²	HVAC ducts and plenums insulated in accordance with C403.11.1 and constructed in accordance with C403.11.2, verification may need to occur during Foundation Inspection.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.5, C403.5.1, C403.5.2 [ME62] ¹	Air economizers provided where required, meet the requirements for design capacity, control signal, ventilation controls, high-limit shut-off, integrated economizer control, and provide a means to relieve excess outside air during operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.5.2 [ME16] ¹	Economizer operation will not increase heating energy use during normal operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.5.3. 3 [ME124] ¹	Air economizers automatically reduce outdoor air intake to the design minimum outdoor air quantity when outdoor air intake will not reduce cooling energy usage. See Table C403.5.3.3 for applicable device types and climate zones.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.5.3. 4 [ME125] ¹	System capable of relieving excess outdoor air during air economizer operation to prevent over pressurizing the building. The relief air outlet located to avoid recirculation into the building.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.5.3.5 [ME126] ¹	Return, exhaust/relief and outdoor air dampers used in economizers have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Reference section C403.7.7 for details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.3.3.2 [ME121] ³	Closed-circuit cooling tower within heat pump loop have either automatic bypass valve or lower leakage positive closure dampers. Open-circuit tower within heat pump loop have automatic valve to bypass all heat pump water flow around the tower. Open- or closed-circuit cooling towers used in conjunction with a separate heat exchanger have heat loss by shutting down the circulation pump on the cooling tower loop. Open- or closed circuit cooling towers have a separate heat exchanger to isolate the cooling tower from the heat pump loop, and heat loss is controlled by shutting down the circulation pump on the cooling tower loop.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.1.4 [ME63] ²	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60F and cooling setpoint >= 80F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.3.3 [ME35] ¹	Hot gas bypass limited to: <=240 kBtu/h - 50% >240 kBtu/h - 25%	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.2.1 [ME111] ²	Gas-fired water-heating equipment installed in new buildings: where a singular piece of water-heating equipment >= 1,000 kBtu/h serves the entire building, thermal efficiency >= 92 Et. Where multiple pieces of water-heating equipment serve the building with combined rating >= 1,000 kBtu/h, the combined input-capacity-weighted-average thermal efficiency >= 90 Et. Exclude input rating of equipment in individual dwelling units and equipment <= 100 kBtu/h.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.2.1 [ME53] ³	Air outlets and zone terminal devices have means for air balancing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.11.3, C403.11.3.1, C403.11.3.2 [ME123] ³	Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.11.3.1 and refrigeration compressor systems that comply with C403.11.3.2..	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

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
C405.7 [EL26] ²	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.8 [EL27] ²	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.9.1, C405.9.2 [EL28] ²	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
C405.10 [EL29] ²	Total voltage drop across the combination of feeders and branch circuits <= 5%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.1.1 [EL30] ²	At least 90% of dwelling unit permanently installed lighting shall have lamp efficacy >= 65 lm/W or luminaires with efficacy >= 45 lm/W or comply with C405.2.4 or C405.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
C405.11, C405.11.1 [EL31] ²	50% of 15/20 amp receptacles installed in enclosed offices, conference rooms, copy rooms, break rooms, classrooms and workstations and > 25% of branch circuit feeders for modular furniture will have automatic receptacle control in accordance with C405.11.1.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: 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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Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3, C408.2.5.3 [F18] ³	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.1.1 [F150] ³	HVAC systems and equipment design loads calculated in accordance with ANSI/ASHRAE/ACCA Standard 183 or by an approved equivalent computational procedure	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.3.1 [F127] ³	HVAC systems and equipment capacity does not exceed calculated loads.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.1 [F147] ³	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.1.1 [F142] ³	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.1.2 [F138] ³	Thermostatic controls have a 5 °F deadband.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.1.3 [F120] ³	Temperature controls have setpoint overlap restrictions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.2 [F139] ³	Each zone equipped with setback controls using automatic time clock or programmable control system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.2.1, C403.4.2.2 [F140] ³	Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.2.3 [F141] ³	Systems include optimum start controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.3 [F111] ³	Heat traps installed on supply and discharge piping of non-circulating systems.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.4 [F125] ²	All piping insulated in accordance with section details and Table C403.12.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C404.6.1 [FI12] ³	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank. System return pipe is a dedicated return pipe or a cold water supply pipe.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406.3 [FI67] ¹	Reduced lighting power - this credit specifies that the connected lighting power is >= 10% more efficient than 2021 IECC requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.1.1 [FI57] ¹	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.1 [FI28] ¹	Commissioning plan developed by registered design professional or approved agency.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.3.1 [FI31] ¹	HVAC equipment, systems and system-to-system relationships have been tested to ensure proper operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.3.2 [FI10] ¹	HVAC and service water heating control systems have been tested to ensure proper operation, calibration and adjustment of controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.3.3 [FI32] ¹	Economizers have been tested to ensure proper operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.4 [FI29] ¹	Preliminary commissioning report completed and certified by registered design professional or approved agency.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.5 [FI7] ³	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.5.1 [FI43] ¹	An air and/or hydronic system balancing report is provided for HVAC systems.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.5.2 [FI30] ¹	Final commissioning report due to building owner within 90 days of receipt of certificate of occupancy.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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PUBLIC NOTICE

REQUEST FOR PROPOSAL: 2025-02

The Lubbock County Hospital District will receive Competitive Sealed Proposals for the following University Medical Center project:

UMCP New Wolfforth Clinic

The proposals will be received until **3:00 p.m. cst, Wednesday, March 05, 2025**, in the UMC Health System, Medical Office Building 1, Suite 240, 3502 9th Street, Lubbock, Texas 79415. Proposals will be opened and the proposer's name and dollar amounts to be read aloud.

A Pre-Proposal Conference will be held virtually on **Tuesday, February 18, 2025 at 11:00 a.m. cst** as a Microsoft Teams Meeting. The link for this meeting will be provided in the Project Manual or can be requested by sending an email to the contact below.

Proposal documents and plans may be obtained upon request from The Reproduction Company at 2102 Avenue Q, Lubbock, TX, 79411 at the contractor's expense.

Please contact Grant Koertner at the office of the Architect at (806) 748-6190 or at grant@condray.com with questions.

Sincerely,

Maria "Alex" Villarreal
Contract Administrator
University Medical Center



UMC HEALTH SYSTEM

Service • Teamwork • Leadership

REQUEST FOR

COMPETITIVE SEALED PROPOSALS

CONSTRUCTION SERVICES

RFP Number: **2025-02**
UNIVERSITY MEDICAL CENTER PHYSICIANS
NEW WOLFFORTH CLINIC

UMC MUST RECEIVE SEALED PROPOSALS BEFORE:
3:00 p.m., CST, Wednesday, March 05, 2025

NOTE: Proposal must either be received or time stamped at **the office of Maria “Alex” Villarreal, Contract Administrator, UMC Health System, Medical Office Plaza 1, Suite 240 (Second Floor) 3502 9th Street, Lubbock, TX 79415; Maria.Villarreal@umchealthsystem.com** before the hour and date specified for receipt of proposal.

UMC will receive sealed proposals until the date and time established for receipt. After receipt, only the names of Proposers and monetary amount of the proposals will be made public.

REFER INQUIRIES TO ARCHITECT:

Condray Design Group
Grant Koertner
3708 Upland Avenue
Lubbock, Texas 79407
Email: grant@condray.com
or
Telephone: (806) 748-6190

REQUEST FOR PROPOSALS

1. OWNER

University Medical Center
602 Indiana Avenue
Lubbock, Texas 79415

2. PROJECT

University Medical Center Physicians
New Wolfforth Clinic
602 Indiana Avenue
Lubbock, Texas 79415

3. ARCHITECT

Condray Design Group
3708 Upland Avenue
Lubbock, Texas 79407

4. DESCRIPTION

- A. University Medical Center (UMC) is soliciting **COMPETITIVE SEALED PROPOSALS** for The construction of a new medical clinic facility located in Wolfforth, Texas. The building is approximately 9,214 s.f. and includes a medical clinic office with drive through testing. You are invited to submit a proposal for furnishing of all labor, materials, services, and equipment necessary for and incidental to the work as called for on the Drawings and in the Project Manual.
- B. A contract will be awarded based on which proposal offers the best value to the Owner for the Project after the evaluation and ranking of proposals as described in the Instructions to Proposers.
- C. Estimated Construction Budget: \$4,500,000.00

5. BASIS OF PROPOSALS

- A. Proposals shall be made on a stipulated sum basis on the attached forms for furnishing of all labor, materials, services, and equipment necessary for and incidental to the work as called for on the Drawings and in the Project Manual.
- B. Owner will be utilizing the Competitive Sealed Proposal (CSP) procurement method as authorized by Texas Government Code, Chapter 2269.001 - .059, and Subchapter D. The selection criteria used to evaluate each proposer's proposal is stipulated in the Instructions to Proposers.

6. SUBMISSION OF PROPOSALS

- A. Owner will receive sealed proposals until the given time, date, and location. Owner will consider proposals prepared in compliance with the Instruction to Proposers issued by the Owner, and delivered as follows:
- B. Proposal Due Date: March 5, 2025**
- C. Proposal Due Time: 3:00 p.m. cst**

- D. Proposal Delivered to:
UMC Health System
Medical Office Plaza 1, Suite 240
3502 9th Street
Lubbock, Texas 79415
Attn: Maria “Alex” Villarreal, Contract Administrator
maria.villarreal@umchealthsystem.com
806.761.0812
- E. Sealed proposals will be received until the time and date specified for receipt.
- F. Any proposals received after the deadline will be returned to the sender unopened.

7. PROPOSAL DOCUMENTS

- A. Public Advertisements for this Project have been placed in the local newspaper on **February 9, 2025 and February 23, 2025.**
- B. Electronic Proposal Documents may be acquired from the office of the Architect beginning **February 10, 2025 at 4:00 p.m.** or after and at the following plan room the same day:
The Reproduction Co.
2102 Avenue Q
Lubbock, Texas 79411
- C. General Contractors may secure an electronic copy of Proposal Documents from the Architect’s FTP site as follows:
Download documents (.PDF file extension format) from
<https://cdg.sharefile.com/d-s973ce73f79cf41dfa7be954173da6952>
after registering as a plan holder. No cost or deposit required for this option.
- D. Proposal Documents will not be provided to subcontract proposer.
- E. No partial sets will be issued.

8. ADDENDA

- A. Addenda will be issued to document holders by one of the following methods:
 - 1. E-mail notification to document holder with link to download addenda from the Architect’s office.
 - 2. For document holders without e-mail, addenda may be picked up at the issuing office or mailed via the United States Postal Service (USPS).
- B. Addenda will not be faxed to document holders.

9. PRE-PROPOSAL CONFERENCE

- A. A pre-proposal conference will be held **Tuesday, February 18, 2025 at 11:00 a.m. cst** as a virtual meeting hosted on Microsoft Teams. The link for the meeting is below, or can be requested by sending an email to the Architect listed.

https://teams.microsoft.com/l/meetup-join/19%3ameeting_Mzc0ZDZhZWItODEzOS00MmE3LWFiMzgtY2YxMjM2YTQyOTM3%40thread.v2/0?context=%7b%22Tid%22%3a%22804a17b4-4962-4f38-ad5c-115cc86f8aa4%22%2c%22Oid%22%3a%22faebe01e-8590-46f2-845e-afc69e9bc71d%22%7d

- B. Any Proposer that does not attend, or does not sign in to the conference, will be considered absent.

10. PROPOSAL SECURITY

- A. Proposal security in the sum of 5% of the total proposal amount and in the form of a cashier's check, certified check, or Surety Bond, shall accompany all proposals as stipulated in the Instruction to Proposers.

11. OPENING OF PROPOSALS

- A. Proposals will be publicly opened in the identified location immediately after closing of time proposals are due, on the date due, to identify the names of each proposer and their respective proposed cost.
- B. No interviews will be conducted for this Proposal.
- C. Within forty-five (45) days of opening the Proposals, the designated Selection Committee will convene in closed session to evaluate and rank each Proposal with respect to the published Selection Criteria. The designated Selection Committee shall select the highest ranked Proposer that submits the proposal that offers the best value for the Owner based on the published selection criteria and point system. The Owner shall first attempt to negotiate a contract with the selected Proposer. The Owner may discuss with the selected Proposer options for a scope or time modification and any price change associated with the modification. Other than the data read at the Proposal opening, the Owner shall not disclose any information derived from the Proposals submitted by competing proposers in conducting such discussions.
- D. If the Owner is unable to negotiate a satisfactory contract with the selected Proposer, the Owner shall formally and in writing, end negotiations with that Proposer and proceed to negotiate with the next Proposer in the order of the selection ranking until a contract is reached or negotiations with all ranked Proposers end.
- E. If the Owner negotiates a contract with a selected Proposer, the Owner will present the negotiated contract to the Owner's Finance Committee for recommendation of approval to the Owner's Board of Managers or directly to the Owner's Board of Managers.
- F. It is the intent of the Owner to enter into a contract with the selected Proposer at the earliest scheduled Board Meeting. **(March 24, 2025)**
- G. Following the Owner's award of a contract or Proposal rejection action, the Proposers will be notified by facsimile or e-mail message.
- H. The award or rejection action regarding this Proposal is at the sole discretion of the Owner and the Owner makes no warranty regarding this Proposal that a contract will be awarded to any proposer.
- I. The Owner agrees that if the Contract is awarded, it will be awarded to the Proposer offering the best value to the Owner. The Owner is not bound to accept the lowest priced Proposal if that Proposal is judged not to be the best value for the Owner, as determined by the Owner based on the selection criteria stated in the Request for Proposals.

12. PROPOSAL EVALUATION COMMITTEE

- A. The Evaluation Committee will be composed of the following people:

Zach Sawyer, UMC	Grant Koertner, CDG
Edward Munoz, UMC	Justin Fincher, Fincher Engineering
Tim McLean, McLean's Consulting	

- B. All questions concerning the proposal shall be directed to Grant Koertner, Architect.

13. FORMALITIES

- A. The Owner reserves the right to waive irregularities and to reject all proposals.
- B. Any interlineations or notation on any submitted proposal form must be initiated by the signer or the signer's designee for the proposal at the time of such marking.
- C. Any interlineations or notation on the envelope and/or cover of the submitted proposal must be initiated by the signer or the signer's designee of the proposal at the time of such marking.

14. APPLICABLE GOVERNING LAWS AND REGULATIONS

- A. In accordance with the Instruction to Proposers, all proposers shall comply with State Labor Laws concerning prevailing wage rates.

15. PERFORMANCE, PAYMENT, AND PROPOSAL BONDS:

- A. As a part of this proposal, each Proposer shall provide a Letter of Intent to issue Performance and Payment Bonds from the Proposer's bonding company listing availability of current bonding capacity and amount of work currently under bond. The Proposer shall establish through this letter the ability to provide the bonds in the amount of the published budget and schedule.
- B. Before beginning the Work and, in any case, within ten (10) days after the contract is signed, the successful Proposer shall furnish Performance and Payment Bonds to the owner for 100% of the Contract Amount and in accordance with Texas Government Code Chapter 2253.
- C. In addition to the Performance and Payment Bonds, the Proposer shall provide a good and sufficient proposal bond in the amount of 5% of the total estimated contract price. A proposal bond must be executed with a surety company authorized to do business in this state. See "Instructions to Proposers," Section 5.2, "Proposal Security."

16. CONSTRUCTION SCHEDULE:

- A. It is the intent of the Owner to issue Notice to Proceed within two (2) weeks of the Board of Manager's approval of the Proposal. The commencement date will be fixed in a Notice to Proceed.

END OF SECTION

INSTRUCTIONS TO PROPOSERS

ARTICLE 1 – DEFINITIONS

- 1.1 **Proposal Documents** include the Proposal Requirements and the proposed Contract Documents.
 - 1.1.1 **Proposal Requirements** consist of the Advertisement of Proposals, Instructions to Proposers, the Proposal Form, and other sample proposal and contract forms.
 - 1.1.2 **Contract Documents** consist of the Form of Agreement between the Owner and Contractor, Conditions of the Contract, Drawings, Project Manual that includes Specification Sections, and all Addenda issued prior to execution of the Contract.
- 1.2 **Definitions** set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Proposal Documents.
- 1.3 **Addenda** are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Proposal Documents by additions, deletions, clarifications or corrections.
- 1.4 A **Proposal** is a complete and properly signed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Proposal Documents.
- 1.5 The **Base Proposal** is the sum stated in the Proposal for which the Proposer offers to perform the Work described in the Proposal Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Proposals.
- 1.6 An **Alternate Proposal** (or Alternate) is an amount stated in the Proposal to be added to or deducted from the amount of the Base Proposal if the corresponding change in the Work, as described in the Proposal Documents, is accepted.
- 1.7 **Unit Price** is an amount stated in the Proposal as a price for measurement of materials, equipment or services or a portion of the Work as described in the Bidding Documents.
- 1.8 **Proposer** is a person or entity who submits a Proposal.
- 1.9 **Sub-proposer** is a person or entity who submits a proposal to a Proposer for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 – PROPOSER’S REPRESENTATIONS

- 2.1 Proposer, by making a Proposal, represents that:
 - 2.1.1 Proposer has read and understands the Proposal Documents and the Proposal is made in accordance therewith.
 - 2.1.2 Proposer has read and understands the Proposal Documents or Contract Documents, to the extent that such documentation related to the Work for the Proposal is submitted.
 - 2.1.3 Proposer has visited the site and become familiar with local conditions under which the Work is to be performed and has correlated the Proposer’s personal observations with the requirements of the proposed Contract Documents.

2.1.3.1 Proposer should be familiar with the adjacent working conditions.

2.1.4 The Proposal is based upon the materials, equipment and systems required by the Proposal Documents without exception.

ARTICLE 3 - PROPOSER COMMUNICATIONS

3.1 *Except as provided in this Proposal* and as otherwise necessary for the conduct of ongoing UMC business operations, Proposers are expressly and absolutely prohibited, directly or indirectly, from engaging in communications with system personnel who are involved in any manner in the review and/or evaluation of the proposals, selection of a proposer, and/or negotiation or formalization of any agreement or any other UMC person, including members of the Board of Managers, officers, agents, or other employees of UMC. **IF ANY PROPOSER ENGAGES IN CONDUCT OR COMMUNICATIONS THAT UMC DETERMINES IS CONTRARY TO THE PROHIBITIONS SET FORTH IN THIS SECTION, UMC MAY, AT ITS SOLE DISCRETION, DISQUALIFY THE PROPOSER AND WITHDRAW THE PROPOSER'S PROPOSAL FROM CONSIDERATION.**

3.2 UMC is committed to operating in an ethical and lawful manner. In addition to established policies and procedures for the resolution of concerns regarding UMC operations, UMC has selected a hotline service (EthicsPoint) for use by our employees, patients and their families, physicians, and other individuals/parties. The EthicsPoint hotline service is for any concern, including but not limited to compliance, patient care and safety, HIPAA privacy/security, Human Resources, workplace safety, vendor relations. The information provided to EthicsPoint will be sent to UMC on a confidential basis. While reporters can remain anonymous, leaving contact information is often helpful in investigating reports. Proposers who have concerns about inappropriate proposal activity may report those concerns to the EthicsPoint hotline by phone at 1-888-329-6445 or by website at <https://secure.ethicspoint.com/domain/media/en/gui/23121/index.html>. Proposers may also contact UMC's Chief Compliance Officer, Robert Brace, directly at 806-761-0995.

ARTICLE 4 – PROPOSAL DOCUMENTS

4.1 COPIES

4.1.1 Proposers may obtain complete digital sets of the Proposal Documents from <https://cdg.sharefile.com/d-s973ce73f79cf41dfa7be954173da6952> as stated in the Advertisement for Proposals.

4.1.2 Proposal Documents will not be issued directly to Sub-proposers or others unless specifically offered in the Advertisement for Proposals.

4.1.3 Proposers shall use complete sets of Proposal Documents in preparing Proposals; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Proposal Documents.

4.1.4 In making copies of the Proposal Documents available on the above terms, the Owner and the Architect do so only for the purpose of obtaining Proposals on the Work and do not confer a license or grant permission for any other use of the Proposal Documents.

4.2 INTERPRETATION OR CORRECTION OF PROPOSAL DOCUMENTS

- 4.2.1 The Proposer shall carefully study and compare the Proposal Documents with each other, and with other work being proposed concurrently or presently under construction to the extent that it relates to the Work for which the Proposal is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.
- 4.2.2 Proposers and Sub-proposers requiring clarification or interpretation of the Proposal Documents shall make a written request which shall reach the Architect at least **seven (7) days** prior to the date for receipt of Proposals.
- 4.2.3 Interpretations, corrections and changes of the Proposal Documents will be made by Addendum. Interpretations, corrections and changes of the Proposal Documents made in another manner will not be binding, and Proposers shall not rely upon them.

4.3 SUBSTITUTIONS

- 4.3.1 Materials, products, and equipment described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.
- 4.3.2 No substitution will be considered prior to receipt of Proposals unless written request for approval has been received by the Architect at least **seven (7) days** prior to the date for receipt of Proposals. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. An item by item (line by line) comparison of each item listed in the specification shall be compiled and submitted comparing specified material/product with proposed substitution. A statement setting forth changes in other material, equipment or other portions of the Work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included. The burden of proof of the merit of the proposed substitution is upon the Proposer. Architect approval is for manufacturer only, and not specific material, system or equipment. Approved manufacturer's material, system or equipment is subject to additional and final review after award of contract and submitted for Architect's approval during Construction Administration submittal/shop drawing review process. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- 4.3.3 If the Architect approves a proposed substitution prior to receipt of Proposals, such approval will be set forth in an Addendum. Proposers shall not rely upon approvals made in any other manner.
- 4.3.4 No substitutions will be considered after the Contract award unless otherwise specifically noted in the Proposal Documents.

4.4 ADDENDA

- 4.4.1 Addenda will be issued at the same FTP site and link listed above in 4.1, by email, or mail (if internet service is not available) to all who are known by the issuing office to have received a complete set of Proposal Documents. See Section 1.8 of the document titled Request for Proposals.

- 4.4.2 Copies of Addenda will be made available for inspection wherever Proposal Documents are on file for that purpose.
- 4.4.3 No Addenda will be issued later than two (2) days prior to the date for receipt of Proposals except an Addendum withdrawing the Request for Proposals or one which includes postponement of the date for receipt of Proposals.
- 4.4.4 Each Proposer shall ascertain, prior to submitting a Proposal, that the Proposer has received all Addenda issued, and the Proposer shall acknowledge their receipt in the Proposal.

ARTICLE 5 – PROPOSAL PROCEDURES

5.1 FORM AND STYLE OF PROPOSALS

- 5.1.1 Proposals shall be bound, include a table of contents, information located behind tabs and the requested information shall be organized and numbered (lettered) in the exact order as the selection criteria as listed in table titled “**AWARD SELECTION CRITERIA**” in Section 6.4.1 below.
- 5.1.2 Proposals shall be submitted on forms identical to the form included with the Proposal Documents.
- 5.1.3 All blanks of the proposal form shall be filled in by typewriter or manually, in ink.
- 5.1.4 Where so indicated by the makeup of the proposal form, sums shall be expressed in both words and figures, and in case of discrepancy between the two, the amount written in words shall govern.
- 5.1.5 Interlineations, alterations, and erasures, on any proposal form or envelope that contains any proposal whether handwritten, typed or printed, must be initialed by the signer of the Proposal or the signer’s designee, or the Proposal may be considered invalid.
- 5.1.6 All requested Alternates shall be proposed. If no change in cost to the Base Proposal is required, mark “No Change.”
- 5.1.7 Each copy of the Proposal shall include the legal name of the Proposer and a statement that the Proposer is a sole proprietor, partnership, corporation or other legal entity. Each copy shall be signed by a person or persons legally authorized to bind the Proposer to a contract. A Proposal by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Proposal submitted by an agent shall have a current power of attorney attached certifying the agent’s authority to bind the Proposer.
- 5.1.8 All costs associated with the preparation, submission and delivery of Proposal is the sole responsibility of the Proposer.
- 5.1.9 The Proposer shall make no stipulations on the proposal form nor qualify the Proposal in any manner. Refer also to 5.1.5 above.

5.2 PROPOSAL SECURITY

- 5.2.1 Each Proposal shall be accompanied by a proposal security as stipulated in the Advertisement for Proposals, in the form and amount required, pledging that the Proposer

will enter into a Contract with the Owner on the terms stated in the proposal and will furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Proposer refuse to enter into such Contract, or fail to furnish such bonds, the amount of the proposal security shall be forfeited to the Owner as liquidated damages, not as a penalty.

- 5.2.2 The surety bond shall be written on AIA Document A310, Proposal Bond, or a similar standard form of the Surety, and the attorney-in-fact who executes the bond on behalf of the Surety, shall affix to the bond a certified and current copy of the power of attorney.
- 5.2.3 The Owner shall have the right to retain the proposal security of Proposers to whom an award is being considered until either (a) the Contract has been executed and bonds have been furnished, or (b) the specified time has elapsed so that Proposals may be withdrawn, or (c) all Proposals have been rejected.

5.3 SUBMISSION OF PROPOSALS

- 5.3.1 All copies of the Proposal, the proposal security and other documents required to be submitted with the Proposal shall be enclosed in a sealed opaque envelope. The envelope shall be addressed as indicated in the Invitation for Proposals and shall be identified with the Project name, the Proposer's name and address. If the Proposal is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED PROPOSAL ENCLOSED" on the face thereof. Any other interlineations or notations on the envelope must be initiated by the proposal signer or the signer's designee at the time of the interlineations or notations, or the proposal may be considered invalid.
- 5.3.2 Proposals shall be deposited at the designated location prior to the time and date for receipt of Proposals. Proposals received after the time and date for receipt of Proposals will be returned unopened.
- 5.3.3 The Proposer shall assume full responsibility for timely delivery at the location designated for receipt of Proposals.
- 5.3.4 Oral, telephonic, or telegraphic Proposals are invalid and will not receive consideration.
- 5.3.5 The Proposer shall be responsible for all costs associated with preparing the Competitive Sealed Proposal Document response. The Owner and Architect shall not incur any costs associated with the production and printing of Competitive Sealed Proposal Document and post proposal information.
- 5.3.6 The Proposer shall prepare one (1) flash drive with a digital copy and one (1) hard copy of the proposal information which will be sealed in an opaque envelope. Proposal Form and Procurement Form Supplement portion of the required documents can be turned in as a hard copy and will not be required to be included in the digital file.**

5.4 MODIFICATION OR WITHDRAWAL OF PROPOSAL

- 5.4.1 A Proposal may not be modified, withdrawn or canceled by the Proposer during the stipulated time period following the time and date designated for the receipt of Proposals except as described in "Request for Proposals," Section 1.11 subsections C and D and each Proposer so agrees in submitting a Proposal.

- 5.4.2 Prior to the time and date designated for receipt of Proposals, a Proposal submitted may be modified or withdrawn by notice to the party receiving Proposals at the place designated for receipt of Proposals. Such notice shall be in writing over the signature of the Proposer or the Proposer's designee or by email; if by email, written confirmation over the signature of the Proposer shall be mailed and postmarked on or before the date and time set for receipt of Proposals. A change shall be so worded as not to reveal the amount of the original Proposal.
- 5.4.3 Withdrawn Proposals may be resubmitted up to the date and time designated for the receipt of Proposals provided that they are then fully in conformance with these Instructions to Proposers.

ARTICLE 6– CONSIDERATION OF PROPOSALS

6.1 OPENING OF PROPOSALS

As described in the “Request for Proposals,” the properly identified Sealed Proposals, delivered on time, will be opened publicly, and the names of Proposers and their proposed cost will be read aloud.

6.2 REJECTION OF PROPOSALS

- 6.2.1 The Owner shall have the right to reject any, or all Proposals, reject a Proposal not accompanied by a required proposal security, or by other data required by the Proposal Documents, or reject a Proposal which is in any way incomplete or irregular.
- 6.2.2 The Owner shall have the right to reject any Proposal, in whole or in part, that proposes an Alternate if the Owner determines in its sole discretion that the Alternate proposed lacks sufficient information in the Proposal to address structural integrity and feasibility.

6.3 ACCEPTANCE OF PROPOSAL (AWARD)

- 6.3.1 After privately reviewing the opened Proposals, the designated Selection Committee will evaluate and rank each Proposal with respect to the published selection criteria in the section titled “Selection Criteria and Scoring Methodology.” The designated Selection Committee shall select the highest ranked Proposer that submits the proposal that offers the best value for the Owner based on the published selection criteria and point system. The Owner shall first attempt to negotiate a contract with the selected Proposer. The Owner may discuss with the Proposer options for a scope or time modification and any price change associated with the modification. Other than the data read at the Proposal opening, the Owner shall not disclose any information derived from the Proposals submitted by competing proposers in conducting such discussions.
- 6.3.2 If the Owner is unable to negotiate a satisfactory contract with the selected Proposer, the Owner shall formally and in writing, end negotiations with that Proposer and proceed to negotiate with the next Proposer in the order of the selection ranking until a contract is reached or negotiations with all ranked Proposers end.
- 6.3.3 Owner shall have the right to accept or reject Alternates and/or Voluntary Alternates, if any, in any order or combination unless otherwise specifically provided in the Proposal Documents, and to determine the low Proposer on the basis of the sum of the Base Proposal and any Alternate accepted.

6.3.4 Each proposer agrees to waive any claim it has or may have against the Owner, the Architect, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal.

6.4 SELECTION CRITERIA AND SCORING METHODOLOGY

6.4.1 Proposers will be selected using a weighted value that is explained below for each category of the Selection Criteria. The weighted value system assigns a specific ratio of valuation to each specific proposal relative to the base line lowest price proposed. The following explanation describes how the weighted value is determined for each selection criteria:

AWARD SELECTION CRITERIA		
Criteria	Weighting Value	Methodology
Construction Cost	45%	Each Proposed Price is divided by Low Price for a Price Differential. Calculated Final Score on price is based on the ratio of Low Price divided by Proposed Price multiplied by 45. Maximum possible score on Price = 45.
Construction Time	15%	Each Proposed Days (duration, in calendar days) is divided by Low Days for a Days Differential. Calculated Final Score on Days is based on the Low Days by Proposed Days multiplied by 15. Maximum possible score on Days = 15.
Proposed Team (including HUB Subcontracting Plan) & Healthcare Experience	40%	Designated Selection Committee will collectively evaluate and score each Proposal based on all relevant information. Criteria to be evaluated may include the factors below.
<ul style="list-style-type: none"> • Specific and relevant to this Project experience of Proposed Team, and commitment of Proposed Team for duration of this specific Project. • Experience of Proposed Team on UMC Projects and record of timely completion and on budget. • Past experience of Team and firm on UMC Projects as to the satisfaction of the performance of the Team with UMC staff. Additionally as to the satisfaction of the performance of the Team and Firm on projects outside UMC. • List of Subcontractors, including HUB Subcontracting Plan, and major Material Suppliers. The HUB Subcontracting Plan must meet the requirements under 34 Texas Administrative Code § 20.285. Information and forms are available from the first individual listed in Section 12.B of the Request for Proposals. • HUB Subcontracting Plan and Procurement Form Supplement which includes list of subcontractors is due by Thursday, March 06, 2025 at 3:00 p.m. CST at the office of Maria “Alex” Villarreal, Contract Administrator, UMC Health System, Medical Office Plaza 1, Suite 240, 3502 9th Street, Lubbock, Texas 79415. 		

SCORING METHOD	
BASE SCORE	<p>Criteria on Proposed Team & Firm Experience will be scored by the Selection Committee on a qualitative basis with the following scoring system:</p> <p>Outstanding/Superior - 10.0 points Very Good - 8.0 points Acceptable - 6.0 points Fair/Poor - 4.0 points Unacceptable - 2.0 points No information - 0.0 points</p>
CUMULATIVE SCORE	Addition of final score on Construction Cost, Construction Time, and Team/Experience.
FINAL RANKING	Final ranking of Proposals based on final scoring of Proposals based on Final Cumulative Weighted Score.

ARTICLE 7 – POST-PROPOSAL INFORMATION

7.1 CONTRACTOR’S QUALIFICATION STATEMENT

Proposers to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305 – Contractor’s Qualification Statement.

7.2 SUBMITTALS

7.2.1 The Proposer shall, as soon as practical, after notification of selection for the award, furnish to the Owner through the Architect in writing:

- a. A designation of the Work to be performed with the Proposer’s own forces.
- b. Names of the manufacturers, products and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
- c. Names of subcontractors, persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

7.2.2 The Proposer will be required to establish, to the satisfaction of the Architect and Owner, the reliability and responsibility of the persons or entities proposed to furnish and perform the work described in the Proposal Documents.

ARTICLE 8 – PERFORMANCE BOND AND PAYMENT BOND

8.1 BOND REQUIREMENTS

8.1.1 The Proposer shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

8.1.2 The cost of bonds shall be included and identified in the Proposal.

8.2 TIME AND DELIVERY OF BONDS

- 8.2.1 The Proposer shall deliver the required bonds to the Owner prior to beginning the Work and, in any case, within ten (10) after the contract is signed.
- 8.2.2 The bonds shall be written on AIA Document A312, Performance Bond and Payment Bond or the Bonding Company's standard bond forms. Both bonds shall be written in the amount of the Contract Sum.
- 8.2.3 The bonds shall be dated on or after the date of the Contract.
- 8.2.4 The Proposer shall require the attorney-in-fact who executes the required bonds on behalf of the surety, to affix thereto a certified and current copy of the power of attorney.

ARTICLE 9 – INSURANCE REQUIREMENTS

9.1 **General Insurance Requirements.** Unless otherwise stated in the General Conditions or Special Conditions of the Contract, the successful Proposer (“Contractor”) shall furnish insurance in the types and amounts indicated in this Request for the duration of the Contract.

- 9.1.1 The required insurance shall include coverage for Owner’s property for preparation prior to construction, during construction and during the warranty period.
- 9.1.2 The insurance shall be evidenced by delivery to Owner of certificates of insurance executed by the insurer or its authorized agent stating coverages, limits, expiration dates and compliance with all applicable required provisions.
- 9.1.3 Coverage shall be written on an occurrence basis by companies authorized and admitted to do business in the State of Texas and rated A- or better by A.M. Best Company or similar rating company or otherwise acceptable to Owner.
- 9.1.4 Policies must include the following clauses, as applicable:
 - a. This insurance shall not be canceled, materially changed, or nonrenewed except after thirty (30) days written notice has been given to Owner.
 - b. It is agreed that Contractor’s insurance shall be deemed primary with respect to any insurance or self-insurance carried by Owner for liability arising out of operations under the Contract with Owner.
 - c. Owner, its officials, directors, employees, representatives, and volunteers are added as additional insureds as respects operations and activities of, or on behalf of the named insured performed under Contract with Owner. The additional insured status must cover completed operations as well. This is not applicable to workers’ compensation policies.
 - d. A waiver of subrogation in favor of Owner shall be provided in all policies.

9.2 **Workers’ Compensation.** Insurance with limits as required by the Texas Workers’ Compensation Act, with the policy endorsed to provide a waiver of subrogation as to Owner, employer’s liability insurance of not less than: \$100,000 each accident; \$100,000 disease each employee; and \$500,000

disease policy limit. Workers' compensation insurance coverage must meet the statutory requirements of Tex. Lab. Code § 401.011(44) and specific to construction projects for public entities as required by Tex. Lab. Code § 406.096.

- 9.3 **Commercial General Liability.** Including premises, operations, independent contractor's liability, products and completed operations and contractual liability, covering, but not limited to, the liability assumed under the indemnification provisions of the Contract, fully insuring Contractor's liability for bodily injury (including death) and property damage with a minimum limit of:

\$1,000,000 per occurrence;
\$2,000,000 general aggregate;
\$2,000,000 products and completed operations aggregate;
and Coverage shall be on an "occurrence" basis.

The policy shall include coverage extended to apply to completed operations and explosion, collapse, and underground hazards. The policy shall include endorsement CG2503 Amendment of Aggregate Limits of Insurance (per Project) or its equivalent.

- 9.4 **Asbestos Abatement Liability Insurance.** Including coverage for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos containing materials. This requirement applies if the Work or the Project includes asbestos containing materials.

9.4.1 The combined single limit for bodily injury and property damage will be a minimum of \$1,000,000 per occurrence.

9.4.2 Specific requirement for claims-made form: Required period of coverage will be determined by the following formula: continuous coverage for life of the Contract, plus one (1) year (to provide coverage for the warranty period), and an extended discovery period for a minimum of five (5) years which shall begin at the end of the warranty period.

9.4.3 Employer's liability limits for asbestos abatement will be:

\$500,000 each accident;
\$500,000 disease each employee; and
\$500,000 disease policy limit.

9.4.4 If this Contract is for asbestos abatement only, the all-risk builder's risk or all-risk installation floater is not required.

- 9.5 **Comprehensive Automobile Liability Insurance.** Covering owned, hired, and non-owned vehicles, with a minimum combined single limit for bodily injury (including death) and property damage of \$1,000,000 per occurrence. No aggregate shall be permitted for this type of coverage.

9.5.1 Such insurance is to include coverage for loading and unloading hazards.

9.5.2 Contractor or any subcontractor responsible for transporting asbestos or other hazardous materials defined as asbestos shall provide pollution coverage for any vehicle hauling asbestos containing cargo. The policy must include a Pollution Endorsement.

- 9.6 **All-Risk Builder's Risk Insurance.** Coverage shall be all-risk, including, but not limited to, fire, extended coverage, vandalism and malicious mischief, theft and, if applicable, flood, earth movement

and named storm.

- 9.6.1 Builder's risk and installation floater limits shall be equal to 100 percent of the Contract Sum plus, if any, existing property and Owner-furnished equipment specified by Owner.
- 9.6.2 The policy shall be written jointly in the names of Owner and Contractor. Subcontractors shall be named as additional insureds.
- 9.6.3 The policy shall have endorsements as follows:
- a. This insurance shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the property.
 - b. This insurance shall not contain an occupancy clause suspending or reducing coverage should Owner partially occupy the Site and before the parties have determined Substantial Completion.
 - c. Loss, if any, shall be adjusted with and made payable to Owner as trustee for the insureds as their interests may appear. Owner shall be named as loss payee.
 - d. For renovation projects or projects that involve portions of Work contained within an existing structure, the Insurance and Bond Exhibit may have additional builder's risk insurance requirements.
 - e. For Owner furnished equipment or materials that will be in care, custody or control of Contractor, Contractor will be responsible for damage and loss.
 - f. For those properties located within a Tier 1 or 2 windstorm area, named storm coverage must be provided with limits specified by Owner.
 - g. For those properties located in flood prone areas, flood insurance coverage must be provided with limits specified by Owner.
 - h. Builder's risk insurance policy shall remain in effect until Substantial Completion.
- 9.7 **"Umbrella" Liability Insurance.** Contractor shall obtain, pay for and maintain umbrella liability insurance during the Contract term, insuring Contractor for an amount of not less than amount specified in the Insurance and Bonds Exhibit that provides coverage at least as broad as and applies in excess and follows form of the primary liability coverages required hereinabove. The policy shall provide "drop down" coverage where underlying primary insurance coverage limits are insufficient or exhausted.
- 9.8 **Delivery and Form.** The Contractor shall deliver the required certificates of insurance coverage to the Owner upon its execution of the Contract. The insurance certificate shall be written on a form acceptable to the Owner. Insurance shall be written in the amount required by the Contract. The insurance certificates shall be dated on or before the date of the Contract.

ARTICLE 10 – FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

The Agreement for the Work will be written on AIA Document A101 - 2017, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

ARTICLE 11 – APPLICABLE GOVERNING LAWS AND REGULATIONS

11.1 WAGE RATES

- 11.1.1 All Proposers must comply with State Labor Laws as required by current amended provisions of Tex. Gov't Code, Chapter 2258. Contractor is required to pay not less than the prevailing wage rate of per diem wages of the various applicable classes of labor.

11.1.2 The Contractor shall forfeit as a penalty to the Owner, \$60.00 for each worker employed for each calendar day or portion thereof, if such worker is paid less than the said stipulated rates for any work done under said contract, by the contractor or by their subcontractor.

11.2 NON-DISCRIMINATION

During the bidding and, if successful, during performance of the Contract, the Proposer agrees they shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, or national origin. The Proposer shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, sex, religion, age, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Proposer agrees to post in conspicuous places, available to employees or applicants for employment, notices to be provided setting forth the provisions of this non-discrimination article.

END OF SECTION

PROPOSAL FORM

Date: _____, 2025

UMC Health System
Medical Office Plaza 1, Suite 240
3502 9th Street
Lubbock, Texas 79415

The undersigned, having carefully examined the proposal documents that include the specifications, drawings, and related documents entitled:

**UNIVERSITY MEDICAL CENTER PHYSICIANS
NEW WOLFFORTH CLINIC
602 INDIANA AVENUE
LUBBOCK, TEXAS 79415**

all as prepared by Condray Design Group, 3708 Upland Avenue, Lubbock, Texas 79407, as well as having attended a pre-proposal conference, and made an on-site inspection of the premises and all other conditions affecting the cost and/or execution of the work, proposes to furnish all materials, labor, and equipment necessary to complete the work in accordance with said documents, of which this proposal is a part, for the following sum:

BASE PROPOSAL:

_____ Dollars (\$) _____)

(Note: All amounts shall be shown in both written and figure form. In case of discrepancy between the written amount and the figure, the written amount will govern. For alternates, check whether it is an add, deduct or no change.)

We have included, in the Proposal sum, all applicable taxes and all material allowances.

The undersigned acknowledges receipt of _____ addenda to the Drawings and Project Manual as follows:

No. _____	Date _____	No. _____	Date _____	No. _____	Date _____
No. _____	Date _____	No. _____	Date _____	No. _____	Date _____

(The Proposer is to fill in I.D. Number and date of each thereby acknowledging receipt of Addenda).

If awarded the contract, the undersigned agrees to commence work under this contract on or before a date to be specified in Written Notice to Proceed, and to substantially complete the project within _____ (Proposer to fill in number) **calendar days** from said commencement date, unless modified by change order.

Notice to Proceed will be issued after material procurement has been completed and material is on site.

Proposer agrees to pay the Owner **\$1,000.00** per day, as liquidated damages, for each day the substantial completion of this project extends beyond the stipulated substantial completion date.

If notified of the acceptance of this proposal within **seventy-five (75) days from the time set for the opening of proposals**, proposer agrees within ten (10) days of notification, to execute a contract in the form of the AIA Document A101-2017, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum, as amended for the above work, for the above stated compensation.

PROPOSAL SECURITY, as defined in the Advertisement For Proposals and Instructions to Proposers, which the Undersigned agrees to disposition of, as stated in Advertisement For Proposals and Instructions to Proposers, is attached to this Proposal.

Upon acceptance of this Proposal by Owner, Contractor shall furnish, before beginning the Work and, in any case, no later than ten (10) days after of the signing of the contract, a PERFORMANCE BOND AND LABOR/MATERIAL PAYMENT BOND, in the amount of 100% of the Contract Price. Surety shall meet requirements specified in the Owner/Contractor Agreement.

It is understood that the Owner reserves the right to accept or reject any and all Proposals and to waive all formalities in accordance with State law.

ATTACHMENTS

In accordance with Instructions to Proposers, the following documents will be submitted with and made a condition of the Proposal:

Proposal security in form of _____
Proposer's qualifications statement and supporting data.

The Procurement Form Supplement to be turned in to UMC no later than Twenty-Four (24) hours after Proposal Opening and to be made a condition of the Proposal.

Respectfully Submitted,

By: _____

Title: _____

Business Address with Zip Code

(SEAL: If
by Corporation)

Telephone Number with Area Code: _____

Fill in the applicable information:

A Corporation, chartered in the State of _____.

Authorized to do business in the State of Texas.

A Partnership, composed of _____, and
_____, and _____.

An Individual operating under the name of _____
_____.

Corporate Seal:

END OF SECTION

PROCUREMENT FORM SUPPLEMENT

To: UMC Health System
Medical Office Plaza 1, Suite 240
3502 9th Street
Lubbock, Texas 79415
Attn: Maria “Alex” Villarreal, Contract Administrator

Project: **University Medical Center Physicians
New Wolfforth Clinic
720 Donald Preston Drive
Wolfforth, Texas 79382**

Date: _____

Submitted by: _____
(full name)

Full Address _____

In accordance with the Instructions to Proposers and the Proposal Form, we include the Proposal Form Supplements listed below designated as the Procurement Form Supplement. The information provided shall be considered an integral part of the Proposal Form.

This Procurement Form Supplement must be turned in to UMC Purchasing no later than Twenty-Four (24) hours after Proposal Opening.

Please provide the following information:

1. Mechanical Subcontractor (Included in Proposal Amount):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

1a. Mechanical Subcontractor (First Alternate):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

Total Change to Proposal Amount, Add / Deduct (circle one):

1b. Mechanical Subcontractor (Second Alternate):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

Total Change to Proposal Amount, Add / Deduct (circle one):

2. Plumbing Subcontractor (Included in Proposal Amount):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

2a. Plumbing Subcontractor (First Alternate):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

Total Change to Proposal Amount, Add / Deduct (circle one):

2b. Plumbing Subcontractor (Second Alternate):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

Total Change to Proposal Amount, Add / Deduct (circle one):

3. Electrical Subcontractor (Included in Proposal Amount):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

3a. Electrical Subcontractor (First Alternate):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

Total Change to Proposal Amount, Add / Deduct (circle one):

3b. Electrical Subcontractor (Second Alternate):

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

Total Change to Proposal Amount, Add / Deduct (circle one):

4. Painting Subcontractor:

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

5. Flooring Subcontractor:

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

6. Fire Sprinkler Subcontractor:

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

7. Millwork Subcontractor:

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

8. Drywall and Ceiling Subcontractor:

Firm Name: _____

Address: _____

Phone No.: _____

Contact: _____

CONFLICT OF INTEREST QUESTIONNAIRE		FORM CIQ
<p>This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.</p> <p>This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).</p> <p>By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. See Section 176.006(a-1), Local Government Code.</p> <p>A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.</p>		OFFICE USE ONLY
1	Name of vendor who has a business relationship with local governmental entity.	Date Received
2	<input type="checkbox"/> Check this box if you are filing an update to a previously filed questionnaire. (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)	
3	Name of local government officer about whom the information is being disclosed. _____ Name of Officer	
4	Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary. A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor? <input type="checkbox"/> Yes <input type="checkbox"/> No B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity? <input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.	
6	<input type="checkbox"/> Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).	
7	_____ Signature of vendor doing business with the governmental entity	_____ Date

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at <http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm>. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

- (A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;
- (B) a transaction conducted at a price and subject to terms available to the public; or
- (C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds \$2,500 during the 12-month period preceding the date that the officer becomes aware that

- (i) a contract between the local governmental entity and vendor has been executed;
- or
- (ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than \$100 in the 12-month period preceding the date the officer becomes aware that:

- (i) a contract between the local governmental entity and vendor has been executed; or
- (ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

- (1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);
- (2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or
- (3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

- (1) the date that the vendor:
 - (A) begins discussions or negotiations to enter into a contract with the local governmental entity; or
 - (B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or
- (2) the date the vendor becomes aware:
 - (A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);
 - (B) that the vendor has given one or more gifts described by Subsection (a); or
 - (C) of a family relationship with a local government officer.

VENDOR CONFLICT OF INTEREST DISCLOSURE

VENDOR QUESTIONNAIRE

Rev. 03/16/2018

Beginning January 1, 2006, all persons and entities that contract or contemplate contracting with local governmental entities must complete a vendor questionnaire. The form requires the vendor to disclose the following:

- 1) any business or other relationships with persons associated with the local government (UMC) who influence decisions over contracts
- 2) any business or other relationships with local government officers.

The questionnaire is attached, along with a list of UMC's local government officers.

UMC simply has to keep this on file and make it available if anyone asks. If any circumstances change, the vendor must file an updated questionnaire.

You have a contractual and legal obligation to update this form if applicable circumstances change.

GOVERNING BODY OF UMC HEALTH SYSTEM

President and Chief Executive Officer: Mark Funderburk

Board of Managers:

Gladys Whitten, DMD
John C. DeToledo, MD
Gary Greenstreet
Jason Medina
Mont McClendon
Mikella Newsom
Laura Vinson
Jolyn Wilkins



HUB Subcontracting Plan (HSP) QUICK CHECKLIST

While this HSP Quick Checklist is being provided to merely assist you in readily identifying the sections of the HSP form that you will need to complete, it is very important that you adhere to the instructions in the HSP form and instructions provided by the contracting entity.

- ▶ **If you will be awarding all of the subcontracting work you have to offer under the contract to only Texas certified HUB vendors, complete:**
 - Section 1 - Respondent and Requisition Information
 - Section 2 a. - Yes, I will be subcontracting portions of the contract.
 - Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors.
 - Section 2 c. - Yes
 - Section 4 - Affirmation
 - GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

- ▶ **If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you do not have a continuous contract* in place for more than five (5) years meets or exceeds the HUB Goal the contracting entity identified in the "Entity Special Instructions/Additional Requirements", complete:**
 - Section 1 - Respondent and Requisition Information
 - Section 2 a. - Yes, I will be subcontracting portions of the contract.
 - Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.
 - Section 2 c. - No
 - Section 2 d. - Yes
 - Section 4 - Affirmation
 - GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

- ▶ **If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors or only to Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you do not have a continuous contract* in place for more than five (5) years does not meet or exceed the HUB Goal the contracting entity identified in the "Entity Special Instructions/Additional Requirements", complete:**
 - Section 1 - Respondent and Requisition Information
 - Section 2 a. - Yes, I will be subcontracting portions of the contract.
 - Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.
 - Section 2 c. - No
 - Section 2 d. - No
 - Section 4 - Affirmation
 - GFE Method B (Attachment B) - Complete an Attachment B for each of the subcontracting opportunities you listed in Section 2 b.

- ▶ **If you will not be subcontracting any portion of the contract and will be fulfilling the entire contract with your own resources (i.e., employees, supplies, materials and/or equipment), complete:**
 - Section 1 - Respondent and Requisition Information
 - Section 2 a. - No, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources.
 - Section 3 - Self Performing Justification
 - Section 4 - Affirmation

***Continuous Contract:** Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service, to include under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.



HUB Subcontracting Plan (HSP)

In accordance with Texas Gov't Code §2161.252, the contracting entity has determined that subcontracting opportunities are probable under this contract. Therefore, all respondents, including State of Texas certified Historically Underutilized Businesses (HUBs) must complete and submit this State of Texas HUB Subcontracting Plan (HSP) with their response to the bid requisition (solicitation).

NOTE: Responses that do not include a completed HSP shall be rejected pursuant to Texas Gov't Code §2161.252(b).

The HUB Program promotes equal business opportunities for economically disadvantaged persons to contract with the Texas governmental entities in accordance with the goals specified in the 2009 State of Texas Disparity Study. The statewide HUB goals defined in 34 Texas Administrative Code (TAC) §20.284 are:

- **11.2 percent for heavy construction other than building contracts,**
- **21.1 percent for all building construction, including general contractors and operative builders' contracts,**
- **32.9 percent for all special trade construction contracts,**
- **23.7 percent for professional services contracts,**
- **26.0 percent for all other services contracts, and**
- **21.1 percent for commodities contracts.**

- - Entity Special Instructions/Additional Requirements - -

*In accordance with 34 TAC §20.285(d)(1)(D)(iii), a respondent (prime contractor) may demonstrate good faith effort to utilize Texas certified HUBs for its subcontracting opportunities if the total value of the respondent's subcontracts with Texas certified HUBs meets or exceeds the statewide HUB goal or the entity specific HUB goal, whichever is higher. When a respondent uses this method to demonstrate good faith effort, the respondent must identify the HUBs with which it will subcontract. If using existing contracts with Texas certified HUBs to satisfy this requirement, only the aggregate percentage of the contracts expected to be subcontracted to HUBs with which the respondent **does not** have a **continuous contract*** in place for **more than five (5) years** shall qualify for meeting the HUB goal. This limitation is designed to encourage vendor rotation as recommended by the 2009 Texas Disparity Study.*

SECTION 1: RESPONDENT AND REQUISITION INFORMATION

a. Respondent (Company) Name: _____ State of Texas VID #: _____
 Point of Contact: _____ Phone #: _____
 E-mail Address: _____ Fax #: _____

b. Is your company a State of Texas certified HUB? - Yes - No

c. Requisition #: _____ Bid Open Date: _____
(mm/dd/yyyy)

SECTION 2: RESPONDENT'S SUBCONTRACTING INTENTIONS

After dividing the contract work into reasonable lots or portions to the extent consistent with prudent industry practices, and taking into consideration the scope of work to be performed under the proposed contract, including all potential subcontracting opportunities, the respondent must determine what portions of work, **including contracted staffing, goods and services will be subcontracted**. Note: In accordance with 34 TAC §20.282, a "Subcontractor" means a person who contracts with a prime contractor to work, to supply commodities, or to contribute toward completing work for a governmental entity.

a. Check the appropriate box (Yes or No) that identifies your subcontracting intentions:

- *Yes*, I will be subcontracting portions of the contract. (If *Yes*, complete Item b of this SECTION and continue to Item c of this SECTION.)
- *No*, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources, including employees, goods and services. (If *No*, continue to SECTION 3 and SECTION 4.)

b. List all the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

Item #	Subcontracting Opportunity Description	HUBs		Non-HUBs
		Percentage of the contract expected to be subcontracted to HUBs with which you do not have a continuous contract* in place for more than five (5) years .	Percentage of the contract expected to be subcontracted to HUBs with which you have a continuous contract* in place for more than five (5) years .	Percentage of the contract expected to be subcontracted to non-HUBs.
1		%	%	%
2		%	%	%
3		%	%	%
4		%	%	%
5		%	%	%
6		%	%	%
7		%	%	%
8		%	%	%
9		%	%	%
10		%	%	%
11		%	%	%
12		%	%	%
13		%	%	%
14		%	%	%
15		%	%	%
Aggregate percentages of the contract expected to be subcontracted:		%	%	%

(Note: If you have more than fifteen subcontracting opportunities, you may continue on the next page, which you may also photo-copy as necessary.)

c. Check the appropriate box (Yes or No) that indicates whether you will be using **only** Texas certified HUBs to perform **all** of the subcontracting opportunities you listed in SECTION 2, Item b.

- *Yes* (If *Yes*, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed.)
- *No* (If *No*, continue to Item d, of this SECTION.)

d. Check the appropriate box (Yes or No) that indicates whether the aggregate expected percentage of the contract you will subcontract **with Texas certified HUBs** with which you **do not** have a **continuous contract*** in place with for **more than five (5) years**, **meets or exceeds** the HUB goal the contracting entity identified on page 1 in the "Entity Special Instructions/Additional Requirements."

- *Yes* (If *Yes*, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed.)
- *No* (If *No*, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method B (Attachment B)" for **each** of the subcontracting opportunities you listed.)

***Continuous Contract:** Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.

Enter your company's name here: _____

Requisition #: _____

SECTION 2: RESPONDENT'S SUBCONTRACTING INTENTIONS (CONTINUATION SHEET)

This page can be used as a continuation sheet to the HSP Form's page 2, Section 2, Item b. Continue listing the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB). You may photo-copy this page.

Item #	Subcontracting Opportunity Description	HUBs		Non-HUBs
		Percentage of the contract expected to be subcontracted to HUBs with which you do not have a continuous contract* in place for more than five (5) years .	Percentage of the contract expected to be subcontracted to HUBs with which you have a continuous contract* in place for more than five (5) years .	Percentage of the contract expected to be subcontracted to non-HUBs.
16		%	%	%
17		%	%	%
18		%	%	%
19		%	%	%
20		%	%	%
21		%	%	%
22		%	%	%
23		%	%	%
24		%	%	%
25		%	%	%
26		%	%	%
27		%	%	%
28		%	%	%
29		%	%	%
30		%	%	%
31		%	%	%
32		%	%	%
33		%	%	%
34		%	%	%
35		%	%	%
36		%	%	%
37		%	%	%
38		%	%	%
39		%	%	%
40		%	%	%
41		%	%	%
42		%	%	%
43		%	%	%
Aggregate percentages of the contract expected to be subcontracted:		%	%	%

***Continuous Contract:** Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.

Enter your company's name here: _____

Requisition #: _____

SECTION 3: SELF PERFORMING JUSTIFICATION (If you responded "No" to SECTION 2, Item a, you must complete this SECTION and continue to SECTION 4.) If you responded "No" to SECTION 2, Item a, in the space provided below **explain how** your company will perform the entire contract with its own employees, supplies, materials and/or equipment.

SECTION 4: AFFIRMATION

As evidenced by my signature below, I affirm that I am an authorized representative of the respondent listed in SECTION 1, and that the information and supporting documentation submitted with the HSP is true and correct. Respondent understands and agrees that, if awarded any portion of the requisition:

- The respondent will provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor for the awarded contract. The notice must specify at a minimum the contracting entity's name and its point of contact for the contract, the contract award number (as applicable), the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting entity's point of contact for the contract no later than ten (10) working days after the contract is awarded.

_____ Signature	_____ Printed Name	_____ Title	_____ Date (mm/dd/yyyy)
--------------------	-----------------------	----------------	-------------------------------

Reminder:

- If you responded "Yes" to SECTION 2, Items c or d, you must complete an "HSP Good Faith Effort - Method A (Attachment A)" for each of the subcontracting opportunities you listed in SECTION 2, Item b.
- If you responded "No" SECTION 2, Items c and d, you must complete an "HSP Good Faith Effort - Method B (Attachment B)" for each of the subcontracting opportunities you listed in SECTION 2, Item b.

HSP Good Faith Effort - Method A (Attachment A)

Enter your company's name here: _____ Requisition #: _____

IMPORTANT: If you responded "Yes" to **SECTION 2, Items c or d** of the completed HSP form, you must submit a completed "HSP Good Faith Effort - Method A (Attachment A)" for each of the subcontracting opportunities you listed in **SECTION 2, Item b** of the completed HSP form. You may photo-copy this page.

SECTION A-1: SUBCONTRACTING OPPORTUNITY

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

Item Number: _____ Description: _____

SECTION A-2: SUBCONTRACTOR SELECTION

List the subcontractor(s) you selected to perform the subcontracting opportunity you listed above in SECTION A-1. Also identify whether they are a Texas certified HUB and their Texas Vendor Identification (VID) Number or federal Employer Identification Number (EIN), the approximate dollar value of the work to be subcontracted, and the expected percentage of work to be subcontracted. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas' Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at <http://mycpa.cpa.state.tx.us/tpasscblsearch/index.jsp>. HUB status code "A" signifies that the company is a Texas certified HUB.

Company Name	Texas certified HUB	Texas VID or federal EIN <small>Do not enter Social Security Numbers. If you do not know their VID / EIN, leave their VID / EIN field blank.</small>	Approximate Dollar Amount	Expected Percentage of Contract
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%

REMINDER: As specified in SECTION 4 of the completed HSP form, if you (respondent) are awarded any portion of the requisition, you are required to provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor. The notice must specify at a minimum the contracting entity's name and its point of contact for the contract, the contract award number (as applicable), the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting entity's point of contact for the contract no later than ten (10) working days after the contract is awarded.

HSP Good Faith Effort - Method B (Attachment B)

Enter your company's name here: _____ Requisition #: _____

IMPORTANT: If you responded “No” to **SECTION 2, Items c and d** of the completed HSP form, you must submit a completed “HSP Good Faith Effort - Method B (Attachment B)” for **each** of the subcontracting opportunities you listed in **SECTION 2, Item b** of the completed HSP form. You may photo-copy this page.

SECTION B-1: SUBCONTRACTING OPPORTUNITY

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

Item Number: _____ Description: _____

SECTION B-2: MENTOR PROTÉGÉ PROGRAM

If respondent is participating as a Mentor in a State of Texas Mentor Protégé Program, submitting its Protégé (Protégé must be a State of Texas certified HUB) as a subcontractor to perform the subcontracting opportunity listed in **SECTION B-1**, constitutes a good faith effort to subcontract with a Texas certified HUB towards that specific portion of work.

Check the appropriate box (Yes or No) that indicates whether you will be subcontracting the portion of work you listed in SECTION B-1 to your Protégé.

- Yes (If *Yes*, continue to SECTION B-4.)
- No / Not Applicable (If *No* or *Not Applicable*, continue to SECTION B-3 and SECTION B-4.)

SECTION B-3: NOTIFICATION OF SUBCONTRACTING OPPORTUNITY

When completing this section you **MUST** comply with items **a, b, c and d**, thereby demonstrating your Good Faith Effort of having notified Texas certified HUBs and trade organizations or development centers about the subcontracting opportunity you listed in SECTION B-1. Your notice should include the scope of work, information regarding the location to review plans and specifications, bonding and insurance requirements, required qualifications, and identify a contact person. When sending notice of your subcontracting opportunity, you are encouraged to use the attached HUB Subcontracting Opportunity Notice form.

Retain supporting documentation (i.e., certified letter, fax, e-mail) demonstrating evidence of your good faith effort to notify the Texas certified HUBs and trade organizations or development centers. Also, be mindful that a working day is considered a normal business day of a governmental entity, not including weekends, federal or state holidays, or days the entity is declared closed by its executive officer. The initial day the subcontracting opportunity notice is sent/provided to the HUBs and to the trade organizations or development centers is considered to be “day zero” and does not count as one of the seven (7) working days.

- a.** Provide written notification of the subcontracting opportunity you listed in SECTION B-1, to three (3) or more Texas certified HUBs. Unless the contracting entity specified a different time period, you must allow the HUBs at least seven (7) working days to respond to the notice prior to you submitting your bid response to the contracting entity. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas’ Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at <http://mycpa.cpa.state.tx.us/tpasscmlsearch/index.jsp>. HUB status code “A” signifies that the company is a Texas certified HUB.
- b.** List the **three (3) Texas certified HUBs** you notified regarding the subcontracting opportunity you listed in SECTION B-1. Include the company’s Texas Vendor Identification (VID) Number, the date you sent notice to that company, and indicate whether it was responsive or non-responsive to your subcontracting opportunity notice.

Company Name	Texas VID <small>(Do not enter Social Security Numbers.)</small>	Date Notice Sent <small>(mm/dd/yyyy)</small>	Did the HUB Respond?
			- Yes - No
			- Yes - No
			- Yes - No

- c.** Provide written notification of the subcontracting opportunity you listed in SECTION B-1 to **two (2)** or more trade organizations or development centers in Texas to assist in identifying potential HUBs by disseminating the subcontracting opportunity to their members/participants. Unless the contracting entity specified a different time period, you must provide your subcontracting opportunity notice to trade organizations or development centers at least seven (7) working days prior to submitting your bid response to the contracting entity. A list of trade organizations and development centers that have expressed an interest in receiving notices of subcontracting opportunities is available on the Statewide HUB Program’s webpage at <https://www.comptroller.texas.gov/purchasing/vendor/hub/resources.php>.
- d.** List **two (2) trade organizations or development centers** you notified regarding the subcontracting opportunity you listed in SECTION B-1. Include the date when you sent notice to it and indicate if it accepted or rejected your notice.

Trade Organizations or Development Centers	Date Notice Sent <small>(mm/dd/yyyy)</small>	Was the Notice Accepted?
		- Yes - No
		- Yes - No

HSP Good Faith Effort - Method B (Attachment B) Cont.

Enter your company's name here: _____	Requisition #: _____
---------------------------------------	----------------------

SECTION B-4: SUBCONTRACTOR SELECTION

Enter the item number and description of the subcontracting opportunity you listed in **SECTION 2, Item b**, of the completed HSP form for which you are completing the attachment. You may photo-copy this page.

a. Enter the item number and description of the subcontracting opportunity for which you are completing this Attachment B continuation page.
 Item Number: _____ Description: _____

b. List the subcontractor(s) you selected to perform the subcontracting opportunity you listed in **SECTION B-1**. Also identify whether they are a Texas certified HUB and their Texas Vendor Identification (VID) Number or federal Employer Identification Number (EIN), the approximate dollar value of the work to be subcontracted, and the expected percentage of work to be subcontracted. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas' Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at <http://mycpa.cpa.state.tx.us/passcmbsearch/index.jsp>. HUB status code "A" signifies that the company is a Texas certified HUB.

Company Name	Texas certified HUB	Texas VID or federal EIN <small>Do not enter Social Security Numbers. If you do not know their VID / EIN, leave their VID / EIN field blank.</small>	Approximate Dollar Amount	Expected Percentage of Contract
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%

c. If any of the subcontractors you have selected to perform the subcontracting opportunity you listed in **SECTION B-1** is **not** a Texas certified HUB, provide written justification for your selection process (attach additional page if necessary):

REMINDER: As specified in SECTION 4 of the completed HSP form, if you (respondent) are awarded any portion of the requisition, you are required to provide notice as soon as practical to **all** the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor. The notice must specify at a minimum the contracting entity's name and its point of contact for the contract, the contract award number (as applicable), the subcontracting opportunity it (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting entity's point of contact for the contract no later than ten (10) working days after the contract is awarded.



HUB Subcontracting Opportunity Notification Form

In accordance with Texas Gov't Code, Chapter 2161, each governmental entity that considers entering into a contract with an expected value of \$100,000 or more shall, before the entity solicits bids, proposals, offers, or other applicable expressions of interest, determine whether subcontracting opportunities are probable under the contract. The governmental entity I have identified below in Section B has determined that subcontracting opportunities are probable under the requisition to which my company will be responding.

34 Texas Administrative Code, §20.285 requires all respondents (prime contractors) bidding on the contract to provide notice of each of their subcontracting opportunities to at least three (3) Texas certified HUBs (who work within the respective industry applicable to the subcontracting opportunity), and allow the HUBs at least seven (7) working days to respond to the notice prior to the respondent submitting its bid response to the contracting entity. In addition, at least seven (7) working days prior to submitting its bid response to the contracting entity, the respondent must provide notice of each of its subcontracting opportunities to two (2) or more trade organizations or development centers (in Texas) that serves members of groups (i.e., Asian Pacific American, Black American, Hispanic American, Native American, Woman, Service Disabled Veteran) identified in Texas Administrative Code §20.282(19)(C).

We respectfully request that vendors interested in bidding on the subcontracting opportunity scope of work identified in Section C, Item 2, reply no later than the date and time identified in Section C, Item 1. Submit your response to the point-of-contact referenced in Section A.

SECTION A: PRIME CONTRACTOR'S INFORMATION	
Company Name: _____	State of Texas VID #: _____
Point-of-Contact: _____	Phone #: _____
E-mail Address: _____	Fax #: _____

SECTION B: CONTRACTING GOVERNMENTAL ENTITY AND REQUISITION INFORMATION	
Name: _____	
Point-of-Contact: _____	Phone #: _____
Requisition #: _____	Bid Open Date: _____ (mm/dd/yyyy)

SECTION C: SUBCONTRACTING OPPORTUNITY RESPONSE DUE DATE, DESCRIPTION, REQUIREMENTS AND RELATED INFORMATION	
1. Potential Subcontractor's Bid Response Due Date:	
If you would like for our company to consider your company's bid for the subcontracting opportunity identified below in Item 2,	
we must receive your bid response no later than _____ on _____.	
Central Time Date (mm/dd/yyyy)	
<p><i>In accordance with 34 TAC §20.285, each notice of subcontracting opportunity shall be provided to at least three (3) Texas certified HUBs, and allow the HUBs at least seven (7) working days to respond to the notice prior to submitting our bid response to the contracting entity. In addition, at least seven (7) working days prior to us submitting our bid response to the contracting entity, we must provide notice of each of our subcontracting opportunities to two (2) or more trade organizations or development centers (in Texas) that serves members of groups (i.e., Asian Pacific American, Black American, Hispanic American, Native American, Woman, Service Disabled Veteran) identified in Texas Administrative Code, §20.282(19)(C).</i></p> <p><i>(A working day is considered a normal business day of a governmental entity, not including weekends, federal or state holidays, or days the entity is declared closed by its executive officer. The initial day the subcontracting opportunity notice is sent/provided to the HUBs and to the trade organizations or development centers is considered to be "day zero" and does not count as one of the seven (7) working days.)</i></p>	
2. Subcontracting Opportunity Scope of Work:	
3. Required Qualifications:	- Not Applicable
4. Bonding/Insurance Requirements:	- Not Applicable
5. Location to review plans/specifications:	- Not Applicable

SECTION 005000 – WAGE RATES

PART 1 - GENERAL

- 1.1 Contractor is to comply with the minimum wage rates as indicated on Attachment “A”.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 005000

ATTACHMENT "A"

University Medical Center

Prevailing Wage Rates for Construction Projects

November 2020

Building Construction Trade Classification	Prevailing Wage Rate
Asbestos Worker	\$14.50
Carpenter	\$21.65
Carpet/Floor Installer	\$16.46
Concrete Finisher	\$18.85
Datacomm/Telecom	\$15.50
Drywall Installer	\$19.00
Ceiling Installer	\$17.68
Electrician - Journeyman	\$24.05
Electrician - Apprentice	\$16.96
Elevator Mechanic	\$34.88
Glazier	\$17.00
Heavy Equipment Operator	\$20.00
Piping/Ductwork Insulator	\$17.00
Iron/Structural Worker	\$23.00
Laborer	\$14.00
Lather/Plasterer	\$20.56
Light Equipment Operator	\$18.80
Mason/Bricklayer	\$23.95
Painter	\$15.00
Plumber/Pipefitter Journeyman	\$24.40
Plumber Apprentice	\$15.00
Roofer	\$16.00
Sheetmetal	\$22.73
Sprinkler Fitter	\$21.50
Terrazzo Worker	\$20.00
Tile Setter	\$16.00
Waterproofers	\$15.72

Unlisted classifications needed for work not included within the scope of the classifications listed may not be added after award. The job classifications are not inclusive of all possible trades on a construction project.

It is the responsibility of the contractor to classify the worker in accordance with the published classifications and demonstrate that workers are paid commensurate with determined rates.

SECTION 007000 – GENERAL CONDITIONS

PART 1 - GENERAL

1.1 APPLICABLE DOCUMENT

- A. AIA Document A201, 2017 ed. “General Conditions of the Contract for Construction” is a part of this project Manual. See attached document as part of this specification section.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 007000

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

University Medical Center Physicians
New Wolforth Clinic
720 Donald Preston Drive
Wolforth, Texas 79382

THE OWNER:

(Name, legal status and address)

Lubbock County Hospital District, d/b/a
University Medical Center

P.O. Box 5980
Lubbock, TX 79415

THE ARCHITECT:

(Name, legal status and address)

Condray Design Group, Inc.

3708 Upland Ave.
Lubbock, TX 79407

TABLE OF ARTICLES

- 1 GENERAL PROVISIONS
- 2 OWNER
- 3 CONTRACTOR
- 4 ARCHITECT
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
- 7 CHANGES IN THE WORK
- 8 TIME
- 9 PAYMENTS AND COMPLETION
- 10 PROTECTION OF PERSONS AND PROPERTY
- 11 INSURANCE AND BONDS

ADDITIONS AND DELETIONS:

The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™–2017, Guide for Supplementary Conditions.

- 12 UNCOVERING AND CORRECTION OF WORK
- 13 MISCELLANEOUS PROVISIONS
- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect and approved by the Owner. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.1.9 The Project Manual

The Project Manual is a volume assembled for the Project that may include the bidding requirements, sample forms, Conditions of the Contract, and Specifications.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.1.2 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

- .1 Modifications.**
- .2 The Agreement.**
- .3 Addenda, with those of later date having precedence over those of earlier date.**
- .4 The Supplementary Conditions.**
- .5 The General Conditions of the Contract for Construction.**
- .6 Division 1 of the Specifications.**
- .7 Drawings and Divisions 2–49 of the Specifications.**
- .8 Other documents specifically enumerated in the Agreement as part of the Contract Documents.**

In the case of conflicts or discrepancies between Drawings and Divisions 2–49 of the Specifications, or within or among the Contract Documents and not clarified by Addendum, the Architect will determine which takes precedence in accordance with Sections 4.2.11 and 4.2.12.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in

establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 The mention of certain items in the Specifications to the exclusion of others (whether in the general statement of the Work in a section or paragraph or in itemized lists of any nature); or the mention of work to be done in a specific area to the exclusion of similar or like work required in other areas; or the failure to properly cross-reference related work specified elsewhere, shall not relieve the Contractor of his responsibilities under the Contract Documents.

§ 1.2.5 The titles of sections and paragraphs are not necessarily fully descriptive of the work required thereby. The segregation of the various parts of the Work under headings, by trades, does not relieve the Contractor of the responsibility for furnishing every item shown on the drawings or specified in the specifications, or reasonably inferable therefrom as being necessary to produce the intended results, whether properly segregated or not.

§ 1.2.6 If an item is addressed differently in two places of the contract documents the greater quality or quantity applies and is assumed to take precedence.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 As between the Contractor and the Owner, the Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the

Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person,

by certified registered mail, or by courier providing proof of delivery.

§ 1.6.2 Intentionally omitted.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™-2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Intentionally omitted.

§ 2.2.2 Intentionally omitted.

§ 2.2.3 Intentionally omitted.

§ 2.2.4 Intentionally omitted.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 The Contractor will be furnished, free of charge, two .pdf file copies of Drawings and Project Manuals for execution of the Work. Additional copies may be purchased from the Architect at the cost of reproduction, postage and handling plus a reasonable mark-up.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to

reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. Nevertheless, any errors, inconsistencies, or omissions discovered shall be reported to the Architect at once.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for

information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.2.5 The Contractor shall satisfy itself as to the accuracy of grades, elevations, dimensions, and locations. In cases of interconnection of Work with existing or other work, it shall verify at the site dimensions relating to such existing or other work.

§ 3.2.6 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, filed conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.4 To the extent that any portion of the Work requires a trench excavation exceeding five (5) feet in depth, in accordance with Texas Health and Safety Code Section 756.023(a), Contractor shall fully comply, and shall require any applicable Subcontractor to comply, with:

- 1 The Occupational Safety and Health Administration standards for trench safety in effect for Construction of the Work;

- .2 The special shoring requirements, if any, of the Owner; and
- .3 Any geotechnical information obtained by Owner for use by the Contractor in the design of the trench safety system.
- .4 Trench excavation safety protection shall be a separate pay item and shall be based on linear feet of trench excavated. Special shoring requirements shall also be a separate pay item and shall be based on the square feet of shoring used.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.2.1 After the Contract has been executed, the Owner and Architect may consider requests for the substitution of products in place of those specified only under conditions set forth in the General Requirements (Division 1 of the Specifications). By making requests for substitutions, the Contractor:

- .1 Represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
- .2 Represents that it will provide the same warranty for the substitution as it would have provided for the product specified;
- .3 Certifies that the cost data presented is complete and includes all related costs for the substituted product and of Work that must be changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent; and
- .4 Shall coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects.

§ 3.4.2.2 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and making agreed-upon changes in the Drawings and Specifications resulting from such substitutions.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them. The Contractor shall not employ or subcontract with any persons (including, but not limited to, the project superintendent) or entity to which the Owner shall reasonably object.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the

Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

§ 3.6.1 The Owner qualifies for exemption from State and Local Sales Taxes pursuant to the provisions of the Texas Limited sales Excise and Use Tax Act.

§ 3.6.2 The Contractor performing the Contract may purchase, rent, or lease all materials, supplies, and equipment used or consumed in the performance of this Contract by issuing to his suppliers an exemption certificate in lieu of the tax, said exemption certificate complying with State Comptroller of Public Accounts Ruling No. 95-0.07. Any such exemption certificate issued by the Contractor in lieu of the tax shall be subject to the provision of the State Comptroller of Public Accounts Ruling No. 95-0.09 as amended to be effective October 2, 1968.

§ 3.6.3 The Owner is n exempt entity under the tax laws of the State of Texas. Texas Tax Code §151.309; 34 TAC §3.322. The Owner represents that this Project is eligible for exemption from the State Sales Tax on tangible personal property and material incorporated in the Project, provided that the Contractor fulfills the requirements of the Texas Tax Code §151.311 and 43 TAC §3.291; 3.287. For the purpose of establishing exemption, it is understood and agreed that the Contractor may be required to segregate materials and labor costs at the time a Contract is awarded. Contractor will accept a Certificate of Exemption from the Owner, pursuant to Texas Tax Code §151.054(e); §151.154; 34 TAC §3.285. Failure of Contractor or any Subcontractor to obtain Certificates of Resale from their suppliers shall make the Contractor or Subcontractor responsible for absorbing the tax, without compensation from Owner. Contractor shall pay all necessary local, county, and state taxes, income tax, compensation tax, social security, and withholding payments as required by law.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing, or where he reasonably should have known, it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 CONCEALED OR UNKNOWN CONDITIONS

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If Contractor disputes the Architect's reasons, he may proceed as provided in Article 15.

§ 3.7.4.1 The concealed or unknown conditions encountered below the surface of the ground shall apply to man-made conditions only. The materials to be excavated shall be considered as unclassified and the Contractor shall assume responsibility for excavating to the depths and limits required by the Contract Documents unless otherwise directed by the Architect, in which case the unit prices (if any) stated in the Contract Documents or subsequently agreed upon shall apply.

§ 3.7.4.2 Failure of the Drawings to show underground utility lines or other concealed piping, wiring, and the like shall not be construed as a guarantee on the part of the Architect or the Owner that such conditions do not exist. All operations involving excavation or removals shall be done at the risk of the Contractor who shall take the necessary precautions to protect employees and the public from injury or death and to avoid damage to existing systems.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

- 3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made a reasonable objection. The superintendent cannot be changed during the course of the project without written approval from the Owner unless the superintendent leaves the employ of the Contractor, in which case Section 3.9.2 shall apply.

§ 3.9.4 The Contractor shall provide an experienced full-time superintendent on the project. The superintendent shall be on the job site from 8:00 AM to 4:00 PM each workday for the duration of the Project. The Contractor agrees to pay the Owner \$200,00 per day, or portion of any day, that the superintendent is not on the job site, unless authorized in writing by the Owner. The Owner reserves the right to accept or reject the proposed superintendent based upon the individual's qualifications.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work and Project in full cooperation with any other contractors who may be on the Project. The Contractor's schedule shall indicate the critical path necessary for the Work to be successfully completed within the Contract Time.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The

submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the

information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional resubmittals.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Application for Payment, the Architect will review the amounts due to the Contractor and will consult with the Owner regarding such payments.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have a responsibility to inform the Owner of his recommendation to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to recommend to the Owner the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 Intentionally omitted.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

§ 4.2.14.1 Contractor's requests for information shall be prepared and submitted in accordance with Division 1 "General Requirements" sections on the form included in the Contract Documents, or, if not included, on AIA Document G716-2004. The Architect will return without action requests for information that do not conform to requirements of the Contract Documents.

§ 4.2.14.2 Where "as directed by Architect" or similar notation appears in the Contract Documents, the Contractor shall ask for and receive the necessary instructions from the Architect and Owner before proceeding with that portion of the Work. Requests for instructions shall be made with reasonable promptness.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.2.1 If required by the Owner, the Contractor shall submit evidence that the persons or entities he proposes to use are competent, have had experience and have performed satisfactorily on jobs of similar size, complexity, type, and scope. The information, if required, shall give complete experience records of the proposed person(s) or entit(ies), which records shall include: name of job(s), type(s) of job, General Contractor(s), Architect(s), date(s) completed, and approximate cost of subcontract(s).

§ 5.2.2.2 The acceptance of a person or entity (including those who are to furnish materials or equipment fabricated to a special design) shall not constitute approval of the materials they customarily handle, unless the materials are acceptable to the Architect as being equal to those specified in quality, function, performance, and appearance. The Architect shall render a judgment as to acceptability of the materials.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.2.5 Manufacturers and Fabricators

§ 5.2.5.1 Not later than fourteen (14) days after the date of commencement of the Work, the Contractor shall furnish in writing to the Owner through the Architect the names of persons or entities proposed as manufacturers or fabricators for certain products, equipment, and systems

identified in the General Requirements (Division 1 of the Specifications) and, where applicable, the name of the installing Subcontractor. The Architect may reply within fourteen (14) days to the Contractor in writing stating 1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or 2) that the Architect requires additional time to review. Failure of the Owner or Architect to reply within the fourteen (14) day period shall constitute notice of no reasonable objection.

§ 5.2.5.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.5.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has not reasonable objection. If the proposed but rejected manufacturer or fabricator was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute manufacturer's or fabricator's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsibly in submitting names as requires.

§ 5.2.5.4 The Contractor shall not substitute a person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor

- and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Intentionally omitted.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect and the Owner of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect and Owner of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's

or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Owner will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner and Contractor. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 The combined markup for overhead and profit included in the total cost to the Owner for a change in the Work shall be based on the following schedule:

- .1 For the Contractor, for Work performed by the Contractor's own forces, ten percent (10%) of the cost.
- .2 For the Contractor, for Work performed by the Contractor's Subcontractors, five percent (5%) of the amount due the Subcontractors.
- .3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, ten percent (10%) of the cost.

.4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7.

.6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.

§ 7.1.5 In cases where changes in the Work result in a credit to the Owner, the credit shall include direct costs for overhead, bonds, insurance, and profit. In cases where a change in the Work results in both credits and charges to the Owner, the Contractor will be allowed to add the overhead and profit percentages indicated in 7.1.4 to the net change.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time. To permit evaluation, any request for a time extension must be justified and presented in adequate detail, showing the cause and how the proposed change will delay the final Substantial Completion date.

§ 7.2.2 In responding to a request for a proposed price for a change in the Work, or in submitting a claim, the Contractor shall furnish a lump sum proposal supported by a complete breakdown as described hereafter, indicating the estimated or actual cost of the Contractor for the performance of the changed Work, including the applicable percentage of overhead and profit described hereafter. Any request for a time extension must be justified and presented in adequate detail, showing that the proposed change will delay the final Contract Completion Date, to permit evaluation.

§ 7.2.2.1 The proposal for the adjustment of Work that a Subcontractor directly performs shall contain the following items:

.1 Estimated cost, using any discounts to the trades, for the materials and supplies used, which shall be itemized completely to include unit cost, quantity, and total cost.

.2 Estimated wages paid for skilled, semi-skilled, or unskilled labor performing the additional work, which shall be itemized completely to include trade(s), hourly rate, hours, and total cost. Such wages shall include labor required for performance of the changed Work only. Working foremen may be included; all other supervisors shall be excluded and shall be considered as a part of field supervision. Labor for supporting services, including but not limited to safety provisions, layout, and trash removal, shall be excluded and shall be considered a part of overhead.

.3 Estimated cost to the contractor for additional construction equipment used solely on the Change Order work, to include rental rates of owned equipment, rates for such items of equipment while in use, which shall be itemized completely to include types of equipment, number of each type of equipment, hourly rate, hours, and total cost. Equipment that is used regularly at the job shall be used in Change Order work at no extra charge. Rates for rental of owned equipment shall be no greater than those established by the AGC for the local area. As used herein the terms "construction equipment" and "equipment" shall include wheeled vehicles and small tools.

.4 Estimated transportation costs for delivery and handling of materials and supplies, bringing to and removing from the site additional construction equipment and/or new items of installed

equipment, if applicable, which shall be itemized separately.

.5 Estimated off-site storage costs in excess of thirty (30) calendar days for new items of installed equipment, if applicable.

.6 Percentage permitted to be added to total sum of .1, .2, .3, .4, and .5 above, to cover all field supervision (including superintendents), use of other tools and equipment already on the job as necessary for performance of the Change Order work, field and general home office services and expenses, interference with other work, adjustments to progress schedules and all other overhead (including bond and insurance, only if the Work is by Contract Amendment.

.7 To the total cost proposed for the Change Order work that is the sum of .1, .2, .3, .4, .5, and .6 above, and be added to the net cost of the following, if applicable, Social Security, Old Age pension and/or other taxes of like nature imposed upon the Subcontractor (or Contractor when Contractor performs the Work) by the State and Federal Government, or both, which are incident solely to such Change Order work and which the Contractor would be required to pay if or as it performs the Work.

§ 7.2.2.2 To the amount of the adjustment of Subcontractor proposal(s) as listed under paragraph 7.2.2.1 above, the Contractor will be allowed to add a percentage to cover all overhead expenses and profit, including supervision, small tools, insurance and bond. This percentage shall not exceed the combined allowable Subcontractor/Contractor percentage of ten percent (10%). It is expressly understood that when the Contractor performs the Work with its own forces there is no Subcontractor involved, the Contractor will be allowed a full maximum allowable markup of ten percent (10%).

§ 7.2.2.3 In cases where changes in the Work result in a credit to the Owner, the credit shall be limited to direct costs; that is, no overhead or profit shall be applied to such credit. In cases where a change in the Work results in both credits and charges to the Owner, the Contractor will be allowed to add the overhead and profit percentages in 7.2.2.1 and 7.2.2.2 to the net charge; if there is a net credit, no overhead or profit shall be charged.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such

case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of

the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and the Owner and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

§ 8.3.4 In the event of a delay in Contract Time, caused by the Owner, the Contractor will be reimbursed at a rate of \$60.00 per hour for the time his superintendent is required to be on the

job site.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect and Owner. This schedule, unless objected to by the Architect or Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect or Owner, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect and Owner an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents. The form of Application for Payment, duly notarized, shall be a current authorized edition of AIA Document G702TM-1992, Application and Certificate for Payment, supported by a current authorized edition of AIA Document G703TM-1992, Continuation Sheet.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 Until Substantial Completion, the Owner will pay ninety-five percent (95%) of the amount due the Contractor on account of progress payments.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.2.1 In preparing the Application for Payment, the Contractor shall verify the accuracy of the requests for payment submitted by his Subcontractors and materials suppliers and shall not include in his Application for Payment any sum that, in his opinion, if approved, will result in an overpayment for their work performed or materials delivered.

§ 9.3.2.2 All items that are shipped in crates or otherwise wrapped shall be uncrated or unwrapped and inspected by the Contractor upon arrival at the site. Materials shall be carefully inspected for quantities, sizes, and color, if color selection is a consideration, damaged, or defects; and if damaged, defective, or otherwise not in conformance with the Contract Documents, shall be recorded immediately.

§ 9.3.2.3 The Contractor shall not request payment for any items until he has inspected the items, and any materials that are not in conformance with the Contract Documents shall not be included in any Application for Payment.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the

Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent agreed to by the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment for undisputed amounts, the Owner shall make payment in the manner and within the time provided in the Contract

Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. The Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner

does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.3.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.1.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the

Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.2.1 In compliance with laws of the State of Texas, it is distinctly understood that by virtue of this Contract, no mechanic, Contractor, material man, artisan, or laborer, whether skilled or unskilled, shall in any manner have, claim, or acquire any lien upon the house, building, or any of the improvements of whatever nature or kind so erected or to be erected under this Contract or upon any so erected, built, or situated.

§ 9.10.2.2 Although the above Article clearly states that no entity may place a lien on this building or property, the Owner requires releases and waivers of liens as required in other portions of this Contract.

§ 9.10.2.3 As a prerequisite to final payment, the Contractor shall submit the following items to the Architect, properly executed:

- .1 AIA Document G706 "Contractor's Affidavit of Payment of Debts and Claims".
- .2 AIA Document G706A "Contractor's Affidavit of Release of Liens", conditional upon receipt of final payment
- .3 AIA Document G707 "Consent of Surety Company to Final Payment", along with Contractor's release or waiver of lien (conditional upon receipt of final payment and separate releases or waivers of liens from all Subcontractors and all material or equipment suppliers).
- .4 Written guarantee by Contractor and each Subcontractor that the Work will be free of defects in materials and workmanship for a period of one year from date of Substantial Completion, except as otherwise specified.
- .5 Maintenance Manuals as required in Specifications.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.11 Time for Completion and Liquidated Damages

§ 9.11.1 It is hereby understood and mutually agreed, by and between the Contractor and Owner, that the date of the beginning and the time for completion of the Work are essential conditions of the Contract. The Contractor agrees that the Work will be prosecuted regularly and diligently at such rate of progress as will insure full completion thereof within the specified time as agreed upon and set forth in the Contract.

§ 9.11.2 If the Contractor shall neglect, fail, or refuse to complete the Work within the Contract Time specified, or any proper extension thereof granted by the Owner, then the Contractor and the Contractor's surety will be liable for and does hereby agree to pay to the Owner the sum of One Thousand Dollars and Zero Cents Dollars (\$1,000.00), not as a penalty but as liquidated damages, for each and every calendar day that the Work remains incomplete after the time stipulated. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the extreme difficulty in fixing and ascertaining the actual damages the Owner would sustain in such an event and said amount is agreed to be the amount of damages that the Owner would sustain.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.4.1 When use or storage of explosives, or other hazardous materials, substances or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall give Owner no less than fourteen (14) days' advance notice.

§ 10.2.4.2 If the Contract Documents require the Contractor to handle materials or substances that under certain circumstances may be designated as hazardous, the Contractor shall handle such materials in an appropriate manner.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.2.9 Additional Liquidated Damages

In the event of any incident negligent or intentional misconduct that creates the potential for or actually results in injury, Contractor agrees to pay, to the Owner, liquidated damages of \$10,000 in addition to any other damages for which Contractor would be liable by law or under this contract.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact, due to Owner's negligence or intentional misconduct, the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity. The foregoing notwithstanding, Owner's obligation to indemnify shall apply only to the extent permitted by the Constitution and laws of the State of Texas, without waiving sovereign immunity, and not to exceed the limits provided by Texas Civil Practice & Remedies Code Chapters 101, 102, and 108.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred in instances other than those addressed in Subparagraph 10.3.5.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

§ 10.5 Affidavit for Asbestos Exclusion and Notification

§ 10.5.1 Within Thirty (30) days of "Notice to Proceed," the Contractor will submit a notarized affidavit that states, "The undersigned Contractor certifies that to the best of his knowledge, information, and belief, the Work covered by the Contract Documents for his project will be completed without the use of any asbestos, asbestos related materials, fibers, or equipment and that the Architect and Owner will be immediately notified if the Contractor or any of his assigns or Subcontractors uncovers or has belief that asbestos products or materials are being used, installed, or uncovered at the jobsite."

§ 10.5.2 Upon completion of the Work, the Contractor will submit a notarized affidavit that states, "The undersigned Contractor certifies that to the best of his knowledge, information, and belief, the Work has been completed without the use of any asbestos related materials, fiber, or equipment." In addition, the Contractor shall prepare a ring binder with indexed dividers for each specification section. Behind each divider the Contractor shall insert the MSDS for each product utilized in the construction of the project that is associated with this section.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any

required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 Intentionally omitted.

§ 11.2.2 Intentionally omitted.

§ 11.2.3 Intentionally omitted.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay In Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Contractor shall pay the Architect its just share of insurance proceeds received by the Contractor, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner and shall require their Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Contractor shall notify the Owner of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Owner shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Owner does not object, the Contractor shall settle the loss and the Owner shall be bound by the settlement and allocation. Upon receipt, the Contractor shall deposit the insurance proceeds in a separate account and make the appropriate distribution. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Owner timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Contractor may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.2.4 Just prior to termination of the one year warranty period, the Contractor shall accompany the Owner and Architect on an inspection tour of the building and shall note defects and shall start remedying these defects within ten (10) days of the inspection tour. For extended warranties or guarantees required by various sections, e.g., roofing, compressors, mechanical equipment, the Owner will notify the Contractor of deficiencies and Contractor shall start remedying these defects within seven (7) days of initial notification from the Owner. Contractor shall prosecute the Work without interruption until accepted by the Owner and the Architect even though such prosecution should extend beyond the limits of the warranty period.

§ 12.2.2.5 Upon request by the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments and interest are due and payable in accordance with the Texas Prompt Pay Act, Texas Government Code Chapter 2251.

§ 13.7 Equal Opportunity in Employment

§ 13.7.1 **The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, color, religion, sex (including pregnancy), national origin, age, physical or mental disability, genetic information, status as a protected veteran, or any other legally protected category, class, or characteristic. The Contractor agrees to post in conspicuous places, available to employees and applicants, notices setting forth the Contractor's nondiscrimination policies.**

§ 13.7.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex (including pregnancy), national origin, age, physical or mental disability, genetic information, status as a protected veteran, or any other legally protected category, class, or characteristic.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
or
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire

Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 7 days after occurrence of the event giving rise to such Claim or within 7 days after the claimant first

recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the critical path of construction as indicated on the Construction Schedule submitted and updated according to Section 3.10.1.

§ 15.1.6.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work, and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

§ 15.1.6.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Owner's representative will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Intentionally omitted.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Immunities; Attorneys' Fees

§ 15.4.1 Contractor stipulates that Owner is a political subdivision of the State of Texas, and, as such, enjoys immunities from suit and liability provided by the Constitution and laws of the State of Texas. By entering into this Agreement, Owner does not waive any of its immunities from suit and/or liability, except as otherwise specifically provided herein and as specifically authorized by law.

§ 15.4.1.1 Intentionally omitted.

§ 15.4.2 In any adjudication under this Agreement, reasonable and necessary attorneys' fees may be awarded to the prevailing party.

§ 15.4.3 Intentionally omitted.

§ 15.4.4 Consolidation or Joinder

Intentionally omitted.

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner
4. Owner-furnished products.
5. Access to site.
6. Work restrictions.
7. Specification and drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: **UMCP NEW WOLFFORTH CLINIC**

1. Project Location: 720 Donald Preston Drive, Wolfforth, TX.

B. Owner: **University Medical Center Health System**

1. Owner's Representative: **Zach Sawyer, University Medical Center**

C. Architect: **Condray Design Group**

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. **Mechanical, Plumbing and Electrical Engineering: Justin Fincher, Fincher Engineering, LLC, 5621 114th Street, Suite 100, Lubbock, Texas 79424, (806) 701-5109.**
2. **Structural Engineering: Ross Nieman, Nieman Engineering, 1500 Broadway Avenue, Suite 1210, Lubbock, Texas 79401, (806) 589-3340.**
3. **Civil Engineering: Michael Adams, OJD Civil Engineering, 328 E. Highway 62, Unit 1, Wolfforth, Texas 79382, (806) 791-2300.**

4. Landscape Architect: Tim Oliver, Oliver Landscape Company, 1704 Norwich Avenue, Lubbock, Texas 79416, (806) 788-1883.

E. Other Owner Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Geotechnical Engineer: Braun Intertec, 7320 82nd Street, Suite B, Lubbock, TX 79424, (806) 783-9563 has prepared the following portions of the Contract Documents:
 - a. Sub-surface Investigation and Geotechnical Report.
 - b. Materials Testing during Construction. General Contractor shall coordinate all required testing with Braun Intertec.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. All work related to the construction of a Medical Care Clinic of approximately 9,214 s.f., including all related sitework.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Delivery and installation of X-Ray Equipment to be by Vendor.
2. Installation of Owner provided Security Equipment (cameras, door sensors, etc.) not provided in the Contract Documents.

1.6 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections unless otherwise noted.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.

6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished Products:

1. X-Ray Imaging Equipment.
2. Lab Equipment.
3. Pharmacy Equipment.
4. Toilet Accessories (as scheduled).
5. Exterior Signage.
6. Security System (cameras).

1.7 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.8 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. **A need for after hours or weekend work might be required to accommodate the Owner's continued use of this critical space at no additional cost to the Owner.**

1. Weekend Hours: Coordinate in advance with Owner.
2. Early Morning Hours: Coordinate in advance with Owner.
3. Hours for Utility Shutdowns: Coordinate in advance with Owner.
4. Hours for Core Drilling and noisy activity: Coordinate in advance with Owner.

- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify **Owner** not less than **five working days** in advance of proposed utility interruptions.
2. Obtain **Owner's** written permission before proceeding with utility interruptions.

- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify **Owner** not less than **five working days** in advance of proposed disruptive operations.
 2. Obtain **Owner's** written permission before proceeding with disruptive operations.
- E. Nonsmoking Facilities: Smoking is not permitted **anywhere on the Campus**.
- F. Controlled Substances: Use of tobacco products and other controlled substances **anywhere on the Campus** is prohibited.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
1. Maintain list of approved screened personnel with Owner's representative.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products may be identified by abbreviations scheduled on Drawings.
 3. Keynoting: Materials and products may be identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use a standard form that includes all information required by this Section.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect,

- d. sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - e. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - f. Samples, where applicable or requested.
 - g. Certificates and qualification data, where applicable or requested.
 - h. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - i. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - j. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - k. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - l. Cost information, including a proposal of change, if any, in the Contract Sum.
 - m. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - n. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

- B. Substitutions for Convenience: Architect will consider requests for substitution if received within sixty (60) days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.
 - k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect's standard Supplemental Instruction form.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within seven (7) days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change. **If additional time is needed, on or before the seventh day, submit a list of affected sub-contractors with a schedule of anticipated date(s) that the pricing will be completed.**
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use "UMC Change Request Price Breakdown Sheet." A copy is attached at the end of this section.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. **Proposal Request Form: UMC Change Request Price Breakdown Sheet.**
 - a. **A copy is attached at the end of this section.**

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

UNIVERSITY MEDICAL CENTER- CHANGE REQUEST PRICE BREAKDOWN SHEET									
(STANDARD FORM TO BE FILLED OUT BY SUBTRACTOR FOR ALL CHANGE REQUESTS)									
UMC PROJECT NAME:					DATE:				
PROJECT CCR NUMBER:									
SUB CONTRACTOR: ELECTRICAL SUB CONTRACTOR									
NAME OF PERSON WHO PREPARED THE ESTIMATE FOR THE WORK: JOHN DOE SR.									
CONTACT NUMBER: 806-555-5555									
Item Description	MATERIAL				LABOR				Total
	Quantity	Unit	UNIT COST	SUBTOTAL	MAN HOURS	HOURLY RATE	LABOR BURDEN	SUB TOTAL LABOR	
				\$ -				\$ -	\$ -
				\$ -				\$ -	\$ -
				\$ -				\$ -	\$ -
SUBTOTAL (LABOR AND MATERIAL)								\$ -	
ADDITIONAL EQUIPMENT									
SUBTOTAL (LABOR, MATERIAL AND EQUIPMENT)								\$ -	
OVERHEAD/PROFIT FOR LABOR/MATERIAL/EQUIPMENT (10% MAX FOR ALL FIRST TIER SUB)								10%	\$ -
SUBTOTAL WITH OH&P								\$ -	
ADDITIONAL WORK FROM 2ND TIER SUB (5% MAX FOR ALL SECOND TIER SUBS)									
*ATTACH SUB TIER PRICE BREAKOUT AS SUPPORTING DOCUMENTATION								5%	\$ -
SECOND TIER SUBTOTAL WITH OH&P								\$ -	
								TOTAL	\$ -
<i>*ALL MATERIAL COSTS NEED TO IDENTIFIED AND ATTACHED TO THIS PRICE PROPOSAL BREAKDOWN</i>									
SPECIAL CONDITIONS THAT MAY IMPACT COST:									
GENERAL CONTRACTOR:									
GENERAL CONTRACTOR PROJECT MANAGER:									
SIGNATURE OF PROJECT MANAGER:					SIGNATURE OF SUB CONTRACTOR:				

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than twenty-one (21) days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
 - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
 - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Section 011000 "Summary."

- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G703.
 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
 7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
 10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Submit Application for Payment to Architect by the 25th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 1. Submit draft copy of Application for Payment seven (7) days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: **With prior approval by the Owner include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site. For materials that are allowed to be stored off-site, abide by the following conditions unless otherwise agreed to in writing by the Owner.**
 1. **Store materials in a Bonded Commercial Warehouse**
 2. **Provide separate Insurance Coverage adequate not only to cover materials while in storage, but also in transit from the off-site storage areas to the project site. Copies of duly authenticated Certificates of Insurance, made out to insure the Owner which is signatory to the contract, must be filed with the Owner's representative and submitted with Application for Payment.**
 3. **Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.**
 4. **Inspection by Owner's representative is allowed at any time. The Owner's Inspectors must be satisfied with the security, control, maintenance, and preservation measures.**
 5. **Materials for this project are physically separated and marked for the project in a sectioned-off area. Only materials which have been approved through the submittal process are to be considered for payment.**

6. **Owner reserves the right to reject materials at any time prior to final acceptance of the complete Contract if they do not meet Contract requirements regardless of any previous progress payment made.**
 7. **With each monthly payment estimate, submit a report to the Architect listing the quantities of materials already paid for and still stored in the off-site location.**
 8. **Make warehouse records, receipts and invoices available to Owner's representatives, upon request, to verify the quantities and their disposition.**
 9. **In the event of Contract termination or default by Contractor, the items in storage off-site, upon which payment has been made, will be promptly turned over to Owner or Owner's agents at a location near the jobsite as directed by the Owner. The full provisions of Performance and Payment Bonds on this project cover the materials off-site in every respect as though they were stored on the Project Site.**
 10. **Provide summary documentation for stored materials indicating the following:**
 - a. **Value of materials previously stored and remaining stored as of date of previous Applications for Payment.**
 - b. **Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.**
 - c. **Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.**
- F. Transmittal: Submit a legible digital or scanned copy of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Ensure that the document is notarized as required. Include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
 2. **Submit a current Construction Progress Schedule along with each Application for Payment. Failure to include this with the Application for Payment may result in a delay of the review/certification process.**
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. Copies of building permits.

9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Report of preconstruction conference.
 11. Certificates of insurance and insurance policies.
 12. Performance and payment bonds.
 13. Initial Construction Schedule
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900



AIA[®]

Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

OWNER:

ARCHITECT:

TO OWNER: *(Name and address)*

CONTRACT FOR:

CONTRACTOR:

CONTRACT DATED:

SURETY:

OTHER:

STATE OF:

COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

- Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment Yes No

CONTRACTOR: *(Name and address)*

The following supporting documents should be attached hereto if required by the Owner:

- Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
- Contractor's Affidavit of Release of Liens (AIA Document G706A).

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



AIA[®] Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i>	CONTRACT FOR:	ARCHITECT: <input type="checkbox"/>
	CONTRACT DATED:	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

- Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY: _____
(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:



AIA[®]

Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

OWNER:

CONTRACT FOR:

ARCHITECT:

TO OWNER: *(Name and address)*

CONTRACT DATED:

CONTRACTOR:

SURETY:

OTHER:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall
not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
(Seal):

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including

home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Preparation Format: DWG, latest version, operating in Microsoft Windows operating system.
 3. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
 4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in AutoCAD 2018 .dwg format.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form made available upon request to the Architect.

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (10) days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Include the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.
 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fifteen (15) days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Sustainable design requirements when applicable.
 - m. Preparation of record documents.
 - n. Use of the premises and existing building when applicable.
 - o. Work restrictions.
 - p. Working hours.
 - q. Owner's occupancy requirements.
 - r. Responsibility for temporary facilities and controls.
 - s. Procedures for moisture and mold control.
 - t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. Security.
 - z. Progress cleaning.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements where applicable.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than ninety (90) days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.

- b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Owner's partial occupancy requirements.
 - k. Installation of Owner's furniture, fixtures, and equipment.
 - l. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at regularly schedule intervals as agreed upon at Preconstruction Meeting but not less frequently than biweekly.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.

- 18) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Daily construction reports.
 - 3. Site condition reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. Daily Construction Reports: **Submit at weekly intervals.**
- E. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

- B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than twenty (20) days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than sixty (60) days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than thirty (30) days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 3. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Use of premises restrictions.
 - 4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Submittals.
 - b. Purchases.
 - c. Mockups.

- d. Fabrication.
 - e. Deliveries.
 - f. Installation.
 - g. Tests and inspections.
 - h. Curing.
 - i. Startup and placement into final use and operation.
5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
1. Temporary enclosure and space conditioning.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)
- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within thirty (30) days of date established for commencement of the Work. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three (3) months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 1. List of subcontractors at Project site.
 2. Approximate count of personnel at Project site.
 3. Material deliveries.
 4. High and low temperatures and general weather conditions, including presence of rain or snow.
 5. Accidents.
 6. Meetings and significant decisions.
 7. Unusual events (see special reports).
 8. Stoppages, delays, shortages, and losses.
 9. Emergency procedures.
 10. Orders and requests of authorities having jurisdiction.
 11. Change Orders received and implemented.
 12. Construction Change Directives received and implemented.
 13. Services connected and disconnected.
 14. Equipment or system tests and startups.
 15. Partial completions and occupancies.
 16. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule along with Meeting Notes at each regularly scheduled progress meeting.
 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.

- C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Preconstruction video recordings.
 - 3. Construction progress photographs.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
 - 2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
 - 3. Section 024119 "Selective Demolition" for submitting photographic documentation before selective demolition operations commence.
 - 4. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph or video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs:
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph.
 - 3. File Type: Submit .jpeg image files.
- C. Video Recordings:
 - 1. Submit video recordings in digital video file format acceptable to Architect.
 - 2. Identification: With each submittal, provide the following information:
 - a. Name of Project.
 - b. Date video recording was recorded.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 PRECONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of preconstruction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
- C. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Where applicable, take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Where applicable, take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
 - 5. **Submit these photos to the Architect/ Owner prior to commencement of any Work.**

3.2 PRECONSTRUCTION VIDEO RECORDINGS

- A. As an alternate to Preconstruction Photographs, the Contractor may elect, with the permission of the Owner, to instead provide Preconstruction video recordings as follows.
- B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.
- C. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
 - 1. Confirm date and time at beginning and end of recording.
 - 2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.
- D. Preconstruction Video Recording: Before starting demolition, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.
 - 1. Flag construction limits before recording construction video recordings.
 - 2. Show existing conditions adjacent to Project site before starting the Work.
 - 3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of demolition where applicable or new construction.

4. Show protection efforts by Contractor.
5. **Submit video recordings to the Architect/ Owner prior to commencement of any Work.**

3.3 CONSTRUCTION PROGRESS PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 1. Date and Time: Include date and time in file name for each image.
 2. File Type: Submit .jpeg image files
- C. Construction Progress Photographs: During Construction, take photographs of elements as they are completed as well as overall photographs of the jobsite.
 1. Prior to concealing any constructed items behind, above, or beneath any other fixed material take photographs evidencing the materials and workmanship of construction to be covered or concealed.
 2. **Upload and submit daily photographs to an ftp site or other approved means of web-based file storage that the Architect and Owner can freely access, at a minimum, each week.**

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to

submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals only to the extent stated below.
 1. **Architect will furnish (1) one single layer background screen of the architectural floor plan and/or reflected ceiling plan in electronic format.**
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD 2018 format (.dwg).
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form provide upon request to the Architect.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

- a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal. These include, but are not limited to the following Sections
 - a. Structural
 - b. Mechanical
 - c. Plumbing
 - d. Electrical
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. **File name shall use sequential submittal number, Specification Section number, followed by an "R" and revision number, and then the Section Name**
Example: 01-123456-R0 Spec Section/Submittal Name
 - b. **Resubmittals shall have a new sequential suffix number**
Example: 01-123456-R1 Spec Section/Submittal Name
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.

- o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
- 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. If file size is too large to send via email (over 10 MB), post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project and notify Architect by email when files have been posted.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. **Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.**
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:

- a. PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
 - 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data : For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.

2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.

3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. 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 the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed unless otherwise indicated.
- K. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Payment for these services will be made directly by the Owner.
 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- C. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- G. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. **Distribution:** Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Section 321216 "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
 - 3. Section 321313 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Electric Power Service: Pay electric-power-service connection and use charges for electricity used by all entities for construction operations.
- C. Water and Sewer Service: Pay water and sewer connection and use charges for water and sewer used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion – and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
1. Locations of dust-control partitions at each phase of work.
 2. HVAC system isolation schematic drawing.
 3. Location of proposed air-filtration system discharge.
 4. Waste handling procedures.
 5. Other dust-control measures.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the Texas Accessibility Standards.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts, minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.
- B. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
 3. Drinking water and private toilet.
 4. Coffee machine and supplies.
 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures"

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service if available.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Temporary Water Service: Establish new temporary water service as necessary to perform the Work. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Temporary Electric Power Service: Establish new temporary electric power service as necessary to perform the Work. At Substantial Completion, restore these facilities to condition existing before initial use.
- F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 2. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."

3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Provide temporary parking when none exists or use designated areas of Owner's existing parking areas for construction personnel.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as designed by and transmitted from the Architect.
 - a. Size is to be determined by site layout and scope of work but may be as large as 8'x8' or larger.
 - b. Sign is to be printed and/or mounted on suitable substrate for size of sign.
 - c. Sign is to be weather-resistant.
 - d. Sign is to be printed at a resolution so as to be clearly legible at distances appropriate within the project site.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.

2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.

- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

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INFECTION CONTROL RISK ASSESSMENT (ICRA))

TYPE OF CONSTRUCTION ACTIVITY OR PROJECT (circle type of project):

Level I	Level II	Level III
Inspection and non-invasive activities such as removal of ceiling tiles for visual inspection, painting without sanding, wallcovering, electrical trim work, minor plumbing, all activities that do not generate dust or require cutting of walls	Short duration activities such as installation of telephone and computer cables, cutting of walls or ceiling where dust can be controlled by using temporary zip walls	Any activity that generates moderate to high levels of dust or requires demolition or removal of any fixed building components such as the sanding of walls or painting or wall coverings, removal of floor coverings, ceiling tiles, and casework, new wall construction, minor duct work, electrical work above the ceiling, major cabling activities. Major demolition and construction or renovation projects such as any activity that requires consecutive work shifts. Any new construction or removal of a complete cabling system.

RISK GROUPS (circle area involved):

Low Risk	Medium Risk	High Risk	Highest Risk
All Office areas All Public areas	Admitting Outpatient Areas Food & Nutrition prep areas Radiology Nuclear Medicine MRI Endoscopy Services Outpatient Physical Therapy	Emergency Center Family Birth Center MFSC Pediatrics PACU Pharmacy Newborn Nursery Clinical Pathology Central Stores Outpatient Surgery 3 East 3 West Family Care Unit 4 East 4 West 5 East 5 West RT Blood Gas Rooms Supportive Care Unit Geriatric Trauma	Bone Marrow Transplant Unit Burn Intensive Care Unit Cardiac Cath Lab/6 East Heart Station Sterile Processing Operating Room, including C-Section rooms Negative Air Pressure Rooms, Isolation rooms Surgical Intensive Care Unit Cardiac Intensive Care Unit/6 West Medical Intensive Care Unit Dialysis Unit Pediatric Intensive Care Unit Southwest Cancer Treatment and Research Center Neonatal Intensive Care

RISK CLASS DETERMINATION (match level of project with risk group to determine Risk Class):
Risk Class May be Adjusted Based on Location of Project

RISK GROUPS	Level 1	Level 2	Level 3
Low Risk	I	II	II
Medium Risk	I	II	III
High Risk	I	II	III
Highest Risk	II	II or III	III

Risk Class I:

- Meet with the Infection Preventionist/Construction Committee and obtain ICRA permit before project begins.
- Post ICRA permit at job site in a visible area outside of the construction/renovation site.
- Wet wipe the area when job is completed.
- Wear protective clothing (cover gown) when up in the ceiling. This protects the construction workers clothes and prevents spreading the dust and dirt throughout the facility once the worker is finished with the project.
- If ceiling tiles have been removed replace within 30-40 minutes.

Risk Class II

- Meet with the Infection Preventionist/Construction Committee and complete assessment.
- Obtain ICRA permit before project begins.
- Contact Manager or Director of affected area.
- Post ICRA permit at job site in a visible area outside of the construction/renovation site.
- Minimize dust to prevent airborne contamination.
- Wear protective clothing (cover gown) when up in the ceiling. This protects the construction workers clothes and prevents spreading the dust and debris throughout the facility once the worker is finished with the project.
- Use plastic zip barriers and seal unused doors with tape.
- Restrict access to area as much as possible. Re-route traffic if possible.
- Provide and use walk-off track mats. Ensure mats are sticky and change as needed.
- Block off or seal air vents to prevent dust and debris from being circulated throughout the facility.
- Contain construction waste in tightly clean covered containers. Use the safest route to remove waste.
- Wet mop the area. This is the responsibility of the construction worker or the facilities EVS department.

Risk Class III (precautions may be adjusted based on risk):

- Meet with the Infection Preventionist/Committee and complete assessment.
- Obtain ICRA permit before project begins.
- Contact Manager or Director of affected area.
- Post ICRA permit at job site in a visible area outside, but near, the construction/renovation site.
- Construct solid barriers *before project begins*. The barrier must be well sealed. The barrier, if sheet rock, must have all seams taped and the entire barrier must be painted.
- Construct *anteroom*. This provides the construction worker a place to remove contaminated cover gowns before walking throughout the facility.
- Maintain negative air pressure within the work site.
- Use air scrubbers.
- All construction workers must wear protective clothing to prevent their own clothes from becoming contaminated. This prevents the worker from spreading dust and debris throughout the facility when not in the construction site.
- Contain and remove construction waste in tightly covered containers. The covered containers are to be wiped down before moving throughout the facility.

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- When removing waste in tightly covered containers use the quickest and safest route keeping in mind the safety of the staff and patients.
- Protect the HVAC from contamination. Block off or seal air vents to prevent dust and debris from being circulated throughout the facility.
- Restrict access and control traffic using signage to re-route staff and visitors.
- Provide and use walk-off track mats. Ensure mats are sticky and change as needed.
- When the project is complete, a terminal clean by EVS must be completed. Once the first TC has been completed, the barriers may be removed and a second TC is completed by EVS.
- The area of the project must be inspected by Infection Prevention and Control before it is occupied.

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one (1) week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 6. Protect stored products from damage and liquids from freezing.
 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 - 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 3. Products:
 - a. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product,

that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:
 - a. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 – EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

- B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Section 018113.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations," Section 018113.16 "Sustainable Design Requirements - LEED for Commercial Interiors," Section 018113.19 "Sustainable Design Requirements - LEED for Core and Shell Development," and Section 018113.23 "Sustainable Design Requirements - LEED for Schools."
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.

- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."
- E. Surface and Substrate Preparation: Comply with manufacturer's written recommendations for preparation of substrates to receive subsequent work.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.

- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Final cleaning.
 - 4. Repair of the Work.
- B. Related Requirements:
 - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 017300 "Execution" for progress cleaning of Project site.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 2. Complete final cleaning requirements, including touchup painting.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 - 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use form agreeable to Architect
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect will return annotated file.

1.9 SUBMITAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 1. Prepare Warranties in either hard copy format or electronic format as specified in Section 017839 – Project Record Documents.
 2. If hard copy is required, bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - a. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - b. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 3. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

- o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. **Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.**
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Warranties
 - 2. Record Drawings.
 - 3. Record Specifications.
 - 4. Record Product Data.
 - 5. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.

1.3 CLOSEOUT SUBMITTALS

- A. **General: Submit (2) flash drives with the required information on each. Organize the Data on the flash drive into the following categories.**
- B. Warranties
 - 1. Submit warranties for all Sub-Contracted portions of the work.
 - 2. Submit Builder's Warranty for one year starting at the date of Substantial Completion as issued by the Architect.
- C. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one complete set of marked-up record prints.
 - 2. Indicate all changes that were incorporated into the work including but not limited to addendum items and supplemental drawings.
- D. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- E. Record Product Data: Submit one copy of each final, approved submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

- F. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one copy of each submittal.
- G. Reports: Submit written report indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.
- H. **SDS:** Submit Safety and Data Sheets for **ALL** products incorporated into the Project.

PART 2 - PRODUCTS

2.1 PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Prepare Warranties in electronic format.
 - 2. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

2.2 RECORD DRAWINGS

- A. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 - 1. Format: Annotated PDF electronic file with comment function enabled.
 - 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 3. Refer instances of uncertainty to Architect for resolution.
 - 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
 - 5. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
6. Content: Types of items requiring marking include, but are not limited to, the following:
- a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
7. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
8. Use colors to distinguish between changes for different categories of the Work at same location.
9. Mark important additional information that was either shown schematically or omitted from original Drawings.
10. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: **Organize record prints and newly prepared record Drawings into manageable sets. Scan each page and combine to create one PDF Drawing Set. Use Bookmarks and links to organize the sheets in the file. Include identification on cover sheets.**
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.3 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.4 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. **Format:** Submit miscellaneous record submittals as PDF electronic file, **each section bookmarked digitally, as to properly organize the data.**

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

C. **Submit additional documents as follows:**

1. **Building inspection approval**
2. **Certificate of Occupancy**
3. **Fire alarm installation certificate**
4. **Fire Marshal approval letter**
5. **Fire sprinkler approval letter (city inspection)**
6. **Automatic Fire Sprinkler Shop Drawings with Fire Marshal's approval**
7. **HVAC TAB report with deficiencies noted and corrected**

2.6 SAFETY & DATA SHEETS (SDS)

- A. Safety and Data Sheets for **ALL** products incorporated into the Project are to be provided at the end of the Work.
 - 1. Organize data by Project Manual Section Designations. Scan and index data in PDF format. Use a Table of Contents, Bookmarks, and links to properly organize the data.
 - 2. Include on each sheet a description of where the product was utilized.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Demolition and removal of selected site elements.

- B. Related Requirements:

- 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
- 2. Section 017300 "Execution" for cutting and patching procedures.
- 3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 INFORMATIONAL SUBMITTALS

- A. Predemolition Photographs or Video: Submit before Work begins.
- B. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed

according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

C. Qualification Data: For refrigerant recovery technician.

D. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. **Before selective demolition, Owner will remove items as discussed at the pre-construction meeting. Items remaining that are not addressed are to be brought to the Owner's attention and Owner is to be provided sufficient time to remove all desired materials.**

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and/or preconstruction videotapes.
 - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
 - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 3. **Remove all abandoned utilities back to their source and cap or plug as directed with compatible materials.**
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly.
- B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Store items in a secure area until delivery to Owner.
 3. Transport items to Owner's storage area designated by Owner.
 4. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS
- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers unless prior authorization to do so is provided by the Owner.
- F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Division 7 for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 031200 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED WORK

- A. Applicable provisions of Division 01 shall govern all work of this Section.

1.02 WORK INCLUDED

- A. Include materials, labor, services and incidentals necessary for completion of this Section of Work.
- B. Include formwork for cast-in-place concrete as required by Concrete Contractor.
- C. Include formwork for concrete bases for equipment of mechanical and electrical divisions. Contractors for those divisions of Work shall be responsible for size, location and required inserts.
- D. Notify trades in ample time for each to install own work required in conjunction with formwork.
- E. Inserts, sleeves and other miscellaneous embedded items required by mechanical, electrical or plumbing trades shall be supplied and installed by those respective trades.
- F. Provide and install inserts, sleeves and other miscellaneous embedded items other than those required by mechanical, electrical or plumbing trades.
- G. Supply, install and maintain shoring and re-shoring related to concrete formwork.

1.03 QUALITY ASSURANCE

- A. Industry Standards, Specifications and Codes:

- 1. General:

- a. Comply with provisions of the following codes and standards except as modified herein.
- b. Referenced codes and standards including revisions and commentaries shall be the most currently adopted as of the date of these Contract Documents.

- 2. American Concrete Institute (ACI)

- a. ACI 301 Specifications for Structural Concrete
- b. ACI 318 Building Code Requirements for Structural Concrete
- c. ACI 347 Guide to Formwork for Concrete

- 3. National Forest Products Association (NFPA)

- a. NDS National Design Specification for Wood Construction including Design Values for Wood Construction

4. The Engineered Wood Association (APA)

- a. Plywood Design Specification

1.04 DESIGN CRITERIA

- A. Design forms, shores and bracing. Include factors pertaining to safety of formwork structure such as live load, dead load, weight of equipment on formwork, concrete mix, height of concrete drop, vibration reactions and similar factors.
- B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

1.05 ALLOWABLE TOLERANCES

- A. Flatwork true to plane: 1/4 inch in 10 feet
- B. Vertical surfaces true to plane: 1/4 inch floor to floor
- C. Formwork displacement: Maximum 1/4 inch
- D. Deviation of building dimensions indicated on drawings and position of columns, walls and partitions: 1/4 inch
- E. Deviation in cross sectional dimensions of columns, piers or beams or in thickness of slabs and walls: plus/minus 1/4 inch

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. General: Plywood, metal-framed plywood-faced or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Formed Surfaces Exposed To View: New plywood complying with U.S. Standard PS-1 Plyform Class I, B-B Concrete Form Plywood, B-Matte MDO Plywood by Simpson, 5/8 inch or 3/4 inch thick without defects, mill oiled and edge sealed or wood forms lined with 3/16 inch tempered pressed wood or 1/4 inch thick plywood B-B conforming to EXT-DFPA as large a size as possible to minimize joints.
- C. Formed Surfaces Concealed From View: Clean straight lumber dressed on face and edges, nominal 1 inch thickness or plywood 5/8 inch or 3/4 inch thick conforming to EXT-DFPA or metal forms smooth and as large a size as possible.

- D. Reveals and Chamfers: Wood or purpose-made plastic or high density plastic foam to achieve sharp, true lines.

2.02 FORMWORK ACCESSORIES

- A. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sizes as required of sufficient strength and character to maintain formwork in place while placing concrete.
- B. Form Ties:
1. For Unexposed Concrete: Adjustable length removable or snap-off type which will leave holes no larger than 1 inch in diameter in face of concrete and when forms are removed no metal will be within 1 inch of finished concrete surface.
 2. For Exposed Concrete: Ties shall be snap-off type (break point 1 inch or more from surface) with plastic cones added to form a 1-1/4 inch diameter, 1-1/2 inch deep recess around tie, which shall be grouted flush to match adjacent concrete surface.
 3. No wire ties or site fabricated ties permitted.

2.03 CONCRETE ACCESSORIES

- A. Dovetail Anchor Slots: #305 Hohman and Barnard, Inc. or equivalent 20 gage sheet metal in Eraydo Zinc with felt strip protector.
- B. Wedge-Type Inserts: Hot rolled steel with wedge shaped holding faces designed to receive a 3/4 inch hot dipped galvanized askew head bolt. Gateway Type SL-R hot dipped galvanized or equivalent.
- C. Waterstops: PVC or SBR type, purpose made, split serrated type, center bulb.

2.04 FORM COATINGS

- A. Form coatings for exposed concrete shall consist of an approved non-staining form oil, lacquer or plastic. Plywood approved for reuse shall be recoated as directed by Engineer. When oil is used, excess shall be wiped off with rags. When lacquer is used, a light coating of form oil over lacquer will be permitted provided excess is wiped off. Lacquer shall be MasterFinish PT 100 from BASF Corporation or approved equal. When factory-applied plastic coatings are used, follow manufacturer's instructions. Contact surface of forms shall be free of foreign matter, including dust. Form oil shall be applied to forms before reinforcing is erected. Form oil shall be of type which will not affect bonding of specified exterior finish.

2.05 CONSTRUCTION JOINT MATERIALS

- A. Solid Wood Lumber: Spruce-Pine-Fur (SPF) #2 or equivalent.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure dimensions agree with Drawings.

3.02 COORDINATION

- A. Coordinate work of other sections and cooperate with trades involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts. Do not perform work unless specifically indicated on Drawings or reviewed prior to installation.

3.03 FORMWORK ERECTION

- A. Erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Construct forms to sizes, shapes, lines and dimensions shown on Drawings and to obtain accurate alignment, location and grades. Level and plumb work. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crust plates or wrecking plates where stripping may damage concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses and like to prevent swelling and for easy removal.
- D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- E. At all exposed corners of concrete walls, beams, columns, slab edges and miscellaneous items not specified or indicated, provide 3/4 inch, 45 degree chamfer.
- F. Install ties so portion remaining within concrete after removal is at least 1 inch inside concrete. Remove so surrounding concrete is not disfigured and cleanout hole remains to be patched.
- G. Coat contact surfaces of forms with form-coating compound before reinforcement is placed.
- H. Thin form coating compounds only with thinning agent of type and in amount and under conditions of form coating compound manufacturer's directions. Do not allow excess form coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.04 INSERTS, EMBEDDED PARTS AND OPENINGS

A. Plumbing, Heating and Electrical Items:

1. Premanufactured items including inserts, sleeves and other embedded items required by mechanical, electrical and plumbing trades shall be supplied, accurately located, and installed by respective trades.
2. Site fabricated box outs for chases, sleeves and other miscellaneous openings for mechanical, electrical and plumbing trades shall be supplied and installed by Formwork Contractor.
3. Location of mechanical, electrical and plumbing inserts, embedded parts, openings and recesses shall be coordinated with respective trades by General Contractor.

B. Other Items:

1. Other inserts, embedded parts, box outs for openings, chases, reveals and recesses except those specifically mentioned above by mechanical, electrical or plumbing trades, shall be installed by Formwork Contractor. Special inserts, embedded parts or other special requirements needed by specific trades shall be supplied by that respective trades to Formwork Contractor for installation. General Contractor shall have overall responsibility for coordinating location of inserts, embedded parts, openings and recesses.
2. Install concrete accessories in accordance with manufacturer's recommendations; straight, level and plumb. Ensure items are not disturbed during concrete placement.
3. Set and build into Work, anchorage devices and other embedded items required for other work attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached. Build-in dovetail anchor slots vertically.
4. Build-in wedge inserts indicated.

3.05 JOINTS AND EDGE FORMS

- A. Locate construction joints as shown on Drawings or as approved by Engineer. Form with keyway. Place perpendicular to main reinforcement. Continue reinforcement through joint, except slabs-on-grade, and locate joint so as not to affect structural integrity or appearance of structure. Includes joint between wall and footing.
- B. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units of sufficient strength to support types of screeds required. Align concrete surface to elevation of screed strips by use of strike-off templates or accepted compacting type screeds.

3.06 CLEANING

- A. Clean forms as erection proceeds to remove foreign matter. Remove cuttings, shavings and debris from within forms. Flush with water or use compressed air to remove remaining foreign matter. Ensure water and debris drain to exterior through clean-out ports. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.07 FIELD QUALITY CONTROL

- A. Inspect and check completed formwork, shoring and bracing to ensure work is in accordance with formwork design and supports, fastenings, wedges, ties and parts are secured.
- B. Clean and repair surfaces of forms to be reused in Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact form surfaces as specified for new formwork.
- C. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces. Do not use metal cover plates for repairing defects in forms for exposed concrete work.
- D. Inform Engineer when formwork is complete and has been cleaned to allow for inspection. Obtain review prior to placing concrete.
- E. For exposed to view concrete surfaces do not reuse plywood formwork.
- F. Allow Engineer to inspect each section of plywood type formwork prior to reuse.

3.08 FORMWORK REMOVAL

- A. Notify Engineer and Owner's field representative prior to removing formwork, centering, shoring and reshoring.
- B. Remove forms in a manner to insure safety of structure at all times. Where entire structure is supported on shores; beam and girder sides, columns and similar vertical forms may be removed after 48 hours, providing concrete is sufficiently hard not to be injured thereby. In no case shall supporting forms or shoring be removed until members have acquired sufficient strength to support their weight and load safely. Coordinate removal with work of other trades.
- C. Remove forms according to ACI-347.

END OF SECTION 031200

SECTION 032013 – REINFORCING STEEL

PART 1 - GENERAL

1.01 RELATED WORK

- A. Applicable provisions of Division 01 shall govern all work of this Section.

1.02 WORK INCLUDED

- A. Include materials, labor, services and incidentals necessary for completion of this Section of Work.
- B. Work includes fabrication and placement of reinforcement for cast-in-place concrete including bars, welded wire fabric, ties, dowels, stirrups, supports and accessories required.

1.03 QUALITY ASSURANCE

- A. Industry Standards, Specifications and Codes:

- 1. General:

- a. Comply with provisions of the following codes and standards except as modified herein.
- b. Referenced codes and standards including revisions and commentaries shall be the most currently adopted as of the date of these contract documents.

- 2. American Concrete Institute (ACI):

- a. ACI 301 Specifications for Structural Concrete
- b. ACI 318 Building Code Requirements for Structural Concrete
- c. ACI 315 Details and Detailing of Concrete Reinforcement

- 3. Concrete Reinforcing Steel Institute (CRSI):

- a. Manual of Standard Practice
- b. Recommended Practice for Placing Reinforcing Bars

- 4. ASTM International (ASTM):

- a. Specific ASTM numbers are noted in later text.

1.04 QUALIFICATIONS

A. Acceptable Manufacturers:

1. Shall be regularly engaged in the manufacture of steel bar, welded wire fabric reinforcing and mechanical splicing devices.

B. Installer Qualifications:

1. Shall have 3 years experience in installation of steel bar and welded wire fabric reinforcing.

C. Source Quality Control:

1. Mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered if requested.

1.05 SUBMITTALS

A. Submit in accordance with Division 01 requirements.

B. Steel Properties:

1. Submit certification of grade, chemical analysis and tensile properties of steel furnished if requested.

C. Shop Drawings:

1. Show sizes and dimensions for fabrication and placing of reinforcing steel and bar supports.
2. Show type, size and location of accessories.
3. Indicate bar schedules, stirrup spacing and diagrams of bent bars, arrangements and assemblies.
4. Indicator for yield strength of bars being provided.
5. Show required bar laps and call out specific lap dimensions.
6. Lap splices shall develop the full strength of the bar unless lesser laps are permitted by Drawings.

D. Manufacturer's Literature:

1. Submit manufacturer's specifications, capacities and installation instructions for splice devices.

PART 2 - PRODUCTS

2.01 REINFORCING STEEL

A. Reinforcing Bars:

1. Conform to ASTM A-615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement".
2. Reinforcing bars shall be deformed, except that plain bars may be used for spirals.
3. Main reinforcing bars and other bars not listed above shall be Grade 60, unless noted otherwise on Contract Documents.

B. Welded Wire Reinforcement:

1. Conform to ASTM A-106 "Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
2. Welded wire reinforcement shall be electrically welded and 65,000 psi yield strength.

2.02 MECHANICAL SPLICES

1. Mechanical splicing devices are to be used where specifically noted on Drawings or at Contractor's option for any splice. Mechanical splicing devices shall develop 125 percent of designated yield strength of reinforcing being spliced.
2. Acceptable products and manufacturers are as follows:

a. COMPRESSION SPLICES:

- 1) - Cadweld (compression only); Erico Products, Inc.
- 2) - Lenton; Erico Products, Inc.
- 3) - Speed Sleeve; Erico Products, Inc.
- 4) - G-Lock; Gateway
- 5) - Grip-Twist; Barsplice Products, Inc.

b. TENSION SPLICES:

- 1) - Cadweld (tension only); Erico Products, Inc.
- 2) - Lenton; Erico Products, Inc.
- 3) - Grip-Twist; Barsplice, Inc.
- 4) - Bar-Grip System, Barsplice Products, Inc.

3. Comply with manufacturer's instructions for bar preparation and installation of splicing devices.

2.03 ACCESSORIES

A. Supports for Reinforcement:

1. Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
2. Use wire bar type supports complying with CRSI recommendations unless otherwise indicated. Do not use wood, brick and other unacceptable materials, e.g., mortar blocks, coarse aggregates.
3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected. For sandblasted or bush-hammered concrete provide stainless steel protected or special stainless bar supports.
4. Where indicated on Drawings, slab on grade reinforcement shall be supported on individual high chairs with sand plates for soil bearing (HCP).
5. Over waterproof membrane, use chairs with plates to prevent penetration of membrane.

2.04 FABRICATION

- A. Shop fabricate reinforcing bars to conform to required shapes and dimensions. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken materials.
- B. Reinforcement shall be bent cold unless otherwise permitted by Engineer.
- C. Unacceptable Materials:
 1. Reinforcement with any of the following defects will not be permitted in Work:
 - a. Bar lengths, depths and bends exceeding specified fabrication tolerances.
 - b. Bends or kinks not indicated on Drawings or final Shop Drawings.
 - c. Bars with reduced cross-section due to excessive rusting or other cause.

2.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General:

1. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size, lengths and other information corresponding to markings shown on placement drawings.
2. Handle and store materials to prevent dirt or excessive rust.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine formwork and other conditions under which concrete reinforcement is to be placed and notify Formwork Contractor of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in a manner to your satisfaction.

3.02 PLACEMENT

- A. Comply with specified codes and standards and CRSI "Recommended Practice for Placing Reinforcing Bars" for details and methods of reinforcement placement and supports and as specified.
- B. Clean reinforcement to remove loose rust and mill scale, earth, ice and other materials which reduce or impair bond with concrete.
- C. Position, support and secure reinforcement against displacement by formwork, construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers as required.
- D. Place reinforcement to obtain coverages for concrete protection as indicated on Contract Documents. Arrange, space and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so ends are directly away from exposed concrete surfaces.
- E. At openings in concrete walls or slabs additionally provide a minimum of two #5 bars around opening.
- F. Provide two #3 bars 3 inches apart on 4 sides of floor drains in slabs.
- G. Unless permitted by Engineer, reinforcing shall not be bent after being embedded in hardened concrete.
- H. Suspend footing reinforcement in place with wires to assure proper placement. Where applicable, solid concrete bricks may be utilized to position reinforcement in spread and strip footings.
- I. Welded wire reinforcement shall lap one full mesh at side and end laps and must be wired together. Mesh for slabs-on-grade shall be raised at least 2 inches during concrete pour. Minimum requirement for concrete toppings and slabs-on-grade shall be WWF 6x6 - W1.4 by W1.4 unless specifically noted otherwise on Drawings. Where indicated on Drawings, slab on grade reinforcement shall be supported on individual high chairs with sand plates for soil bearing (HCP). Supports shall be a minimum of 2 inches high and maximum spacing shall be 48 inches on center each way. Supports shall be tied to reinforcement.
- J. Provide sufficient number of supports and sizes as required to carry reinforcement. Maximum spacing of chairs is 48 inches on center. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

3.03 WELDING OF REINFORCEMENT

- A. Welding of reinforcement covered by this Section is prohibited.

3.04 FIELD QUALITY CONTROL

- A. Notify Engineer when reinforcing is in place so he or she may review reinforcing placement. Engineer shall have a minimum of 24-hour notice prior to placement of concrete.
- B. Tend to reinforcing at all times during concrete placement and make necessary adjustments to reinforcing which has been dislodged by concrete placement or workmen.
- C. Bar Placement Tolerances:
 - 1. 1/4 inch (plus/minus) between bars
 - 2. 1/4 inch (plus/minus) vertically for members 8 inches deep or less
 - 3. 1/2 inch (plus/minus) vertically for members over 8 inches deep and less than 2 foot deep
 - 4. 1 inch (plus/minus) vertically for members 2 foot or deeper

END OF SECTION 032013

SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

- A. Applicable provisions of Division 01 shall govern work of this Section.
- B. 03 12 00 – Concrete Forming and Accessories.
- C. 03 20 13 –Reinforcing Steel

1.02 WORK INCLUDED

- A. Include materials, labor, services, and incidentals necessary for completion of this section of Work.
- B. Extent of cast-in-place concrete work is shown on Drawings.
- C. Provide concrete bases for equipment of mechanical and electrical divisions. Coordinate size and location with HVAC, Plumbing, and Electrical Contractors.
- D. Notify other trades of the date for concrete placement in ample time for each to install their own work.
- E. Install anchor bolts, embedded plates, inserts and similar items furnished by other trades.

1.03 NOTIFICATION

- A. Contractor shall the inspection/testing agency and Engineer at least 24 hours prior to major concrete pour.

1.04 PROTECTION OF ADJACENT WORK

- A. Contractor shall be responsible to see that due care is exercised to avoid staining adjacent finished material during concrete work. Contractor, without expense, shall make such damage good to Owner.

1.05 QUALITY ASSURANCES

- A. Industry Standards, Specifications and Codes:

1. General:

- a. Comply with provisions of the following codes and standards except as modified herein.
- b. Referenced codes and standards including revisions and commentaries shall be the most currently adopted as of the date of these Contract Documents.

2. American Concrete Institute (ACI):

- a. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials
- b. ACI 301 Specifications for Structural Concrete

- c. Additional ACI sections are noted in later text.
- 3. ASTM International (ASTM):
 - a. Specific ASTM standards are noted in later text.

1.06 ALLOWABLE TOLERANCES

- A. Flatwork tolerance for random-traffic floors should be measured in accordance with ASTM E 1155.
- B. When area of slab surface within 2 feet of construction joints exceeds 25 percent of slab surface, entire surface area shall be tested, including those areas within 2 feet of construction joints.
- C. Floor tolerance measurements shall be made within 16 hours after completion of final troweling operation, and where applicable, before removal of supporting shores.
- D. Floor Flatness and Levelness Tolerances:
 - 1. General: Tolerances in floor slab elevation shall not exceed the following:
 - 2. Definitions:
 - a. Ff – maximum variation in floor elevation within any 2-foot length; “flatness”
 - b. Fl – maximum variation in floor elevation between any 2 points separated by 10 feet; “levelness”
 - c. Specified overall value – minimum average for Project.
 - d. Local value – minimum within each column bay.
 - 3. Floor flatness and levelness measurements:
 - a. Measurements shall be made where requested by Owner or Architect, at Owner’s expense.
 - b. Measurements shall be made in accordance with ASTM E-1155 and ACI 117
 - 4. Typical Slabs
 - a. Slab on Grade
 - 1) Specified Overall Value – Ff25/Fl20
 - 2) Minimum Local Value – Ff17/Fl15
- E. See ACI 117 for other tolerances not stated herein.

1.07 SUBMITTALS

- A. Submit in accordance with Division 01 requirements.
- B. Mix Designs:
 - 1. Prepare design mixtures for each class of concrete on the basis of laboratory trial mixtures or field test data, or both in accordance with ACI 301. Design mixtures shall meet the requirements listed in Table 033000-1. Submit material content per cubic yard of each class of concrete furnished including:
 - 2. Weight of cementitious materials.
 - 3. Saturated surface-dried weights of fine and coarse aggregates.
 - 4. Quantities, type and name of admixtures.
 - 5. Weight of mixing water.
- C. Submit to Engineer mix designs, certification that materials used in concrete mixtures meet ASTM and other applicable specifications, and documentation indicating proposed concrete proportions will produce an average compressive strength equal to or greater than the required compressive strength as specified in ACI 301. Obtain approval prior to placing concrete.
- D. Test Reports:
 - 1. Submit reports of concrete testing including, compressive strength, density (unit weight), air content, temperature and slump. Furnish copies to General Contractor, Consulting Engineer, Concrete Supplier and Owner Representative. Test results shall be reported in writing within 2 days that tests are made.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Hydraulic Cement:
 - 1. For normal concrete, hydraulic cement shall meet requirements of ASTM C 150, ASTM C 595, or ASTM C 1157.
 - 2. For air-entrained concrete, cement shall meet requirements of ASTM C 150, Type 1A Portland Cement or cement specified for normal concrete may be used with an air-entraining admixture conforming to ASTM C 260.
- B. Slag Cement:
 - 1. Slag cement shall meet requirements of ASTM C 989.
- C. Silica Fume Cement:
 - 1. Silica fume shall meet the requirements of ASTM C 1240.

D. Fly ash:

1. Fly ash shall meet the requirements of ASTM C 618.

E. Aggregates:

1. Normal weight aggregate shall comply with requirements of ASTM C 33. Lightweight aggregates shall comply with requirements of ASTM C 330.

F. Water:

1. Water used for batching concrete shall meet the requirements of ASTM C 1602.

2.02 ADMIXTURES

A. No other admixtures will be allowed except those listed without Engineer's approval.

B. Air-Entraining:

1. Shall Conform to ASTM C 260, certified by the manufacturer to be compatible with other required admixtures. The Entrained air content shall be controlled at 6½ percent for ¾" aggregate concrete and 5½ percent for 1½" aggregate concrete within limits of plus or minus 1½ percent each.
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Darex II" – W.R. Grace
 - b. "AEA 92S" - Euclid
 - c. "Catexol AE 260" – Axim Concrete Technologies
 - d. "Micro-Air" – BASF Admixtures, Inc.
 - e. "MB AE 90" – BASF Admixtures, Inc.

C. Water Reducing:

1. Shall conform to ASTM C 494, Type A
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "WRDA 82" – W.R. Grace
 - b. "Eucon WR-91" - Euclid
 - c. "Catexol 1000N" – Axim Concrete Technologies
 - d. "Pozzolith 200N" – BASF Admixtures, Inc.

D. Mid-Range Water Reducing:

1. Shall conform to ASTM C 494, Type A or Type F
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Daracem 65" – W.R. Grace
 - b. "Eucon MR" - Euclid
 - c. "Catexol 3500N" – Axim Concrete Technologies
 - d. "Polyheed 997" - BASF Admixtures, Inc.

E. High-Range Water Reducing (Super Plasticizer):

1. Shall conform to ASTM C 494, Type F or Type G.
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Daracem 19" - W.R. Grace & Co.
 - b. "ADVA 100" - W.R. Grace & Co.
 - c. "Eucon 37" - Euclid
 - d. "Catexol 1000SP-MN" – Axim Concrete Technologies
 - e. "Rheobuild 1000" - BASF Admixtures, Inc.

F. Water Reducing, Non-Chloride Accelerator:

1. Shall conform to ASTM C 494, Type C or Type E.
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Polarset" - W.R. Grace & Co.
 - b. "Accelguard 80" - Euclid Chemical Co.
 - c. "Catexol 2000RHE" – Axim Concrete Technologies
 - d. "Pozzutec 20" - BASF Admixtures, Inc.

G. Water Reducing, Retarding:

1. Shall conform to ASTM C 494, Type D.
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Daratard 17" - W.R. Grace & Co.

- b. "Eucon Retarder 100" - Euclid Chemical Co.
- c. "Catexol 1000R" – Axim Concrete Technologies
- d. "Pozzolith 100XR" - BASF Admixtures, Inc.

2.03 BONDING AGENT

- A. Shall be a poly-vinyl acetate emulsion.
- B. Products: Subject to compliance with requirements, provide one of the following:
 1. "Southcrete 45" – SGM
 2. "Euco Weld" – Euclid Chemical Company

2.04 RELATED MATERIALS

- A. Evaporation Retardant and Finishing Aid: Shall be "Confilm" by BASF Admixtures, Inc.
- B. Vapor Retarder: Provide vapor retarder over prepared base coarse. Provide manufacturer's recommended pipe boots, mastics and gusset tape. Use only materials resistant to decay when tested in accordance with ASTM E154, as follows:
 1. Vapor Retarder membrane must have the following qualities;
 - a. Water Vapor Transmission Rate ASTM E 96 less than 0.008
 - b. Water Vapor Retarder ASTM E 1745 Class A
 - c. Provide one of the following:
 - 1) Stego Wrap (15 mil) Vapor Barrier by Stego Industries LLC
 - 2) W.R. Meadows Perminator 15 mil
 - 3) Zero-Perm by Alumiseal
- C. Non-Shrink Grout: Factory pre-mixed non-metallic grout, complying with ASTM C 1107.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Set Grout" - ChemRex
 - b. "Sonogrout" - Sonneborn
 - c. "Euco-NS" - Euclid Chemical Co.
 - d. "Sealtight 588" - W.R. Meadows

- e. "Crystex" - L&M Cons. Chemical Co.
 - f. "Sure-Grip Grout" - Dayton Superior Corp.
 - g. "Horngrout" - A.C. Horn
 - h. "Five Star Grout" - US Grout Corp.
- D. Absorptive Cover: Burlap cloth made from jute or Kenaf, weighing approximately 9 ounces per square yard, complying with AASHTO M182, Class 2.
- E. Moisture-Retaining Cover: One of the following, complying with ASTM C 171, Type 1 or 2:
1. Polyethylene Film
 2. Polyethylene Coated Burlap
- F. Liquid Curing Compound
1. Conform to ASTM C309, Types 1 and 1D, Class B, water based.
 2. Meet federal and state VOC/AIM regulations.
 3. Shall be dissipating resin type, which chemically breaks down after approximately eight (8) weeks.
 4. Shall not inhibit bonding of flooring adhesives
 5. Shall not inhibit bond breaker, where applicable
 6. Sodium silicates prohibited.
 7. Use on all interior slabs to receives subsequent floor coverings and parking structures
- G. Curing and Sealing Compounds:
1. Conform to ASTM C1315, Type 1, Class B.
 2. Minimum 25 percent solids by volume.
 3. Moisture loss shall be not more than 0.30 Kg/M2 when applied at 300 square feet per gallon.
 4. Meet federal and state VOC/AIM regulations.
- H. Epoxy Adhesive: ASTM C 881, 2 component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Concresive LPL Liquid" - ChemRex
 - b. "Epoxitite" - A.C. Horn

- c. "Edoco 2118 Epoxy Adhesive" - Edoco Technical Prod.
 - d. "Sikadur Hi-Mod" - Sika Chemical
 - e. "Euco Epoxy 452" - Euclid Chemical Co.
 - f. "Patch and Bond Epoxy" - The Burke Co.
 - g. "Sure-Poxy" - Kaufman Products, Inc.
- I. Non-slip Aggregate Finish: For stairs, landings, platforms and where otherwise noted, provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rust-proof, and non-glassing, and is unaffected by freezing, moisture, and cleaning materials. Submit samples for Architect's approval.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "FricTex" - Sonneborn
 - b. "Euco-Non-Slip" - Euclid Chemical Co.
- J. Isolation Joint Filler: Shall be bituminous (1/2 inch and 1/4 inch thicknesses) conforming to ASTM D 994.
- K. Control Joint Insert: Shall be hardboard or fiberboard.
- L. Expansion Joint Filler: Shall be extruded polystyrene.
- M. Underlayment Compound: Free flowing, self-leveling, pumpable, cement-based compound for applications from 1-1/2 inch thick to feathered edges, minimum strength of 4000 psi.
- N. Products: Subject to compliance with requirements, provide one of the following:
- 1. "Level-Right Plus" – Maxxon Great Lakes
 - 2. "K-15" – Ardex, Inc.
 - 3. "Stonecrete UL1" – Stonehard, Inc.
 - 4. "Thoro SLU" – Thoro System Products
- O. Dovetail Anchor Slots: Shall be #305 Hohman and Barnard, Inc. or equivalent 20 gage sheet metal in Eraydo Zinc with felt strip protector.
- P. Waterstops: shall be one of the following, or an approved equal, installed per manufacturer's recommendations:
- 1. Bulb type with minimum 3 inch ribbed extension into concrete each side of joint. One side shall be split for anchoring to formwork. Representative product: "Sealtight No. 6316", W.R. Meadows Co.

2. Self-sealing non-swelling preformed joint sealant. Representative product" SF302 Synko-Flex Waterstop", Henry Company
3. Expanding preformed strip utilizing high sodium-bentonite content. Representative product:" Volcay Waterstop-RX, Model RX101", American Colloid Company

2.05 READY MIXED CONCRETE

- A. Ready mixed concrete shall be measured, mixed and delivered according to ASTM C94, except as modified herein.
- B. Prepare design mixtures for each class of concrete on the basis of laboratory trial mixtures or field test data, or both in accordance with ACI 301. Design mixtures shall meet the requirements listed in Table 33000-1
- C. Addition of water is permitted for batches of material with insufficient slump at the job site but is limited to the lesser of; 1 gallon per cubic yard or the quantity of water indicated on the delivery ticket such that the mixing water content on approved mix design is not exceeded.
- D. Ready Mixed Concrete Delivery Tickets:
 1. Furnish 2 delivery tickets with each batch of concrete before unloading at site; 1 for Contractor and 1 for Engineer on which is printed, stamped or written the following information:
 - a. Name of ready-mix batch plant
 - b. Serial number of ticket
 - c. Date and truck number
 - d. Name of Contractor
 - e. Job name and location
 - f. Specific class or designation of concrete
 - g. Amount of concrete (cubic yards)
 - h. Time loaded or of first mixing of cement and aggregates
 - i. Type, name and amount of admixture
 - j. Type, brand and amount of cement
 - k. Total water content by producer (or W/C ratio)
 - l. Maximum size of aggregate
 - m. Weights of fine and course aggregates

E. Mix Proportioning:

1. Minimum amount of cementitious material identified in the following mix proportions shall apply for mixes for which field experience or trial mixture information required is not provided.

Table 033000-1

CLASS	28-DAY STRENGTH (PSI)	SLUMP RANGE (IN)	AGGREGATE SIZE (IN)	W/C RATIO (BY WT.)	AIR ENTRAINMENT %	USAGE
A	4,000	3-5	1	0.45 Max.	None	All footings & interior slab on grade (2)
B	4,000	3-5	1	0.50 Max.	5.0	Exterior slab on grade (1) (3)
C	3,000	3-8	1	0.62 Max.	5.0	Electrical encasement, pipe encasement, miscellaneous scheduled concrete work (1) (3)

Notes:

- (1) Air entrained concrete: Use for exterior walls, exterior slabs, walks, platforms, ramps, steps and other concrete exposed to freezing and thawing.
- (2) A maximum of 50 percent total replacement of Portland cement with GGBFS (Ground Granulated Blast-Furnace Slag) and fly ash at a 1:1 ratio; up to 350 pounds, with a maximum 25 percent fly ash. If fly ash is used alone, limit maximum replacement to 25 percent.
- (3) A maximum of 30 percent total replacement of Portland cement with GGBFS (Ground Granulated Blast-Furnace Slag) and fly ash at a 1:1 ratio where freeze-thaw durability and exposure to deicers is likely; up to 350 pounds, with a maximum 25 percent fly ash. If fly ash is used alone, limit maximum replacement to 25 percent.

PART 3 - EXECUTION

3.01 GENERAL

- A. Clean all mixing and transportation equipment. Wet forms thoroughly. Remove all ice, excess water, mud and other debris from within forms and from reinforcement. Notify Engineer prior to placing in ample time for inspection of forms and reinforcing.

3.02 PLACEMENT OF CONCRETE

A. Pre-Placement Inspection:

1. Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in-place. Notify other Contractors to permit installation of their work; cooperate with other trades in setting such work as required. Thoroughly wet wood forms immediately before placing concrete as required where form coatings are not used. Notify inspection agency and Engineer 24 hours in advance of pouring.
2. Remove snow, ice, debris and excessive water from forms
3. Pre-wet soil and sand subgrades and surfaces of precast concrete to receive fresh concrete.
4. Position and secure expansion joint materials, anchors, waterstops, screeds, control joint forms, and expansion caps on slip-dowels.
5. Remove hardened concrete and foreign materials from the inner surfaces of conveying equipment, formwork and reinforcing.
6. Inspect and repair vapor retarder where applicable.

B. Placing Concrete In Forms:

1. Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Maximum length of wall pour is 100 feet between construction joints.
2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.
3. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use vibrators designed to operate with vibratory element submerged in concrete, maintaining a speed of not less than 6000 impulses per minute. Alternate methods of consolidating concrete including the use of self-consolidating concrete may be submitted to the Engineer for approval.
4. Do not use vibrators to move concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Do not insert

vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

C. Placing Concrete Slabs:

1. Deposit and consolidate concrete slabs in a continuous operation until placing of a panel or section is completed.
2. Place interior slabs on grade using long-strip construction techniques or other approved method.
3. Place suspended slabs in sections as large as practicable to complete finishing, within limits acceptable to Engineer.
4. Consult with Engineer with regard to limits of single placements prior to commencing work.
5. Consolidate concrete during placing operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
6. Bring slab surfaces to correct level with a straightedge and strikeoff. Use bull floats or darbies to smooth surface, leaving it free of humps or hollows. Do not sprinkle water on plastic concrete surface. Do not disturb slab surfaces prior to beginning finishing operations. "Wet Screed" placement of slabs is not allowed.
7. Maintain reinforcing in the proper position during concrete placement operations. mesh shall be lifted to 1/2 slab depth as pouring proceeds.

D. Cold Weather Placing:

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions or low temperatures in compliance with ACI 306.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt or other materials containing anti-freeze agents or chemical accelerators other than approved, non-chloride accelerating admixtures.
4. Do not allow carbon dioxide from heating units to contact freshly placed concrete surfaces for 48 hours. Vent heaters outside of enclosure.

E. Hot Weather Placing:

1. Temperature of concrete delivered at job site shall not exceed 95 degrees F. Add ice to mixing water as required to control temperature of mixture.
2. Conform to ACI 305.
3. Use evaporation retarders, and finishing aids when necessary to achieve sound, durable surfaces.
4. Wet forms thoroughly before placing concrete.
5. Do not use retarding admixtures without the written permission of the Engineer.

3.03 CONCRETE JOINTS

A. Construction Joints:

1. Locate as directed by Engineer or as shown on Drawings. Form keyway. Place perpendicular to main reinforcement. Continue reinforcement through joint. Locate joint so as not to affect structural integrity or appearance of the structure. Includes joint between wall and footing.

B. Isolation Joints:

1. Form with keyway with bituminous preformed filler, 1/2 inch with strippable cap to install sealant. Reinforcement is non-continuous. Locate at points of contact between slab-on-grade and vertical structural concrete.

C. Control Joints:

1. Locate on grid lines or on lines as shown on Drawings or as directed by Engineer. Joint size shall be 1/4 inch wide by 1/5 to 1/4 of slab depth. Continue reinforcement through joint. Contractor's option to tool or use insert. Do not tool joints in slabs to receive a finished flooring material. Control joints should be made within first 24 hours of concrete pour.

3.04 FINISHING

A. General:

1. Strike and level concrete. Allow to set before floating. Power float on disappearance of water sheen. Hand float areas inaccessible to power float. Applicable to flat work to obtain smooth, uniform, granular texture. Floors shall be flat and level within tolerances given in Part 1, except where drains occur or sloped floors are indicated, in which case tolerance applies to planes indicated.

B. Slab Surfaces

1. Float Finish

a. Locations

- 1) Initial finish for all horizontal surfaces
- 2) Final finish where topping slabs, waterproofing membrane or roofing is to be placed over finished surface

- b. Method: After concrete has been placed, consolidated, struck off and leveled begin first float. Check levelness and correct as required during first float. Second float shall produce a uniform and true surface with a sandy texture.

2. Trowel Finish

- a. Locations – All floor slabs except where specifically required otherwise.

- b. Method: First apply float finish, then power-trowel and finally hand towel to produce a dense, smooth surface free of trowel marks and blemishes, and uniform in texture and appearance. Do not add cement slurry or water to surface during finishing. Grind high spots and fill low spots with specified materials.
- 3. Broom Finish
 - a. Locations – Concrete ramp surfaces
 - b. Method: After float finish, power-trowel and provide coarse transverse striations with a stiff fiber brush. After brushing, provide indentations perpendicular to the slope of the ramp approximately 1/4th inch wide and deep and at 6 inch intervals with a metal grooving tool.
- 4. Non-Slip Finish
 - a. Locations: interior steel pan type stair treads and platforms, exterior concrete stair and ramps.
 - b. Method: After floating, but before troweling, apply abrasive aggregate to surface in accordance with manufacturers' recommendations, then steel trowel to a smooth, even finish. Rub finished surfaces with abrasive stone or sandblast to remove laitance or cement coating in order to expose abrasive aggregate.
- C. Saw-Cutting Concrete Slabs-on-Grade
 - 1. Saw joints as soon as possible after finishing, but only after concrete is hard enough. Concrete is hard enough when saw blade does not dislodge aggregate and when edges of sawcut do not travel.
 - 2. Joints shall be a minimum of 1/4 inch wide and 1/4 of the slab thickness deep.
 - 3. Formed strips may be used in lieu of saw-cutting in the same locations and to equal depth as sawn joints.
- D. Formed Surfaces
 - 1. General: Holes resulting from the removal of bolts or tie rods shall be solidly filled with cement grout. Fill holes passing entirely through concrete members from inside face with a plunger-type grease gun or other device that will force the mortar through to the outside face.
 - 2. Rough Form Finish: for surfaces not exposed to view
 - a. Remove fins exceeding 1/4th inch in height, and grind bulges that interfere with other trades.
 - b. Fill holes and honeycombs
 - 3. Smooth Form Finish: For surfaces exposed to view
 - a. Remove all fins, bulges and unsightly form marks.
 - b. Fill holes and honeycombs to match surrounding concrete surfaces.
 - c. Provide rubbed finish where satisfactory form finish cannot be achieved.

4. Rubbed Finish
 - a. Apply finish as soon as possible after casting concrete, no later than the day following form removal.
 - b. Wet surface and rub with carborundum brick or other abrasive to produce uniform color and texture
 - c. Form tie holes and honeycombs shall be patched and dressed to match color and texture of surrounding concrete.
5. Grout Cleaned Finish
 - a. Thoroughly clean surfaces to be finished.
 - b. Mix 1-part Portland cement and 1 ½ parts fine sand with sufficient water to produce a grout with the consistency of thick paint. Use white cement as necessary to match color of surrounding concrete. Wet concrete surfaces to prevent absorption of water from the grout. Apply grout uniformly, filling all holes and air bubbles. Remove excess grout. After initial set, rub surface with burlap. Wet cure for minimum 36 hours after final rubbing.

3.05 CURING

- A. General: beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical damage.
- B. Preservation of Moisture: protect surfaces not in contact with forms from moisture loss with one of the following methods immediately after finishing and continuing for a period of at least 7 days.
 1. Ponding or continuous sprinkling
 2. Application of absorptive mats or fabric kept continuously wet.
 3. Application of sand kept continuously wet.
 4. Continuous application of steam or mist.
 5. Application of waterproof sheet materials
 6. Application of curing compound in conformance with ASTM C309, "Specification for Liquid Membrane-Forming Compounds for Curing Concrete". Apply curing compounds in accordance with manufacturer's recommendations. Do not use curing compound on any surface against which additional concrete is to be placed or other material is to be bonded unless it is proven that the compound will not inhibit bonding, or positive measures are taken to completely remove the compound from areas to received bonded materials.
- C. Protect surfaces cast against forms from moisture loss by keeping forms wet until removed. After form removal, protect exposed surfaces by one of the methods specified.
- D. Curing shall be continued for a period of 7 days for Type I cement, or 3 days for Type III cement or until tests indicate that the concrete has attained 70 percent of required strength.

3.06 REPAIRING AND PATCHING

A. Concrete Surface Repairs:

1. Comply with ACI 301 "Specifications for Structural Concrete".
2. Remove and replace, at no additional cost, concrete not formed as shown on Drawings, concrete out of alignment, surfaces beyond required tolerances or defective surfaces which cannot be properly repaired or patched, including concrete failing to meet strength requirements as determined by testing laboratory.
3. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to concrete surface. Thoroughly clean, dampen with water and brush coat area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
4. For exposed to view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
5. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar or precast cement cone plugs secured in place with bonding agent.
6. Repair concealed formed surfaces, where possible, that contain defects that affect durability of concrete. If defects cannot be repaired, remove and replace concrete.
7. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.
8. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects include crazing, cracks in excess of 0.01 inch wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop outs, honeycomb, rock pockets and other objectionable conditions.
9. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
10. Correct low areas in unformed surfaces during, or immediately after, completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary leveling compounds may be used when acceptable to Architect.
11. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with

clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

12. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry pack, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
13. Do not use repair methods not specified above and do not perform structural repairs, except with prior written approval of Architect for method and procedure, using specified epoxy adhesive mortar.

3.07 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General:

1. Sample fresh concrete to conform to ASTM C 172.

B. Slump:

1. In accordance with ASTM C 143. One slump test at point of discharge from ready mix truck for each set of test cylinders taken, unless noted otherwise, with additional tests when concrete consistency seems to have changed. If measured slump falls outside limits specified, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, concrete will be considered to have failed to comply with Specifications. Slump tests, when taken, shall be conducted after site addition of superplasticizer, however a visual estimate of slump shall be recorded prior to site addition of superplasticizer to a mix. Visual slump should only be used after correlation has been established with actual slump tests.

C. Air Content:

1. Only for air entrained concrete, in accordance with ASTM C 231 pressure method for normal weight concrete and ASTM C 173 for lightweight concrete. One air content test for each set of strength test cylinders made unless noted otherwise. If measured air content falls outside limits specified, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, concrete will be considered to have failed to comply with Specifications. In compliance with ASTM C 94, site addition of additional air entrainment admixture is permissible until plant adjustments have been made. For site added superplasticizer, air should only be checked after the addition of superplasticizer.

D. Concrete Temperature:

1. In accordance with ASTM C 1064 each time a set of compression test specimen is made.

E. Strength Tests:

1. Strength test for any class of concrete shall consist of 4 standard cylinders made from a composite sample secured from a single load of concrete in accordance with ASTM C 172, except when in the opinion of the Engineer, he may require additional specimens.
2. All Concrete:
 - a. Make test cylinders in accordance with ASTM C 31. Each test shall consist of a minimum of 3 cylinders.
 - b. After 24 hours, cylinders to be carefully transported to testing laboratory for moist curing.
 - c. 1 laboratory cured cylinder to be tested at 7 days and 3 laboratory cured cylinders to be tested at 28 days.
3. Maturity Methods:
 - a. Maturity Methods are acceptable as long as they are done in addition to standard cylinder strength tests completed in accordance with ASTM C 172 and are completed in order to facilitate decision making opportunities for construction operations.
 - b. Shall be completed in compliance with ASTM C 1074 "Standard Practice for Estimating Concrete Strength by the Maturity Method".
 - c. Any modifications to the mixture design (including but not limited to admixtures) or material sources shall be accompanied by a re-calibration of strength-maturity relationship, datum temperature and activation energy.
4. Test results at 28 days shall be the average strength of specimens determined in accordance with ASTM C 39.
5. Strength test shall be made for: each day's pour exceeding 5 cubic yards; each class of concrete; each change of supplies or sources; and for each 150 cubic yards of concrete or fraction thereof.
6. Strength of each concrete class shall be deemed satisfactory when both of the following criteria are met:
 - a. The average of three consecutive compressive-strength tests equals or exceeds specified compressive strength.
 - b. Any individual compressive-strength test result does not fall below specified compressive strength by more than 500 psi.
7. Testing shall be performed in compliance with Division 01 provisions by an approved testing laboratory at Owner's expense, which shall submit complete reports of tests to General Contractor, Concrete Supplier, Engineer and Owner's representative. Reports of compressive strength tests shall contain project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, weather at time of placement and compressive breaking strength and type of break. An individual having ACI Level 1 Technician certification shall complete testing, including test cylinder production. Site protection of test cylinders shall be made in compliance with ASTM C 31.

8. If Engineer has reason to believe cylinder strength tests are not representative of strength of concrete in place, he shall require drilled cores to be cut and tested at Contractor's expense. Coring and testing shall be in accordance with ASTM C 42 "Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete". Acceptance or rejection of concrete shall be based on cylinders made from concrete sampled at point of discharge. Impact hammer, sonoscope or other nondestructive device may be permitted, but shall not be used as the sole basis for acceptance or rejection.
9. Air and slump tests shall be performed at a rate coinciding with strength tests. Individual test reports need not be sent to A/E. A summary of test results shall be sent to A/E at completion of the Project. A/E shall be notified immediately by testing lab of any non-conforming tests.

END OF SECTION 033000

SECTION 044313.16 - ADHERED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Stone masonry adhered to cold-formed metal framing and sheathing.
- B. Related Requirements:
 - 1. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.

1.3 **PREINSTALLATION MEETINGS**

- A. **Preinstallation Conference:** It is MANDATORY that the Contractor schedule and conduct a preinstallation conference at Project site. Those in attendance shall include the General Contractor, the masonry subcontractor (including members of the specific crew that will be installing the product for the project), the Manufacturer's Field Service Representative, the Owner's representative, and the Architect. All materials intended to be used for the project must be present on the site prior to this meeting. Prior to this meeting the Contractor shall install an in-place mock-up section in a minimum area of 4' x 4' to include the water resistive barrier, metal lathe, and scratch coat. The Installers shall be prepared to demonstrate mortar mixing methods and installation methods.

1.4 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Samples for Verification:
 - 1. For each stone type indicated. Include at least four Samples in each set and show the full range of color and other visual characteristics in completed Work.

1.5 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.
 - 1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.
- B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for each type of stone masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in mockup.
 - b. Include through-wall flashing installed for a 24-inch length in corner of mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit stone masonry above half of flashing).
 - c. Include metal studs, sheathing, flashing, and weep holes in exterior masonry-veneer wall mockup.
 - 3. Protect accepted mockups from the elements with weather-resistant membrane.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

1.8 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.

- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.9 COORDINATION

- A. Advise installers of other work about specific requirements for placement of flashing and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain each variety of stone from single quarry, whether specified in this Section or in another Section of the Specifications, with resources to provide materials of consistent quality in appearance and physical properties.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 MANUFACTURED STONE

- A. **Product substitutions shall NOT be considered. This is a facility standard material used across all Owner facilities and shall be maintained as specified.**
 - 1. **Eldorado Stone, Cut Course Stone “Seashell”.**
 - a. **Provide pre-manufactured corners in the same family and color selection.**
 - b. **Provide Utility Lightbox Textured stones in Buckskin color at electrical devices, exterior wall hydrants, or other surface mounted devices requiring a flat surface to mount and seal tightly to.**

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.
 - 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime.
- D. Aggregate: ASTM C 144 and as follows:
 - 1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
- E. Water: Potable.

2.4 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:
1. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 2. Fabricate metal drip edges for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
 3. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 4. Metal Sealant Stops: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior wall face. At exterior wall face, bend metal back on itself for 3/4 inch and down into joint 3/8 inch to form a stop for retaining sealant backer rod.
- B. Flexible Flashing: For flashing unexposed to the exterior, use the following unless otherwise indicated:
1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch thick.
- C. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at wall face, use metal flashing with a drip edge.
 4. Where flashing is fully concealed, use flexible flashing.
- D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
1. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

- A. Water-resistive Barrier: Placed behind wire lath and securely attached to sheathing. Provide one of the following:
1. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.
 2. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
- B. Expanded Metal Lath: 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60.

- C. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.

2.6 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
 - 1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
- B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - 1. Clean sawed backs of stone to remove rust stains and iron particles.
- E. Gage backs of stones for adhered veneer if more than 81 sq. in. in area.
- F. Thickness of Stone: Provide thickness indicated, but not less than the following:
 - 1. Thickness: 1 inch plus or minus 1/8 inch.
- G. Shape stone for type of masonry (pattern) as follows:
 - 1. Sawed-bed, range ashlar with uniform course heights and uniform lengths as indicated on Drawings.
 - 2. Split-bed, random-range ashlar with random course heights and random lengths (interrupted coursed).
 - 3. Polygonal or mosaic.
- H. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockups.

2.7 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride.
 - 2. Use latex-portland cement-lime mortar unless otherwise indicated.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Stone Masonry: Comply with ASTM C270 or ASTM C1714 for preblended as well as ASTM C1384 Proportion Specification and **ANSI 118.4 or 118.5 as applicable.**
 - 1. Mortar for Setting Stone: **Polymer Modified Adhered Veneer Mortar**

- D. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
- E. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. **Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.**

3.4 INSTALLATION OF ADHERED STONE MASONRY VENEER

- A. Install flashing over sheathing and behind weather-resistant sheathing paper by fastening through sheathing into framing.
- B. Install lath over weather-resistant sheathing paper by fastening through sheathing into framing to comply with ASTM C 1063.
- C. **Install scratch coat over metal lath a minimum of 1/2 inch thick to comply with ASTM C 926. Allow the scratch coat enough time to properly cure to a proper condition prior to installation of stone.**

3.5 SETTING OF STONE MASONRY, GENERAL

- A. Perform necessary field cutting and trimming as stone is set.
 - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
 - 2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
 - 3. Pitch face at field-split edges as needed to match stones that are not field split.

- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- D. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 3/8 inch at narrowest points or more than 1/2 inch at widest points.
- E. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. Sealing joints is specified in Section 079200 "Joint Sealants."
- F. Install embedded flashing at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least 16 inches, and behind weather barrier.
 - 2. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
 - 3. At sills, extend flashing not less than 4 inches at ends.
 - 4. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
 - 5. Extend sheet metal flashing 1/2 inch beyond masonry face at exterior, and turn flashing down to form a drip.
 - 6. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal drip edge.
 - 7. Install metal flashing termination beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal flashing termination.
 - 8. Cut flexible flashing flush with wall face after completing masonry wall construction.

3.6 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.
- D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.
- E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 - 2. Defective joints.
 - 3. Stone masonry not matching approved samples and mockups.
 - 4. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 - 3. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
 - 4. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.8 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use. **Contractor shall provide a minimum of 5% material in excess of that required for the project for the Owner's salvage stock. This shall include corner pieces and a sampling of all various shapes, sizes, and colors.**
- B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in greatest dimension.
 - 2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044313.16

SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SCOPE

- A. The work under this section includes labor, materials, equipment and services to provide structural steel framing installation as shown on the Drawings and specified herein.
- B. Structural steel includes elements defined as “Structural Steel” by the AISC “Code of Standard Practice for Steel Buildings and Bridges” plus field installed shear stud connectors and dowel bar anchors.

1.02 RELATED WORK

- A. Applicable provisions of Division 01 shall govern work of this Section.
- B. Section 03 12 00 – Concrete Forming
- C. Section 05 50 00 – Metal Fabrications
- D. Items furnished by this section but not installed:
 - 1. Anchor rods
 - 2. Anchor rod templates

1.03 REFERENCES (LATEST EDITIONS)

- A. Referenced codes and standards shall be those currently adopted by the Building Code enforced by the jurisdiction in which the Project is located, as of the date of these Contract Documents. Where no Building Code is enforced, referenced codes and standards shall be the most current published by the respective code bodies, unless noted otherwise.
- B. General Building Code
 - 1. 2021 IBC
- C. American Institute of Steel Construction (AISC)
 - 1. Specification for Structural Steel Buildings
 - 2. Code of Standard Practice for Steel Buildings and Bridges
 - 3. Manual of Steel Construction
- D. Research Council on Structural Connections (RCSC)
 - 1. Specification for Structural Joints Using ASTM A325 or A490 Bolts
- E. ASTM International (ASTM)

1. ASTM standards as noted in short form throughout the specification text.
- F. American Welding Society (AWS):
1. AWS D1.1/D1.1M: 2006 Structural Welding Code – Steel, except remove the following items from this reference:
 - a. Section 7.5.5 in its entirety, including sub-sections, Table 7.2,
 - b. Section 7.7.3, and other references to manual welding of shear stud connectors, headed concrete anchors, deformed bar concrete anchors and threaded base studs. Manual welding of these items is not permitted.
 2. AWS D1.3/D1.3M: 2007 Structural Welding Code - Sheet Steel
 3. AWS A5.1/A5.1M: 2006 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
 4. AWS A5.5/A5.5M:2006 Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
 5. AWS A5.17/A5.17M-97 Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
 6. AWS A5.23/A5.23M:1997 Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
- G. Steel Structures Painting Council (SSPC):
1. SSPC-SP 1 Solvent Cleaning
 2. SSPC-SP 2 Hand Tool Cleaning
 3. SSPC-SP 3 Power Tool Cleaning
 4. SSPC-SP 6 Commercial Blast Cleaning
 5. SSPC-SP 10 Near-White Blast Cleaning

1.04 SUBMITTALS

- A. Provide submittals in accordance with the requirements of Division 1.
- B. Product Data: prepared for review and approval; include manufacturer's data for each product where specific request is made in Part 2.
- C. Shop Drawings: prepared for review and approval; include erection plans, setting diagrams, erection details showing work required for structural steel framing installation, type of steel, details of structural members including cuts, connections, camber, holes, and other modifications to base member. Indicate type, size and length of bolts, distinguishing between shop and field bolts, and identifying pre-tensioned (PT) and slip-critical (SC) bolts. Indicate welds with standard

AWS symbols, distinguishing between shop and field welds, and identifying size, length and type of weld

- D. Test reports: prepared for review; include the result and evaluation of tests performed by a qualified testing agency on structural steel framing elements and on shear stud connectors and dowel bar anchors; applies to tests performed at the fabrication plant and at the jobsite.
- E. Fabricator certifications: prepared for review; include documentation certifying that the structural steel fabricator meets the quality assurance requirements.
- F. Erector certifications: prepared for review; include documentation certifying that the structural steel erector meets the quality assurance requirements.
- G. Mill certifications of structural steel shapes: prepared for review when specifically requested by A/E; show heat number, chemical and mechanical properties and material test results of structural steel delivered to site.
- H. Mill certifications of high strength bolts, nuts and washers: prepared for review when specifically requested by A/E; show chemical and mechanical properties, and bolt test results for fasteners delivered to site.
- I. Welder Certifications: document that structural steel welders performing work on Project are currently certified for welds and welding positions utilized. Include welder and welding operator qualification test records, certifications.

1.05 QUALITY ASSURANCE

- A. Comply with the applicable provisions of the specifications, standards and documents listed under References, except as modified by this specification.
- B. Fabricator: Fabricator shall have a minimum of 5 years of continuous experience in the erection of similar structures.
- C. Erector: Erector shall have a minimum of 5 years of continuous experience in the erection of similar structures.
- D. Testing Agency: independent testing laboratory retained by the Owner and continuously engaged in testing similar that required for the Project for a period of not less than five years.
- E. Welding: Qualify personnel and procedures according to AWS D1.1.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Handle materials to avoid bending, twisting or other damage resulting in permanent deformation.
- B. Store materials to permit easy access for inspection and identification.
- C. Store members off ground by placing on appropriate supports and spacers, adjusted to permit water to drain from parts. Protect members from rust, corrosion and deterioration.
- D. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dirty or dry before use.

- E. Do not store material on completed or partially completed structure in a manner that might overload, cause distortion, or damage material or supporting structure.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Rolled steel plates, shapes and bars, tubular steel and bolts shall be of domestic manufacture and be clean and free of rust and pitting.
- B. W and WT shapes: ASTM A992/A992M-06a (Fy = 50 ksi)
- C. Channels: ASTM A36/A36M-05
- D. Angles: ASTM A36/A36M-05
- E. HSS square and rectangular shapes: ASTM A500-03a Grade B
- F. HSS round shapes: ASTM A500-03a, Grade B.
- G. Pipe: ASTM A53/A53M-06a, Type E or S, Grade B
- H. Plates: ASTM A36/A36M-05
- I. High Strength Bolts: ASTM A325-06, Type 1 or ASTM A490-06, Type 1, as detailed
- J. Anchor Bolts: ASTM F1554-04, Grade 36, Thread Class 2A
- K. Standard Washers: ASTM F436-04, Type 1
- L. Plate Washers: ASTM A36/36M-05
- M. Nuts for High Strength Bolts: ASTM A563, Type 1, Grade DH
- N. Nuts for Anchor Bolts: ASTM A563, Type 1, Grade A
- O. Twist-Off Tension-control Bolt Assemblies: ASTM F1852-05, Type 1, or ASTM F2280-06, Type 1 as detailed.
- P. Threaded Rods: ASTM A36/36M-05
- Q. Welding Electrodes: E70XX
- R. Shear Studs
 1. Headed fusion welded shear connectors with proper ferrules and accessories especially designed to create composite deck action by mating of shear connectors, concrete deck, and supporting beam.
 2. Shall be manufactured from cold drawn bar stock conforming to ASTM A108-03e1, Grades 1010 through 1020. Finished connectors shall meet the requirements of AWS D1.1, Type B. Acceptable products - S3L Shear Connector as manufactured by TRW Nelson

3. Studs shall be of uniform diameter, heads concentric and normal to shaft, and weld end chamfered and solid flux.
- S. Headed concrete anchors: manufactured from cold drawn bar stock conforming to ASTM A108-03e1, Grades 1010 through 1020. Finished connectors shall meet the requirements of AWS D1.1, Type A or Type B. Acceptable products - H4L Shear Connector as manufactured by TRW Nelson
- T. Deformed bar concrete anchors: ASTM A496/496M-05. Acceptable products - D2L as manufactured by TRW Nelson
- U. Primer paint:
 1. Acceptable products for interior exposure:
 - a. Series 88HS, Gray, as manufactured by Tnemec Inc.
 - b. Interlac 393, Gray, as manufactured by International Paint Company
 - c. Equal approved rust-inhibitive primer
 2. Acceptable products for exterior exposure:
 - a. Series 90-97 Tnemec-Zinc as manufactured by Tnemec Inc.
 - b. Interzinc 52 Zinc-Rich Epoxy Primer, Gray, as manufactured by International Paint Company
- V. Grout for structural steel: Non-shrink, non-metallic, pre-mixed, factory-packaged grout conforming to ASTM C1107/C1107M-07.

2.02 FABRICATION

A. GENERAL

1. Fabricate and assemble in shop to the greatest extent possible. Fabricate in accordance with AISC "Code of Standard Practice for Steel Buildings and Bridges"
2. Fabricate items of structural steel according to approved Shop Drawings. Fabrication from Shop Drawings not approved by the Engineer is at the sole risk of the Fabricator.
3. Camber structural steel where noted. Where no camber is noted, beams shall be fabricated so that natural camber is upward in the erected condition.
4. Perform thermal cutting by machine. For cut edges to be welded, comply with AWS D1.1.
5. Combinations of bolts and welds on the same faying surface in the same connection are not permitted unless otherwise detailed.
6. Accurately finish ends of columns and other members transmitting bearing loads.
7. Required straightening of built-up sections shall be performed to minimize residual stresses.

8. Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members as shown on Structural Drawings or approved by Engineer.
9. Complete structural-steel assemblies before starting shop painting operations.
10. Properly mark materials for field assembly.

B. WELDS

1. Comply with AWS D1.1 for welding procedures, tolerances, appearance and quality of welds, and for methods used in correcting welding work. Use only welders qualified in accordance with AWS D1.1 and possessing current valid welding certifications for the welds being performed.
2. Minimum fillet weld size shall be as specified by AISC for the thickness of the thinner part joined, but in no case less than 3/16 inch.
3. Perform welding to minimize residual stress and external distortion of welded assembly.
4. Provide backing bars and run-off tabs for full penetration welds. Remove backing bars and run-off tabs after completion of welds.

C. BOLTS

1. Provide drilled or punched holes perpendicular to surface for shop and field bolted connections. Oversize or slotted holes shall not be used for connections unless specifically noted.
2. Shop bolted connections shall use high strength bolts and nuts and shall be installed "snug tight" as defined by RCSC unless noted otherwise. Washers are required where the outer face of the joint slopes greater than 1:20 with respect to the axis of the bolt, or where a slotted hole occurs in an outer ply.
3. Twist-off tension-control bolt assemblies shall be used for connections designated as pre-tensioned or slip-critical and may be used for other connections. Unless connection is designated as pre-tensioned (PT) or slip-critical (SC), bolts shall be tightened only to "snug tight" condition as defined by RCSC, and spline shall not be removed from bolt assembly.

D. SHEAR CONNECTORS, HEADED/DEFORMED BAR CONCRETE ANCHORS AND THREADED BASE STUDS

1. Remove paint on surfaces to receive connectors/anchors/studs.
2. Install in accordance with manufacturers' recommendations using automatically timed welding equipment as furnished by TRW, Nelson Division. Hand operated shielded metal arc welding is not permitted.
3. Adjust equipment on trial installations until sound anchorages are obtained. A minimum of two successive trial installations for each type of anchor used shall be successfully welded and tested by visual inspection and by bending approximately 30 degrees before beginning production. Record settings used during successful installation, including date and time of

test and name of installer. Trials shall be conducted by each installer. Trial installations shall not be used for production.

4. If there is a change in the power source, gun lift and plunge settings, welding lead length, current settings or time settings in excess of 5%, equipment shall be re-adjusted by conducting new trials.
5. Ferrules shall be removed after installation to facilitate inspection.

2.03 FINISHES

A. GALVANIZING

1. Steel designated to be galvanized, except for structural bolts, washers and nuts, shall be hot dip galvanized after fabrication in accordance with ASTM A123/A123M-02.
2. Galvanizing for structural bolts, washers and nuts shall conform to the following:
 - a. Bolts conforming to ASTM A325 and associated washers and nuts shall be hot dip galvanized in accordance with ASTM A153/A153M-05. Nuts shall be lubricated after galvanizing. Bolts, washers and nuts shall be considered a fastener assembly, shall be provided by a single supplier, and shall be shipped together in the same shipping container.
 - b. Bolt assemblies conforming to ASTM F1852-05 shall be mechanically galvanized in accordance with ASTM B695-04. Nuts shall be lubricated after galvanizing.
 - c. Bolts conforming to ASTM A490 and associated washers and nuts, and bolt assemblies conforming to ASTM F2280-06 shall not be galvanized.
3. Galvanize components indicated and components exposed to the exterior whether indicated or not. For the purposes of this paragraph, components providing direct support for exterior cladding shall be considered exposed to the exterior.
4. Fill vent holes and grind smooth after galvanizing. Apply galvanizing repair paint.

B. PAINTING

1. After inspection and before shipping, clean steel work to be painted to remove oil, grease and similar contaminants complying with SSPC-SP 1. Further cleaning shall be in accordance with paint manufacturer's requirements, but in no case less than the following:
 - a. For interior members not exposed to view use SSPC-SP 2 or SSPC-SP 3
 - b. Where indicated as required in the Drawings interior members exposed to view use SSPC-S10
 - c. For exterior members exposed to atmosphere, and for faying surfaces of members at connections designated as slip-critical (SC) use SSPC-SP 6 or SSPC-SP 10

2. Shop paint structural steel except:
 - a. Embedded portion of member further than 2 inches from surface of concrete or mortar in which it is embedded.
 - b. Surfaces of members to receive field applied shear studs, dowel bar anchors, or similar welded attachments.
 - c. Contact surfaces which are to be field welded.
 - d. Faying surfaces of members where a slip-critical connection is required. Protect faying surfaces from overspray during painting operations.
 - e. Members which are scheduled to receive sprayed-on fireproofing.
 - f. Members designated to be galvanized.
3. Apply structural steel primer paint in accordance with manufacturer's instructions, but in no case at a rate less than that which provides a uniform dry film thickness of 2.0 mils to 3.5 mils for interior unexposed steel or 2.5 mils to 3.5 mils for interior exposed and exterior steel.
4. Use painting methods which result in coverage of joints, corners, edges and exposed surfaces. Stripe paint corners, crevices, bolts, welds, and sharp edges. Stripe paint shall set to touch before applying primer coat.

2.04 SOURCE QUALITY CONTROL

A. GENERAL

1. Owner will engage an independent testing and inspection agency to perform shop tests and inspections and prepare test reports.
2. Cooperate with inspection and testing personnel to provide access at point of fabrication.
3. Maintain schedule which permits required visual inspection and non-destructive tests to be performed in groups. Notify testing agency 48 hours prior to performing operations which require inspecting or testing prior to proceeding.
4. Testing agency shall specifically state in a report whether individual test specimens comply with or deviate from requirements of the Contract Documents.
5. Correct deficiencies that inspections and test reports indicate do not comply with the Contract Documents. Bear costs for repair or replacement of work that has been rejected for non-conformance with the Contract Documents, including the cost of additional testing or retesting.

B. WELDS

1. Verify that welders performing work on the project are qualified according to AWS D1.1 for the welds being performed.

2. Visually inspect fillet and partial penetration welds for appropriate size, length and location. Perform appropriate non-destructive testing in accordance with AWS D1.1 on welds which appear defective.
3. Perform one of the following inspection procedures on full penetration welds:
 - a. Magnetic Particle Inspection: ASTM E709. Perform on root pass and on finished weld. Presence of cracks or zones of incomplete fusion or penetration shall be cause for rejection of weld.
 - b. Ultrasonic Inspection: ASTM E164.
 - c. Radiographic Inspection: ASTM E94.

C. BOLTS

1. Visually inspect [connection for proper number, size and type of bolt, and for proper installation of hardened and plate washers.
2. Verify presence of visible lubricant on threads of galvanized bolts.
3. For bolted connections, inspection shall be made in accordance with the “Specification for Structural Joints Using ASTM A325 or A490 Bolts”, paragraph 9.1. Where twist-off tension-control bolt assemblies are utilized in bolted connections not specifically identified as pre-tensioned (PT) or slip critical (SC), verify that splines have not been removed. If splines have been removed, bolts shall be removed, discarded, and replaced with properly tightened bolts.
4. For bolts identified as pre-tensioned (PT), inspection shall be made in accordance with the “Specification for Structural Joints Using ASTM A325 or A490 Bolts”, paragraphs 9.1 and 9.2.3. Additional inspection in accordance with paragraph 9.3 shall be made for bolts identified as slip critical (SC).

D. SHEAR CONNECTORS, HEADED/DEFORMED BAR CONCRETE ANCHORS AND THREADED BASE STUDS

1. Verify pre-production test records for installation of shear connectors, concrete anchors and threaded studs.
2. A visual inspection shall be made of shear connectors and headed/deformed bar concrete anchors after installation. If visual inspection of a connector/anchor reveals that a sound weld and a 360-degree flash has not been obtained, the connector/anchor shall also be tested by bending a minimum of 15 degrees off vertical opposite to the missing weld/flash. If the connector/anchor does not become loose it shall be considered acceptable and shall be left in this position. Replace failing connectors/anchors.
3. A visual inspection shall be made of threaded studs after installation. If visual inspection of a threaded stud reveals that a sound weld and a 360-degree flash has not been obtained for the threaded stud, the threaded stud shall be removed and replaced.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify elevations of concrete and masonry bearing surfaces, and locations of anchor rods, bearing plates and other embedments.
- B. Do not proceed with installation until conditions not in conformance with the Contract Documents have been corrected.

3.02 PREPARATION

- A. Provide temporary guy lines to achieve and maintain proper alignment of structure as erection proceeds.
- B. Provide temporary shores, braces, and other supports during erection, including connections of sufficient strength to bear imposed loads. Temporary supports may be removed when permanent members and bracing are in place, and final connections have been made.
- C. These requirements do not relieve the Contractor of the responsibility for means, methods, techniques, sequences and procedures of construction, including but not limited to temporary supports, shoring, forming to support imposed loads and other similar items.

3.03 ERECTION

A. GENERAL

- 1. Set structural steel accurately in locations and to elevations indicated, and in accordance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- 2. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.
- 3. Align and adjust members before permanently fastening.
- 4. Do not grout beneath column base plates until columns bearing on the base plates have been set and plumbed.
- 5. Maintain erection tolerances of structural steel within the limits established by the AISC "Code of Standard Practice for Steel Buildings and Bridges".
- 6. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - a. Do not splice members except where shown or specified.
 - b. Do not enlarge unfair holes in members by burning or by use of drift pins. Ream holes that must be enlarged to admit bolts.
 - c. Do not use gas cutting torches in the field to correct fabrication errors in structural framing.

B. WELDS

1. Comply with AWS D1.1 for welding procedures, tolerances, appearance and quality of welds, and for methods used in correcting welding work. Use only welders qualified in accordance with AWS D1.1 and possessing current valid welding certifications for the welds being performed.
2. Utilize field welds only where shown. Field welds shall not be used to replace bolted connections in whole or in part.
3. Minimum fillet weld size shall be as specified by AISC for the thickness of the thinner part joined, but in no case less than 3/16 inch.
4. Perform welding to minimize residual stress and external distortion of welded assembly.
5. Provide backing bars and run-off tabs for full penetration field welds. Remove where noted on drawings or required for inspection.

C. BOLTS

1. Fill bolt holes in connection with high strength bolts of the appropriate size and type.
2. Field bolted connections shall use high strength bolts and nuts and shall be installed snug tight as defined by RCSC unless noted otherwise. Washers are required where the outer face of the joint slopes greater than 1:20 with respect to the axis of the bolt, or where a slotted hole occurs in an outer ply.
3. Twist-off tension-control bolt assemblies shall be used for connections designated as pre-tensioned or slip-critical and may be used for other connections. Unless connection is designated as pre-tensioned (PT) or slip-critical (SC), bolts shall be tightened only to "snug tight" condition as defined by RCSC, and spline shall not be removed from bolt assembly.

D. SHEAR CONNECTORS, HEADED/DEFORMED BAR CONCRETE ANCHORS

1. Remove any paint on surfaces to receive connectors/anchors/studs.
2. Install in accordance with manufacturers' recommendations using automatically timed welding equipment as furnished by TRW, Nelson Division. Hand operated shielded metal arc welding is not permitted.
3. Adjust equipment on trial installations until sound anchorages are obtained. A minimum of two successive trial installations shall be successfully welded and tested by visual inspection and by bending approximately 30 degrees before beginning production. Record settings used during successful installation, including date and time of test and name of installer. Trials shall be conducted by each installer. Trial installations shall not be used for production.
4. If there is a change in the power source, gun lift and plunge settings, welding lead length, current settings or time settings in excess of 5%, equipment shall be re-adjusted by installing new trial connectors/anchors/studs.
5. Welding shall not be performed when the steel temperature is below 0° F.

6. If moisture, corrosion, scale, rust, or other materials are present on metal decking that impairs the installation, the installing contractor shall clean the decking as specified by AWS D1.1.
7. Moisture from rain, snow or condensation trapped between the deck and steel beam shall be removed by use of a heating torch prior to installation.
8. Ferrules shall be kept dry. Ferrules that are obviously moist or that have been exposed to moisture from dew, rain or snow, shall be discarded, or shall be dried in an oven at 250° F for two hours prior to use.
9. Ferrules shall be removed after installation to facilitate inspection.

3.04 REPAIR / RESTORATION

- A. Repair damaged galvanized coatings on galvanized items with zinc rich galvanized repair paint in accordance with ASTM A780-01 and manufacturer's written instructions.
- B. Immediately after installation clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of structural steel.
 1. Clean and prepare surfaces by hand-tool cleaning to SSPC-SP 2, or power-tool cleaning to SSPC-SP 3.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
 3. Apply finish paint over dry primer to match adjacent surfaces.

3.05 FIELD QUALITY CONTROL

- A. GENERAL
 1. Owner will engage an independent testing and inspection agency to perform field tests and inspections and prepare test reports.
 2. Cooperate with inspection and testing personnel to provide access to site.
 3. Maintain schedule which permits required visual inspection and non-destructive tests to be performed in groups. Notify testing agency 48 hours prior to performing operations which require inspecting or testing prior to proceeding.
 4. Testing agency shall specifically state in a report whether individual test specimens comply with or deviate from requirements of the Contract Documents.
 5. Correct deficiencies that inspections and test reports indicate do not comply with the Contract Documents. Bear costs for repair or replacement of work that has been rejected for non-conformance with the Contract Documents, including the cost of additional testing or retesting.
- B. WELDS
 1. Verify that welders performing work on the project are qualified according to AWS D1.1 for the welds being performed.

2. Visually inspect fillet and partial penetration welds for appropriate size, length and location. Perform appropriate non-destructive testing in accordance with AWS D1.1 on welds which appear defective.
3. Perform one of the following inspection procedures on full penetration welds:
 - a. Magnetic Particle Inspection: ASTM E709. Perform on root pass and on finished weld. Presence of cracks or zones of incomplete fusion or penetration shall be cause for rejection of weld.
 - b. Ultrasonic Inspection: ASTM E164.
 - c. Radiographic Inspection: ASTM E94.

C. BOLTS

1. Visually inspect connection for proper number, size and type of bolt, and for proper installation of hardened and plate washers.
2. Verify presence of visible lubricant on threads of galvanized bolts.
3. For bolted connections, inspection shall be made in accordance with the “Specification for Structural Joints Using ASTM A325 or A490 Bolts”, paragraph 9.1. Where twist-off tension-control bolt assemblies are utilized in bolted connections not specifically identified as pre-tensioned (PT) or slip critical (SC), verify that splines have not been removed. If splines have been removed, bolts shall be removed, discarded, and replaced with properly tightened bolts.
4. For bolts identified as pre-tensioned (PT), inspection shall be made in accordance with the “Specification for Structural Joints Using ASTM A325 or A490 Bolts”, paragraphs 9.1 & 9.2.3. Additional inspection in accordance with paragraph 9.3 shall be made for bolts identified as slip critical (SC).

D. SHEAR CONNECTORS, HEADED/DEFORMED BAR CONCRETE ANCHORS

1. Verify pre-production test records for installation of shear connectors, concrete anchors and threaded studs.
2. Shear connectors shall be struck with a hammer. Those not producing a “clean” pinging sound indicative of a fully attached shear connector shall be bent 15 degrees off vertical towards the nearest support by striking with a hammer. If shear connector does not become loose and weld is not broken, it shall be considered acceptable, and shall be left in the bent position. Replace failing shear connectors and test as before.
3. A visual inspection shall be made of shear connectors and headed/deformed bar concrete anchors after installation. If visual inspection reveals that a sound weld and a 360 degree flash has not been obtained, the connector/anchor shall also be tested by bending a minimum of 15 degrees off vertical opposite to the missing weld/flash, irrespective of the results of the “ping” test required for shear connectors. If the connector/anchor does not become loose it shall be considered acceptable and shall be left in this position. Replace failing connectors/anchors and inspect as before.

4. A visual inspection shall be made of threaded studs after installation. If visual inspection of a threaded stud reveals that a sound weld and a 360-degree flash has not been obtained for the threaded stud, the threaded stud shall be removed and replaced.

END OF SECTION 051200

SECTION 052100 – STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 RELATED WORK

- A. Applicable provisions of Division 01 shall govern work of this Section.

1.02 SUMMARY

- A. Include materials, labor, services and incidentals necessary for completion of this Section of work.
- B. Include steel joists, bridging, bridging anchors, headers, and hangers required for framing around openings.

1.03 REFERENCES

- A. Industry Standards, Specifications and Codes:
 - 1. General:
 - a. Comply with provisions of the following codes and standards except as modified.
 - b. Referenced codes and standards including revisions and commentaries shall be the most currently adopted as of the date of these Contract Documents.
 - 2. Steel Joist Institute (SJI)/American Institute of Steel Construction (AISC):
 - a. Standard Specifications for Open Web Steel Joists, K Series
 - b. Recommended Code of Standard Practice for Steel Joists and Joist Girders.
 - c. Steel Structures Painting Council Specification (SSPC)
 - 3. American Welding Society (AWS):
 - a. D1.1 Structural Welding Code - Steel
 - b. C1.1 Recommended Practices for Resistive Welding
 - 4. ASTM International (ASTM):
 - a. Specific ASTM numbers are noted in later text.
 - 5. 2021 IBC

1.04 DESIGN REQUIREMENTS

A. General:

1. Design joists, joist girders and bridging to resist a minimum net wind uplift force of 10 psf unless noted otherwise in the Drawings. Provide additional bridging as required as determined by design.

B. Joist Design:

1. Design joists for loading conditions shown on Drawings where joists are labeled "Special" or "SP". Joists shall be designed for an L/360 live load deflection, unless noted otherwise on plan.
2. Design bridging and joists for net uplift where shown on Drawings.

1.05 QUALIFICATIONS

- A. Qualify welding processes, welders and welding operators in accordance with AWS D1.1 Structural Welding Code-Steel.

1.06 SUBMITTALS

- A. Submit in accordance with Division 1.

B. Shop Drawings:

1. Submit Shop Drawings for fabrication and erection of steel joists. Include plans, elevations, details of sections and connections, and list of materials. Show openings and headers, hangers or other framing required. When bridging is not shown on Drawings, detail and furnish in accordance with SJI Specifications.
2. Include manufacturer's certification that joists comply with SJI Specifications.
3. Reproduction of Contract Drawings shall not be used for drawings.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Handle joists with care to avoid bending, twisting or other damage.
- B. Unload under supervision of Contractor.
- C. Place on blocking to keep joists off ground.
- D. Store joists to allow drainage of water from parts and additionally protect in manner recommended by manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. "K" Series Joists:

1. Comply with requirements of "Standard Specifications for Open Web Steel Joists, K-Series", SJI/AISC.
- B. Shop Paint:
1. SSPC - Paint 15-68T Type I (Red Oxide). (Type II Asphalt coating not permitted).
 2. Federal Specification TT-P-636 (Red Oxide).
- C. Accessories
1. Bridging and bridging clips: Shall conform to ASTM A-36 and A-6.
 2. Bolts for bridging: Shall conform to ASTM A-307.
 3. Bolts for joist splices: Shall conform to ASTM A-325 or A-490.
 4. Sag rods: Shall conform to ASTM A-36 and A-6.
 5. Welding: Shall conform to AWS A5.1 or A5.5, E70XX.

2.02 FABRICATION

- A. Provide diagonal or horizontal type bridging and end anchorages (1 inch by 1 inch by 1/8 inch angle minimum) as required by SJI and additional as may be noted on Drawings.
- B. Provide extended ends for top chords of joists where required. Refer to Drawings for size and locations.
- C. Provide accessories and bridging required for conformance with latest OSHA site and erection regulations.
- D. Provide ceiling extensions or extend lower chord of steel joists where ceiling finish is directly applied to bottom of joists or where required for providing lateral bracing.
- E. Align panel points of joists scheduled to be exposed and where ducts pass through joists.
- F. Joists shall be straight and free of twist and uniformly level to allow direct application of finishes.
- G. Spacers between chord members shall be neat, evenly spaced and shall not extend beyond face of chords.
- H. Provide steel headers, hangers and other framing required to support steel joists and roof deck at openings where structural steel members do not completely frame opening.
- I. Where holes are provided in chord members for securing other work to steel joists, increase size of chord members necessary to provide full strength developed without holes.
- J. Refer to Drawings for profile of joists required for roof drainage.
- K. Provide beveled ends or sloped shoes where joist slope exceeds 1/8 inch in 12 inches.

2.03 SHOP COAT OF PAINT

- A. Provide steel joists and bridging with 1 shop coat paint completely covering surfaces with minimum 1 mil thickness. Two mil thickness is required on exposed to view material.
- B. Thoroughly clean steel joists prior to application of shop coat in accord with SSPC SP-1, 2, 3 and 7.
- C. Do not paint joists schedule to receive spray-on fireproofing.
- D. Certify on Shop Drawings shop paint used.

PART 3 - EXECUTION

3.01 ERECTION

- A. Use experienced personnel and proper equipment.
- B. Set joists accurately to line and level, securely spaced in position until deck has been placed and construction operations which could load structure are complete.
- C. Where joists bear on steel beams, weld or bolt bearing points as shown on Drawings. If not shown, then weld or bolt in accordance with SJI specifications.
- D. Provide temporary bridging connections and anchors to ensure lateral stability during construction. Erect in accordance with SJI specifications.
- E. Install bridging simultaneously with joist erection before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls and beams.
- F. Where "open-web" joist lengths are 40 feet and longer install a center row of bolted bridging to provide lateral stability before slacking of hoisting lines.
- G. Grout anchor bolts, bearing plates or other anchorage devices which are loose parts not an integral part of masonry or concrete wall.
- H. Modify requirements for anchorage, bridging and similar items as required by applicable local and state codes, including uplift requirements.
- I. Where joists are to be exposed to view, thoroughly clean members.
- J. After installation clean field bolt heads, nuts, joist members and bridging. Abraded, welded or rusty surfaces shall receive 1 coat of same paint used for shop painting.
- K. Repair or replace damaged joists prior to enclosing.
- L. Before enclosing, notify A/E so an inspection can be made prior to enclosing.

END OF SECTION 052100

SECTION 053123 – STEEL ROOF DECKING

PART 1 - GENERAL

1.01 RELATED WORK

- A. Applicable provisions of Division 01 shall govern work of this Section.

1.02 SUMMARY

- A. Include materials, labor, services and incidentals necessary for completion of this Section of Work.
- B. Work generally includes detailing, supplying and installation of steel roof deck as detailed on Drawings.
- C. Include closures, accessories and fasteners.
- D. Related work includes field painting, fireproofing, roof sumps, flashings, drains, insulation and other items schedule elsewhere.

1.03 REFERENCES

- A. Industry Standards, Specifications and Codes:
 - 1. General:
 - a. Comply with provisions of the following codes and standards except as modified.
 - b. Referenced codes and standards including revisions and commentaries shall be the most currently adopted as of the date of these Contract Documents.
 - 2. Steel Deck Institute (SDI):
 - a. No. 30 Design Manual for Composite Decks, Form Decks and Roof Decks
 - b. No. DDM03 Diaphragm Design Manual
 - 3. American Welding Society (AWS):
 - a. D1.1 Structural Welding Code - Steel
 - b. D1.3 Structural Welding Code - Sheet Steel
 - 4. American Iron and Steel Institute (AISI):
 - a. Specification for the Design of Cold Formed Steel Structural Members
 - 5. ASTM International (ASTM):
 - a. Specific ASTM numbers are noted in later text.

6. 2021 IBC

1.04 QUALIFICATIONS

- A. Qualify welding processes, welders and welding operators in accord with AWS, Structural Welding Code - Steel and Structural Welding Code - Sheet Steel. Welders shall be currently certified in accordance with the current Building Code.

1.05 UPLIFT LOADING

- A. Install and anchor roof deck units to resist a minimum gross uplift loading of 30 pounds per square foot.

1.06 SUBMITTALS

- A. Submit in accordance with Section [013300](#).
- B. Product Data:
 - 1. Submit manufacture's specifications/installation instructions for each deck type and specified accessories.
 - 2. Welder certificates signed by State certified welding instructor, certifying that welders comply with "Qualifications" Section' or if mechanical fasteners are used, certification from manufacturer indicating compliance of mechanical fasteners with design requirements based upon comprehensive testing.
 - 3. Shop Drawings:
 - a. Submit detailed Shop Drawings showing deck type, gage, finish, layout including laps, extensions, profile orientation and anchorage details. Drawing should also show conditions requiring closure panels, supplementary framing, cut openings, roof sump pans, special jointing or other accessories.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Steel deck shall be delivered, handled and stored in accordance with SDI Standard Specifications.
- B. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- C. If ground storage is needed, deck bundles must be stored off the ground with 1 end elevated to provide drainage. Bundles must be protected against condensation with a ventilated waterproof covering. Bundles must be stacked so they remain stable and material is not damaged. Bundles must be anchored to prevent wind uplift.
- D. Bundles placed on building frame must be located near a main supporting beam/girder at a column or wall. Before bundles are placed, frames must be stable (bolting in place, bridging for joists installed). Contractor is responsible for properly bracing the frame during erection and ensuring frame will not be overloaded by placement of bundles.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Sheets:

- a. Thickness or gage shall be as specified or noted on Drawings.
- b. Shall conform to ASTM A-653/A-653M, Grade A with G60 coating for galvanized deck and accessories. Galvanizing shall conform to ASTM A-924.

B. Steel Deck Units:

1. Type (gage), style (narrow, intermediate or wide rib) depth, finish (if other than painted) and acoustical configuration (if any) shall be as noted on Drawings.
2. Side joints shall overlap (no interlocking side joints are permitted).

C. Paint:

1. Shall be manufacturer's baked on rust inhibitive primer.
2. Galvanized units to be field painted shall be specially cleaned prior to painting.

D. Closures:

1. End Closures: Where detailed shall be 16 gage galvanized steel.
2. Side Closures: As required shall be same gage and finish as deck.
3. Cell Closures: Shall be neoprene or rubber to conform to deck profile.

E. Fasteners:

1. Mechanical self-drilling type, #12 Teks/4, #12 Teks/5 or #12 Stitch Teks as required for condition of use.

F. Powder Actuated or Pneumatic Fasteners:

1. Conforming with SDI Requirements
2. Hardness – 54.5 Rockwell C minimum; Tensile – 285,000 psi; shear – 175,000 psi; Knurled Shank, forged ballistic point with 1/2 inch nominal steel washer.
3. Zinc electroplating conforming to ASTM B633, SC. 1, Type II.
 - a. Equal to Hilti, Inc.:
 - b. For structural steel with flange greater than or equal to 1/4 inch

- 1) ENP-19 MX, MXR
 - 2) ENPH2 MX, MXR
 4. For light chord joist with thickness less than or equal to 1/4 inch
 - a. ENP2K-20-L15
 - b. X-EDN19 THQ12MX-HSN
 - c. X-EDNK22 THQ12M-HSN
- G. Accessories:
1. All accessory gages are minimums.
 2. Sump Pans: Shall be 14 gage galvanized.
 3. Butt Plates: Shall be 20 gauge by 6 inches wide.
 4. Ridge and Valley Plates: Shall be 20 gage by 6 inches wide.
 5. Cant Strips: Shall be 20 gage by 10 inches wide.
- H. Welding Electrodes:
1. Shall conform to AWS A5.1 or A5.5, E60XX.

2.02 FABRICATION

- A. Metal Roof Deck Products:
1. When noted on plans as 1 1/2" type "B" metal roof deck, provide metal roof deck equivalent to Vulcraft type 1.5B, gauge as shown on drawings. Substitutions with equivalent structural properties will be considered if requested by General Contractor.
- B. Fabricate to sizes and details shown on Drawings.
- C. Provide lengths to extend over 4 or more supports where possible. (3 span condition)
- D. Provide minimum end lap of 2 inches. Provide laps over supports only.
- E. Form end laps to provide tight fit and prevent roofing bitumen from dripping through joint.
- F. Apply specified finish immediately after cleaning and phosphatizing surfaces.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examine support framing and field conditions for compliance with requirements and installation tolerances and other conditions affecting performance of work of this Section.

3.02 INSTALLATION

- A. Place deck in accordance with approved Shop Drawings. All installation shall be weather tight.
- B. Install deck and accessories according to SDI specifications and recommendations, Shop Drawings, and this Section.
- C. Install steel roof decking directly to supporting steel members.
- D. Lap end joints over supports 2 inches minimum.
- E. Overlap at sides and fasten with #10 TEK screws at maximum spacing of 18 inches (unless otherwise noted on Drawings).
- F. Do not use deck units for storage or work platforms until permanently secured in place. Construction loads must not exceed load carrying capacity of deck.
- G. Install cover plates over open joint at changes in slopes with screws at not over 12 inches o.c.
- H. Install metal cants, curbs and closures to metal deck with screws spaced not over 12 inches o.c.
- I. Install neoprene cell closures flush with wall face at wall faces where deck is the finished ceiling.
- J. Cut and fit deck around openings through and adjacent to decking
- K. Trades which cut openings not shown on Drawings shall be responsible for reinforcing of decking.
- L. Provide holes through roof deck for installation of ventilators, pipes and other items. Where no other framing is provided, install steel angles welded to underside of decking to reinforce openings where deck capacity is impaired by such openings.

3.03 DECK FASTENING

- A. Screwing:
 - 1. Appropriate screws shall be selected for structural thickness to which deck is being attached.
 - 2. Screws shall be spaced 6 inches on center (1 in each rib) at laps and intermediate supports.

B. Welding:

1. Welding Limitations:

- a. 16 gage welding washers with a 3/8-inch diameter hole will be required on decks 22 gage or lighter.
- b. Deck to deck side seam welding will not be allowed (screw fastening only).
- c. Securely weld deck in place by electric arc method using proper amperage to accomplish proper fusion welds.
- d. 5/8-inch diameter puddle welds at each support shall be 6-inches on center at end laps and 12-inches on center at intermediate supports.
- e. If unsatisfactory welding results in damage to supporting members, make necessary repairs completing installation by use of mechanical fasteners.
- f. See Structural Drawings for increased fastening pattern when required to increase diaphragm capacity.

C. Powder Actuated or Pneumatic Fastening:

1. Fasten at each rib at end laps and at 12-inch on center at intermediate supports.
2. Use tools as recommended for each fastener type, per manufacturer's instructions.
3. Fastener stand-off shall be checked for conformance with manufacturer's recommendations.
4. After erecting, touch up with same paint specified for shop coat/zinc-rich primer at galvanized deck, scarred areas both top and underside of decking including cuts, drill holes, rust spots, welds, weld scars and similar defects.

D. Repairs:

1. Before placement of roof insulation and covering, deck shall be inspected for tears, dents or other damage that would prevent deck from acting as a tight and substantial form. Need for repair or shoring of damaged deck shall be determined by Engineer of Record.

END OF SECTION 053123

SECTION 054000 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 RELATED WORK

- A. Applicable provisions of Division 01 shall govern work of this Section.

1.02 SUMMARY

- A. Include materials, labor, services and incidentals necessary for completion of this Section of Work.
- B. Work includes axially or wind loaded light gage, cold-formed steel studs, tracks, joists, bridging and related accessories 18 gage and heavier indicated on Contract Drawings as "steel" studs and specified.
- C. Extent of cold-formed steel framing is shown on Drawings and includes, but is not limited to the following:
 - 1. "C" shaped steel studs for exterior wall systems (18 gage and heavier).
 - 2. "C" shaped steel studs for load bearing and non-load bearing wall systems (18 gage and heavier).
 - 3. "C" shaped steel joists for floor and roof framing systems.
 - 4. Fasteners and connectors for framing

1.03 REFERENCES

- A. Industry Standards, Specifications and Codes:
 - 1. General:
 - a. Comply with provisions of the following codes and standards except as modified:
 - b. Referenced codes and standards including revisions and commentaries shall be the most currently adopted as of the date of these Contract Documents.
 - 2. American Iron and Steel Institute (AISI):
 - a. North American Specification for the Design of Cold-Formed Steel Structural Members
 - b. Manual of Cold-Formed Steel Design
 - c. Standard for Cold-formed Steel Framing – Header Design
 - 3. American Welding Society (AWS):
 - a. D1.1 Structural Welding Code - Steel
 - b. D1.3 Specification for Welding Sheet Steel in Structures
 - c. Standard Qualification Procedure
 - 4. ASTM International (ASTM): Specific ASTM numbers are noted in later text.

5. American Institute of Steel Construction (AISC): Manual of Steel Construction
6. 2021 IBC

1.04 QUALITY ASSURANCE

A. Design:

1. Compute structural properties of studs and joists in accordance with AISI "Specification for the Design of Cold-Formed Steel Structural Members."

B. Weld Qualifications:

1. Welding: Use qualified welders and comply with the American Welding Society (AWS) D1.3, "Structural Welding Code Sheet Steel." Welders shall be currently certified in accordance with the Section 6.0 "Inspection" of AWS D1.3.

C. Fire Rated Assemblies:

1. Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.

D. Pre-Installation Conference:

1. Prior to start of installation of steel framing systems, meet at project site with Engineer and installers of other work, including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts and coordinate layout and support provisions for interfacing work. Do not start work until Shop Drawings have been approved, mock-up has been successfully tested and welds have been approved.

E. Inspection and Quality Control:

1. Contractor shall provide effective full-time quality control over fabrication and erection activities.
2. As directed by Engineer, Owner's testing agency may inspect maintenance of a quality control program, including spot checking weldments and welding procedures in accordance with AWS standards.
3. Contractor shall remove and replace work, at Contractor's expense, where test results indicate it does not comply with specified requirements. Additional testing and inspection of replaced work shall be a Contractor's expense.
4. Steel framing manufacturer shall provide a qualified representative for periodic on-site review of fabrication and installation in accordance with manufacturer's recommendations.
5. Inspection by Owner's testing agency is not intended to be comprehensive or complete. Full responsibility for quality control shall remain with Contractor.

1.05 SUBMITTALS

A. Submit in accordance with Division 01

B. Product Data:

1. Submit copies of manufacturer's product information and installation instructions for each item of cold- formed steel framing and accessories. Distribute an additional copy of installation instructions to installer.
- C. Samples:
1. Welders shall make sample welds of weld types. Welds shall be inspected by a testing laboratory retained by Owner. Welds shall be approved by lab before production welding begins.
- D. Welder Certifications: document that welders performing work on Project are currently certified for welds and welding positions utilized. Include welder and welding operator qualification test records, certifications.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Protect steel framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry ventilated space or protect from rain and snow or other harmful weather conditions with suitable waterproof coverings adequately vented to avoid condensation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering "C" shaped, load-bearing and non-load bearing steel studs and joists which may be incorporated in the work include, but are not limited to, the following:
1. Dietrich Industries, Inc.
 2. Marino Industries, Inc.
 3. Clark Western Building Systems, Inc.
 4. Wheeling Corrugating Company
- B. With each type of steel framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners and accessories as recommended by manufacturer for application indicated as needed to provide a complete steel framing system.

2.02 MATERIALS

- A. "C" Shaped Studs:
1. For 16 gage and heavier units, fabricate steel framing components of structural quality steel sheet with a minimum yield point of 50,000 PSI; ASTM A 1003/ A 1003M.
 2. For 18 gage and lighter units, fabricate steel framing components of commercial quality steel sheet with a minimum yield point of 33,000 PSI; ASTM A 1003/ A 1003 M.
 3. Provide galvanized finish to steel framing components and accessories in exterior walls complying with ASTM A 653/ A 653 M for minimum G 60 coating.
 4. Provide prime coated finish to steel framing components and accessories in interior walls with 1 coat of shop applied red oxide, zinc chromate or other similar rust inhibitive primer.

5. Runners: Tracks, deep leg tracks and bent plate tracks occurring at top and bottom of steel framing system shall be same gage as framing.
 6. Diagonal bracing straps to resist lateral loads shall be a minimum of 14 gage with a minimum yield point of 50,000 PSI; ASTM A 1003/ A 1003 M unless noted otherwise on Drawings. Runner tracks at diagonal bracing strap locations shall be a minimum of 16 gage.
 7. Provide miscellaneous and special heavy gage galvanized sheet steel shapes indicated on Drawings.
 8. Finish of installation accessories to match that of main framing components unless noted otherwise.
- B. Welding Electrodes:
1. Shielded metal arc welding shall be made in accordance with the AWS "Specification for Welding Sheet Steel in Structures" and its commentary.
- C. Rolled Steel Plates, Shapes and Bars:
1. Shall meet requirements of ASTM A6/ A 6M and A36/ A 36M for steel with $F_y = 36$ KSI.
- D. Power- Actuated Anchors:
1. Fastener system shall be of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.
- E. Expansion Anchors:
1. Expansion bolts shall be hot-dipped galvanized. Expansion bolts with the capability to sustain without failure, a load equal to or more than 5 times design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- F. Other Fasteners:
1. Shall be corrosion-resistant cadmium or zinc plated screws, nuts, bolts, washers and other fasteners.
- G. Sealer Gaskets:
1. Closed cell neoprene foam, 1/4-inch-thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.
- H. Zinc Rich Paint:
1. Touch up welds with zinc-rich paint in compliance with ASTM A 780.

2.03 PROPERTIES

- A. Physical and structural properties listed shall be considered minimum permitted for framing members.

2.04 SUBSTITUTIONS

- A. Substitutions must be approved in writing 10 days prior to bid date by Engineer.

2.05 FABRICATION

A. General:

1. Framing components may be prefabricated into panels on or off-site prior to erecting. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Perform lifting of prefabricated units to prevent damage or distortion.
2. Framing components shall be cut squarely for attachment to perpendicular members or as required for an angular fit against abutting members. Members shall be held positively in place until properly fastened.
3. Fastenings: Attach components by welding, bolting, or screw fastening as standard with manufacturer unless specific method of attachment is noted on Drawings. Wire tying of framing components is not permitted. Welding is permitted on 18 gage or heavier material only. Where Drawings indicate concentrated loads to be attached to channel by bolting, provide stud reinforcement as required at location of bolted connection.
4. Provide insulation equal to that specified elsewhere in double jamb studs and double header members which will not be accessible to Insulation Contractor.
5. Fabrication tolerances: Fabricate panels to a maximum allowable tolerance variation from plumb, level and true to line of 1/8 inch in 10'-0".

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Inspection:

1. Prior to installation, inspect work of other trades. Verify that work is complete and accurate to the point where this installation may properly commence in strict accordance with framing Shop Drawings.

B. Discrepancies:

1. Immediately notify Engineer of discrepancies.
2. Do not proceed with installation in areas of discrepancies until such discrepancy has been fully resolved.

3.02 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness or fire-resistive materials below that required to obtain fire-resistive rating indicated. Protect remaining fire-resistive materials from damage.

3.03 INSTALLATION

A. General:

1. Install steel framing systems in accordance with manufacturer's printed or written instructions and recommendations and ASTM C1007 unless otherwise indicated.

B. Runner Tracks:

1. Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as required for design loads as noted in design calculations portion of this Specification and as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches o.c. spacing for nail or power driven fasteners, nor 16 inches o.c. for other types of attachment. Install concrete anchors only after full compressive strength has been achieved. Provide a sill sealer or gasket barrier between concrete and steel connections. Provide fasteners at corners and ends of tracks.
2. Install load bearing shims or grout between underside of wall bottom track or rim track and top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
3. Track shall be securely anchored to supporting structure as shown on fabrication and erection drawings.
4. Track butt joints shall be securely anchored to a common structural element or they shall be butt-welded or spliced together.
5. Install framing members in 1-piece lengths unless splice connections are indicated for track or tension members.
6. Install insulation, specified in Division 07, in built-up exterior framing members such as headers, sills, boxed joints, and multiple studs at openings, that are inaccessible on completion of framing work.
7. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

C. Wall Stud System:

1. Set studs plumb except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
2. Secure studs to top and bottom runner tracks by welding or screw fastening at both inside and outside flanges, except where vertical movement is specified.
3. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of bridging to supporting structure.
4. Framed wall openings shall include headers and supporting studs. Install headers over wall openings wider than stud spacing, including those required for other trades. Locate headers above openings with double stud at each jamb of frame, except where more than 2 studs are either shown or indicated in manufacturer's instructions. Fabricate headers of compound shapes indicated or required to transfer load of supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates. Install runner tracks and jack studs below wall openings. Anchor tracks to jamb

studs with stud shoes or by welding and space jack studs same as full-height studs of wall. Secure stud system to wall opening frame in manner indicated

5. Frame both sides of expansion and control joints as shown for wall systems with a separate stud and do not bridge joint with components of stud system.
6. Install horizontal bridging in stud system, spaced as recommended by manufacturer and at locations required by load-bearing conditions. Weld or mechanically fasten at each intersection.
7. Wall stud bridging shall be attached in a manner to prevent stud rotation. Bridging rows shall be spaced according to manufacturer's recommendation. Without supportive data, minimum bridging shall be 4'-0" on center.
8. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support, securely attached to supporting members.
9. Temporary bracing shall be provided until erection is completed.
10. Provide stud walls at locations indicated on Drawings as "shear walls" for frame stability and lateral load resistance.
11. Provision for structure vertical movement shall be provided where indicated on Drawings.
12. Erection Tolerances: Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true to line joints. Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16 inch.

D. Supplementary Framing:

1. Install supplementary framing, blocking and bracing in steel framing system as required by AISI and wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.
2. Install suspended brick panel support as shown on approved Shop Drawings.

E. Cold Formed Steel Joists:

1. Install level, straight and plumb, with bracing and reinforcing as indicated on Drawings. Provide not less than 1-1/2 inch end bearing.
2. Joists shall be located directly over bearing studs or a load distribution member shall be provided at top track.
3. Align studs vertically floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
4. Reinforce ends and bearing points of joist with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
5. Joists shall be installed with their web area perpendicular to bearing surface.
6. Joist bridging shall be provided as indicated on Shop Drawings.

7. Provide additional joist under parallel partitions when partition length exceeds 1/2 the joist span.
 8. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
 9. End blocking shall be provided where joist ends are not otherwise restrained from rotation.
 10. Bridging, bracing, blocking, strapping, web reinforcement, etc. must be in place prior to placing any load on joist.
- F. Field Painting:
1. Touch-up shop applied protective coatings damaged during handling and installation. Use compatible primer for prime coated surfaces; use galvanizing zinc-rich paint for galvanized surfaces. Brush on or spray on paint to a minimum 2 mil dry film thickness.
 2. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures cold-formed framing is without damage or deterioration at time of substantial completion.

END OF SECTION 054000

SECTION 054300 – SLOTTED CHANNEL FRAMING

PART I – GENERAL

1.01 SUMMARY

- A. Framing shall be a strut type metal framing system (Strut System)
- B. Strut System shall be used:
 - 1. To support mechanical and electrical equipment and devices.
 - 2. For structural applications as applicable.
- C. Strut System and components must be supplied from a single approved Manufacturer.

1.02 QUALITY ASSURANCE

- A. Manufacturer's qualifications:
 - 1. The manufacturer shall have at least 10 years experience in manufacturing Strut Systems.
 - 2. The manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.
- B. Work shall meet the requirements of the following standards:
 - 1. Federal, State and Local codes
 - 2. American Iron and Steel Institute (AISI) Specification for the Design of ColdFormed Steel Structural Members 2001 Edition
 - 3. American Society for Testing And Materials (ASTM)
 - 4. Metal Framing Manufacturer's Association (MFMA)

1.03 SUBMITTALS

- A. Structural calculations by a Registered Professional or Structural Engineer in the State of the Project's location for approval by the Professional of Record. Calculations may include, but are not limited to:
 - 1. Description of design criteria
 - 2. Stress and deflection analysis
 - 3. Selection of framing members, fittings, and accessories Unistrut International 16100 S. Lathrop Ave. Harvey, IL 60426 Phone: 708-339-1610 800-882-5543 Fax: 708-339-7814 www.unistrut.com
- B. Assembly drawings necessary to install the Strut System in compliance with the Contract Drawings
- C. Pertinent manufacturers published data

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.

B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

1.05 WARRANTY

A. Manufacturer shall warrant for 1 year from the shipment date that products will be free from defects in material or manufacture. In the event of any such defect in violation of the warranty, Manufacturer shall have the option to repair or replace any such defective product.

B. Installer shall warrant for 1 year from the date of completion of work that the work will be free of defects in installation. In the event of any such defect in violation of the warranty, Installer shall have the option to repair or replace any such defective product.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Strut System and components shall be UNISTRUT®

2.02 MATERIALS

A. All channel members shall be fabricated conforming to one of the following ASTM specifications:

1. Plain Carbon Steel: A 1011 SS Grade 33
2. Pre-Galvanized Carbon Steel: A 653 Grade 33
3. UNISTRUT DEFENDER™: A 1046 SS Grade 33
4. Stainless Steel: A 240 (Type 304)
5. Aluminum: B 221 (Type 6063-T6)

B. All fittings shall be fabricated conforming to one of the following ASTM specifications:

1. Carbon Steel: All carbon steel fittings shall be fabricated from steel that meets/exceeds the physical requirements of ASTM A1011 SS Grade 33 and conforms to one of the following ASTM specifications:

- a. A 575
- b. A 576
- c. A 36
- d. A 635
- e. A 1059
- f. A 1046

2. Stainless Steel:

- a. A 240 (Type 304 or Type 316)
- b. A 276 (Type 304 or Type 316)

3. Aluminum:

- a. B 209 (Type 1100F or Type 5052-H32)

C. Any substitutions of product or manufacturer must be approved in writing ten days prior to bid date by the Professional of Record.

2.03 FINISHES

A. FACTORY PAINTED

1. Channel

- a. Rust inhibiting thermoset acrylic enamel paint applied by electrodeposition after cleaning and phosphating, and thoroughly baked.

2. Fittings

- a. Polyester powder coat after cleaning and phosphating, and thoroughly baked.

3. Color shall be FHWA Highway Green, Color Tolerance Chart, PR Color No. 4

4. Hardness = 2H

5. Performance

- a. Salt Spray per ASTM B117

(1) Scribed: Exceed 400 hours

(2) Unscribed: Exceed 600 hours

- b. Nominal chalking at 1,000 hours per weatherometer G-23 test

- c. No checking at 1,000 hours per weatherometer G-23 test

B. ELECTRO-GALVANIZED per ASTM B 633 Type III SC 1

C. PRE-GALVANIZED per ASTM A653

1. Zinc coated by hot-dipped process prior to roll forming at the steel mill

2. Zinc coating thickness shall be G90 (0.75 mil = 0.45 oz./ sq. ft. surface area)

D. HOT-DIPPED GALVANIZED per ASTM A123 or A153

1. Zinc coated after all manufacturing operations are complete

2. Zinc coating thickness shall be G65 (2.6 mils = 1.50 oz./ sq. ft. surface area)

E. UNISTRUT DEFENDER™ per ASTM A1046 and A1059

1. Strut coated per A1046 to a mass of 0.45 oz./ sq. ft. surface area

2. Fittings coated per A1059 to a thickness of 30 microns and/or A1046 to a mass of 0.45 oz./sq. ft. surface area

F. SPECIAL COATING / MATERIAL (Describe as applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections are completed.

3.02 INSTALLATION

- A. Installation shall be accomplished by a fully trained manufacturer authorized installer.
- B. Set Strut System components into final position true to line, level and plumb, in accordance with approved drawings.
- C. Anchor material firmly in place, and tighten all connections to their recommended torques.

3.03 CLEANUP

- A. Upon completion of this section of work, remove all protective wraps and debris. Repair any damage due to installation of this section of work.

3.04 PROTECTION

- A. During installation, it shall be the responsibility of the installer to protect this work from damage.
- B. Upon completion of this scope of work, it shall become the responsibility of the general contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

END OF SECTION 005430

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Wood blocking, cants, and nailers.
- 2. Plywood backing panels.

- B. Related Requirements:

- 1. Section 061600 "Sheathing."
- 2. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NLGA: National Lumber Grades Authority.
 - 2. WCLIB: West Coast Lumber Inspection Bureau.
 - 3. RIS: Redwood Inspection Service.
 - 4. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping,] and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency. **Stamp must be visible upon inspection.**
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
 - 1. Framing for raised platforms.
 - 2. Framing for stages.
 - 3. **All Concealed blocking.**

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and the following species and grades:
 - 1. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.7 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with approved fastener patterns where applicable.

2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

- M. **Install 2x6 wood blocking behind gypsum board at all door hardware wall stop locations. Securely attach blocking to adjacent studs.**
- N. **Install 2x6 wood blocking behind gypsum board at all toilet accessories and compartment anchor locations. Securely attach blocking to adjacent studs.**
- O. **Install 2x6 wood blocking behind gypsum board at all undercounter support bracket locations. Securely attach blocking to adjacent studs.**

3.2 WOOD SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preserved-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Sheathing joint and penetration treatment.

- B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.
2. Section 072726 "Fluid-Applied Membrane Air Barrier" for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.2 WOOD PANEL PRODUCTS

- A. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat all plywood unless otherwise indicated and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
1. Roof and wall sheathing within 48 inches of fire walls.

2.5 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior, Structural I sheathing.
1. Span Rating: Not less than 24/0.
 2. Nominal Thickness: Not less than that indicated on the Drawings.
- B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
1. Span Rating: Not less than 24/0.
 2. Nominal Thickness: Not less than that indicated on the Drawings.
- C. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
1. Type and Thickness: Regular, 1/2 inch thick.
 2. Size: 48 by 96 inches for vertical installation.

2.6 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exterior, Structural I sheathing.
1. Span Rating: Not less than 24/0.
 2. Nominal Thickness: **Not less than that indicated on the Drawings.**

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Power-Driven Fasteners: NES NER-272.

- C. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 - 1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with screws.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
 - 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
 - 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Plastic-laminate-faced architectural cabinets.
- 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
- 2. Section 123661 "Simulated Stone Countertops" for countertops scheduled with Solid Surface, Quartz, Granite, or other such materials.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate and cabinet hardware and accessories.

- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- 1. Show details full size.
- 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
- 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.

C. Samples for Verification:

- 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
- 2. Wood-grain plastic laminates, 8 by 10 inches, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
- 3. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
- 4. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.

- b. Miter joints for standing trim.
- 5. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For each type of product including the following:
 - 1. Composite wood products.
 - 2. High-pressure decorative laminate.
 - 3. Glass.
 - 4. Adhesives.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products and/or Certified participant in AWI's Quality Certification Program.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical plastic-laminate cabinets as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Custom.
- C. Type of Construction: **Reveal overlay.**
- D. Cabinet, Door, and Drawer Front Interface Style: **Reveal overlay.**
- E. Reveal Dimension: **1/4 inch.**
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- G. Laminate Cladding for Exposed Surfaces (**Anything visible when looking at cabinets from either standing or sitting position and tops of upper cabinets**):
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS.
 - 3. Edges: Grade HGS.
 - a. **Cabinet doors and Drawer fronts: (either)**
 - 1) **Grade HGS to match face laminate. Install edge banding before face laminate.**

- 2) **3mm PVC edge banding that matches face laminate. Sample must be submitted and approved by Architect to match. Otherwise, laminate edge banding will be required.**
 4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
 - H. Materials for Semi-exposed Surfaces (areas behind closed doors or drawers):
 1. Surfaces Other Than Drawer Bodies: 3/4" Thermoset Decorative Panels
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding **on all edges**.
 - c. For semi-exposed backs of panels with exposed plastic-laminate surfaces (**i.e. cabinet doors or drawer fronts**), provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 2. **Drawer Sides Subfronts and Backs: ½" thick, 7 ply Baltic birch plywood with sealer.**
 3. Drawer Bottoms: 1/4" Thermoset decorative panels.
 - I. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
 - J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
 - K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 1. Join subfronts, backs, and sides with **Shoulder Lock, glued and pin nailed**.
 - L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - a. Refer to the Finish and Materials Schedule in Section 099999.
- 2.2 WOOD MATERIALS
- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 1. Wood Moisture Content: 4 to 9 percent.
 - B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 2. Thermoset Decorative Panels: Medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
 3. **Hardboard: Tempered Masonite, ¼" thick at form shelves where indicated.**
 4. **NO PARTICLEBOARD SHALL BE USED ANYWHERE IN THE PRODUCTION OF THE MILLWORK.**

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- D. **Catches: Hafele Automatic Door Catch 245.58.754 (245.58.156 for bronze finish where indicated) at all pairs of doors indicated with cam lock.**
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: BHMA A156.9, B04013; metal.
- G. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
 - 2. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
 - 3. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
 - 4. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.
- H. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Product: Subject to compliance with requirements, provide "TG3 series" by Doug Mockett & Company, Inc.
- I. Door Locks: BHMA A156.11, E07121. **Contractor is to coordinate keying schedule with Owner. Keying may be, at the Owner's option, either keyed alike, keyed separately, or a combination of the above. Furnish door locks and catches as indicated on Drawings.**
- J. Drawer Locks: BHMA A156.11, E07041. **Contractor is to coordinate keying schedule with Owner. Keying may be, at the Owner's option, either keyed alike, keyed separately, or a combination of the above. Furnish door locks and catches as indicated on Drawings.**
- K. Door and Drawer Silencers: BHMA A156.16, L03011.
- L. **Countertop Support: Rakks extruded aluminum counter support bracket in recommended size for countertop depth and height. Off-White Powder coat finish.**
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. **Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.**
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate cabinets to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- E. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 064116

SECTION 071800 - TRAFFIC COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes traffic coatings for the following applications:
 1. Pedestrian traffic.
 2. Vehicular traffic coating.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish.
- B. Samples for Initial Selection: For each type of exposed finish.
- C. Samples for Verification: For each type of exposed finish, prepared on rigid backing.
 1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of traffic coating.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 1. Build mockup for each traffic coating and substrate to receive traffic coatings.
 2. Size: 20 sq. ft. of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
 - 1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.
- B. Do not install traffic coating until items that penetrate membrane have been installed.
- C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations:
 - 1. Obtain traffic coatings from single source from single manufacturer.
 - 2. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.
 - 3. Obtain pavement-marking paint from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 TRAFFIC COATING

- A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for pedestrian traffic and Vehicular Traffic service condition; according to ASTM C957/C957M.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation.
 - b. Sika USA.
 - c. Tremco Incorporated.
- B. Primer: Liquid primer as recommended in writing for substrate and conditions by traffic-coating manufacturer.
 - 1. Material: Polyurethane.
- C. Preparatory and Base Coats: Aliphatic urethane [**or**].
 - 1. Thicknesses: Minimum dry- or wet- film thickness as recommended in writing by manufacturer for substrate and service conditions indicated.
- D. Intermediate Coat: Aliphatic urethane .
 - 1. Thicknesses: Minimum dry- or wet- film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.

2. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated Not less than 8 to 10 lb/100 sq. ft..
- E. Topcoat: Aliphatic urethane .
 1. Thicknesses: Minimum dry- or wet- film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.
 2. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated As required to achieve slip-resistant finish.
 3. Color: **As scheduled in the Materials and Finish Schedules Section 09999.**
- F. Aggregate: Manufacturer's standard aggregate for each use indicated or of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.
- G. ENERGY STAR Listing: Provide traffic coating that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.
- B. Verify that substrates are visibly dry and free of moisture.
 1. Test for moisture according to ASTM D4263.
 2. Test for moisture content by method recommended in writing by traffic-coating manufacturer.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Begin coating application only after substrate construction and penetrating work have been completed.
 2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
 3. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Clean and prepare substrates according to ASTM C1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.
- B. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.
 1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.
- C. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.
- D. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

- E. Concrete Substrates: Do not acid etch.
 - 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 - 2. Remove concrete fins, ridges, and other projections.
 - 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 - 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D4258.

3.3 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C1127 and manufacturer's written instructions.
- B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.
- C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.
- D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D4258.
 - 1. Comply with recommendations in ASTM C1193 for joint-sealant installation.
- B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

3.5 TRAFFIC-COATING APPLICATION

- A. Apply traffic coating according to ASTM C1127 and manufacturer's written instructions.
- B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.
- C. Start traffic-coating application in presence of manufacturer's technical representative.
- D. Verify that wet-film thickness of each coat complies with requirements every 100 sq. ft..
- E. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.
- F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.
- G. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

3.6 PAVEMENT MARKINGS

- A. Do not apply pavement-marking paint for striping and other markings until layout, colors, and placement have been verified with Architect and traffic coating has cured.
- B. Sweep and clean surface to eliminate loose material and dust.

- C. Apply pavement-marking paint with mechanical equipment to produce markings of dimensions indicated with uniform straight edges. Apply at manufacturer's recommended rates for a minimum wet-film thickness of 15-mils.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
 - 2. Broadcast glass beads uniformly into wet pavement-marking paint at a rate of 6 lb/gal..

3.7 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071800

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket insulation.
- B. Related Sections:
 - 1. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATION

- A. **For each of the Products listed below, each must come from a single approved manufacturer. Mixing of different manufacturer's similar products on the project is not acceptable.**

2.2 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. CertainTeed Corporation.
 2. Johns Manville.
 3. Knauf Insulation.
 4. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

- B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

3.3 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

END OF SECTION 072100

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes fluid-applied, vapor-permeable membrane air barriers.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.
 - 2. Section 044313.16 "Adhered Stone Masonry Veneer" for weather barriers, including building paper flexible flashing and building wraps with air-barrier properties.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- B. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Synthetic Polymer Membrane:
 - 1) W.R. Meadows.; Air-Shield LMP
 - 2) Carlisle Coatings & Waterproofing Inc.; Barritech VP.
2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M.
 - c. Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.
- C. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

- E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, counterflashing strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness, applied in one or more equal coats.
- C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material according to air-barrier manufacturer's written instructions.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier

- or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes metal composite material wall panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
 - 8. Review procedures for repair of panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.

- C. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Composite Material Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal composite material panel assembly including corner, soffits, supports, attachments, and accessories.
 - 2. Water-Spray Test: Conduct water-spray test of mockup of metal composite material panel assembly, testing for water penetration according to AAMA 501.2.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F , ambient; 180 deg F , material surfaces.
- B. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

- A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
- B. Basis-of-Design: Alucobond
- C. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- thick, anodized aluminum sheet facings.
 - 1. Panel Thickness: 0.157 inch.
 - 2. Core: Standard.
 - 3. Exterior Finish: PVDF/FEVE fluoropolymer and Clear anodized as scheduled.
 - a. **Color: Ocean Blue (FEVE) to be used at areas indicated on the Drawings.**
 - b. **Clear anodized to be used at areas indicated on the Drawings.**
- D. Attachment Assembly Components: Formed from extruded aluminum .
- E. Attachment Assembly: Manufacturer's standard Clip Subgirt and spline Track support Rainscreen principle system.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are

not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.

- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:

1. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Exposed Anodized Finish:
 - a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal composite material panels.
 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal composite material panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
 2. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
 3. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.
- F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
 2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.
- G. Subgirt-and-Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal composite material wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
1. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
 2. Do not apply sealants to joints unless otherwise indicated.
- H. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical tracks or drain channels that provide support and secondary drainage assembly, draining to the exterior at horizontal joints

through drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.

1. Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
2. Attach flush wall panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
3. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
4. Do not apply sealants to joints unless otherwise indicated.

I. Rainscreen-Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal composite material wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.

1. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
2. Do not apply sealants to joints unless otherwise indicated.

J. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.

K. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion

of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

SECTION 074616 - ALUMINUM SIDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes aluminum siding and soffit.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
 - 2. Section 061600 "Sheathing" for exterior sheathing under panels.
 - 3. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.3 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For aluminum siding and soffit including related accessories.
- C. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. 12-inch- long-by-actual-width Sample of siding.
 - 2. 24-inch- wide-by-36-inch- high Sample panel of siding assembled on plywood backing.
 - 3. 12-inch- long-by-actual-width Sample of soffit.

1.6 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for siding and soffit including accessories.
 - a. Size: 48 inches long by 60 inches high
 - b. Include outside corner on one end of mockup and inside corner on other end.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking, fading, and deforming.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 5 Hunter color-difference units as measured according to ASTM D 2244.
 - 3. Warranty Period: 50 years from date of Substantial Completion for Material defects and 15 Years for finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 ALUMINUM SIDING

- A. Aluminum Siding: Formed and coated product complying with AAMA 1402.
 - 1. **Basis-of-design: Longboard Aluminum Cladding by Long Board Architectural Products**
- B. Horizontal Pattern: 6-inch exposure in plain, single-board style. 24' panel lengths. Class A fire-rated.
- C. Texture: Smooth.
- D. Extruded Aluminum 6063 T5 thickness: 1/16" (1.62mm) mase metal thickness.
- E. Finish: Manufacturer's standard Decorative finish.
 - 1. Colors: Powder-coated base finish with sublimated finish pattern.
 - 2. Woodgrain color and pattern to match Architect's Example.
 - a. **Rock Elm, 15REM**

2.3 ALUMINUM SOFFIT

- A. Match Siding Materials

2.4 ACCESSORIES AND TRIM

- A. Provide applicable accessories and trim in color and pattern to match panels.
- B. Provide all applicable attachment clips, terminations, flat caps, finishing strips, inside and outside corner pieces, J-trims, etc. as required for a complete and proper system.
- C. Fasteners: 1 ½" length, #8 screw with corrosion resistance suitable for the application and climate.

D. Touch Up Pen, Light or Dark Brown. Provide one of each to Owner upon completion.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of aluminum siding and soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Center screws in elongated attachment slots without binding siding to allow for thermal movement.
- B. Install aluminum siding and soffit and related accessories according to AAMA 1402.
 - 1. Install fasteners no more than 24 inches o.c.
- C. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.
- D. Where aluminum siding contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074616

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Adhered thermoplastic polyolefin (TPO) roofing system.
- 2. Roof insulation.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
- 2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
- 3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
- 4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
- 5. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

- 1. Base flashings and membrane terminations.
- 2. Tapered insulation, including slopes.
- 3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
- 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

- C. Samples for Verification: For the following products:

- 1. Sheet roofing, of color required.
- 2. Roof Insulation
- 3. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
 - 2. Warranty Period: Twenty (20) years from date of Substantial Completion with No Dollar Limit coverage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carlisle SynTec Incorporated.
 - 2. Firestone Building Products.
 - 3. GAF Materials Corporation.
 - 4. Johns Manville.
- B. Source Limitations: Obtain components including fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 - 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- A. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
- B. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a built-up roofing system, and shall be listed in FM

Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90.
 2. Hail-Resistance Rating: **VSH**.
- C. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- E. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.
- F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

- A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.
1. Thickness: 60 mils, nominal.
 2. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.
- C. Bonding Adhesive: Manufacturer's standard, solvent based.
- D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- E. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slopes indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 - 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - 3. Full-spread spray-applied, low-rise, two-component urethane adhesive.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 5/8 inch thick.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Georgia-Pacific Corporation; Dens Deck StormX Prime Roof Board.
 - b. National Gypsum Company; DEXcell Glass Mat Roof Board.

2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. For steel decks, verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 - 4. For concrete decks, verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. If applicable, install insulation strips according to acoustical roof deck manufacturer's written instructions.
- D. Install acoustical roof deck rib insulation strips, if specified in Division 5 Section "Steel Deck," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system if applicable.

3.4 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

- C. When designated, install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
 - 1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together.
 - 1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification
 - 2. Install in a two-part urethane adhesive according to roofing system manufacturer's instruction.
 - 3. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.5 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roofing with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
 2. Flood each area for 48 hours.
 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.9 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed equipment support flashing.

- B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Section 079500 "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

- B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.

5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 6. Include details of termination points and assemblies.
 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 8. Include details of roof-penetration flashing.
 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 10. Include details of special conditions.
 11. Include details of connections to adjoining work.
 12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
 3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
 4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested and FM Approvals approved.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 1. For copings and roof edge flashings that are SPRI ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- E. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: 90 psf.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.
 - 1. Nonpatinated Exposed Finish: Mill.

- C. Aluminum Sheet: ASTM B 209 , alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
1. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 2. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - a. Color: As selected by Architect from full range of industry colors and color densities.
 - b. Color Range: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 3. Color: Match Architect's sample.
 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil .
- D. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
1. Finish: 2B (bright, cold rolled).
- E. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed, stainless-steel sheet of minimum uncoated thickness indicated; coated on both sides with zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied gray preweathering.
- F. Zinc-Tin Alloy-Coated Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper, of minimum uncoated weight (thickness) indicated; coated on both sides with zinc-tin alloy (50 percent zinc, 50 percent tin).
- G. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 ; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
1. Surface: Smooth, flat and mill phosphatized for field painting.
 2. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 3. Color: Match Architect's sample.
 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil .

2.3 UNDERLAYMENT MATERIALS

- A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F ; and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

- 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

- a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
- b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
- c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

- 2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.

- 3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

- 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

- 5. Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.

- 6. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

- 7. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

- C. Solder:

- 1. For Copper: ASTM B 32, with maximum lead content of 0.2 percent.

- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Through-Wall, Ribbed, Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry, with ribs at 3-inch intervals along length of flashing to provide integral mortar bond. Manufacture through-wall flashing with interlocking counterflashing on exterior face, of same metal as flashing.
1. Copper: 10-oz.
 2. Stainless Steel: 0.016 inch thick.
- B. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
1. Material: Aluminum, 0.024 inch thick.
 2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 3. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
 4. Finish: Mill.

2.6 FABRICATION, GENERAL

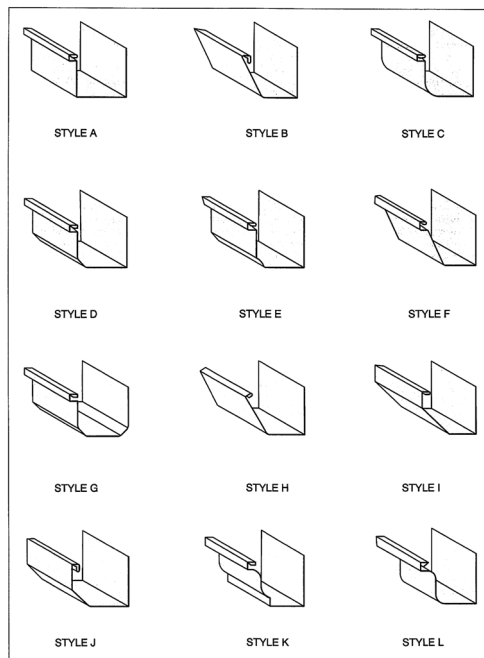
- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.

- E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- I. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- J. Do not use graphite pencils to mark metal surfaces.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

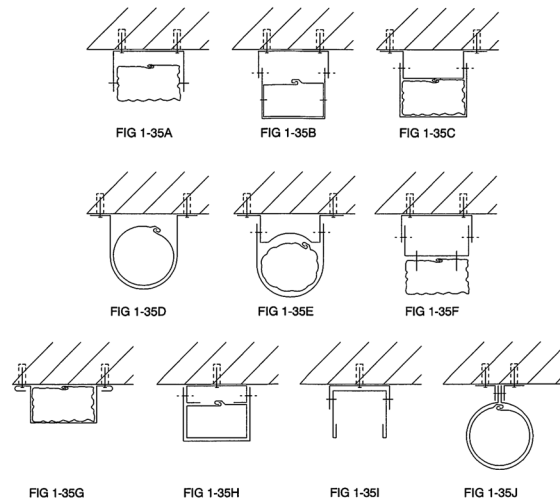
- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

- 1. Gutter Profile: Style A according to cited sheet metal standard.



- 2. Expansion Joints: Lap type.

3. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.
 4. Gutters with Girth 21 to 25 Inches : Fabricate from the following materials:
 - a. Galvanized Steel: 0.034 inch thick.
 5. Gutters with Girth 26 to 30 Inches : Fabricate from the following materials:
 - a. Galvanized Steel: 0.040 inch thick.
- B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Fabricated Hanger Style: Fig 1-35A according to SMACNA's "Architectural Sheet Metal Manual."



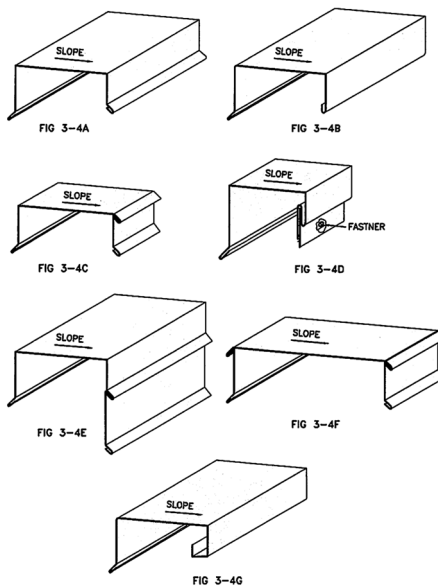
2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
- C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
- D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
- E. Splash Pans: Fabricate to dimensions and shape required and from the following materials:
1. Aluminum: 0.040 inch thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.
1. Joint Style: Overlapped, 4 inches wide.
 2. Fabricate with scuppers spaced 10 feet apart, to dimensions required with 4-inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 3. Fabricate from the Following Materials:
 - a. Galvanized Steel: 0.028 inch thick.

- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal, or solder if copper, watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: Fig 3-4A according to SMACNA's "Architectural Sheet Metal Manual."



2. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
 3. Fabricate from the Following Materials:
 - a. Galvanized Steel: 0.040 inch thick.
- C. Base Flashings and roof penetration flashings: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
- D. All other flashings: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
 - 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F , set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F .
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Fasten gutter spacers to front and back of gutter.
 - 2. Anchor and loosely lock back edge of gutter to continuous cleat.
 - 3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
 - 4. Anchor gutter withstraps spaced not more than 24 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
 - 5. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
 - 6. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
 - 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
 - 2. Provide elbows at base of downspout to direct water away from building.
 - 3. Connect downspouts to underground drainage system.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant compatible with the substrate.

- E. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- D. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- E. Copings: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.
- F. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- G. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.
- H. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing may be specified in other sections.
- C. Reglets: Installation of reglets may be specified in other sections

- D. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.9 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof hatches.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.
 - 1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
- B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.
- C. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- E. Steel Tube: ASTM A 500, round tube.
- F. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- G. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.
- C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. Underlayment:
 - 1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
 - 3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

- E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- G. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Babcock-Davis.
 - b. Bilco Company (The).
 - c. J. L. Industries, Inc.
- B. Type and Size: Single-leaf lid, 36 by 36 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.
 - 1. Finish: Factory prime coating. Field Painted, Color as Selected by Architect.
- E. Construction:
 - 1. Insulation: Cellulosic-fiber board.
 - 2. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - 3. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
- F. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
1. Height: 42 inches above finished roof deck.
 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
 3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
 5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
 6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
 7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
 9. Fabricate joints exposed to weather to be watertight.
 10. Fasteners: Manufacturer's standard, finished to match railing system.
 11. Finish: Manufacturer's standard.
 - a. Color: As selected by Architect from manufacturer's full range.
- H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: 42 inches above finished roof deck.
 3. Material: Steel tube.
 4. Post: 1-5/8-inch- diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: As selected by Architect from manufacturer's full range.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof-Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 3. Attach safety railing system to roof-hatch curb.
 - 4. Attach ladder-assist post according to manufacturer's written instructions.
- D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.
- B. Clean off excess sealants.
- C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

- B. Related Sections:

1. Section 079500 "Expansion Control" for building expansion joints.
2. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
3. Section 088000 "Glazing" for glazing sealants.
4. Section 092900 "Gypsum Board" for sealing perimeter joints.
5. Section 093000 "Tiling" for sealing tile joints.
6. Section 095113 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- C. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

2.3 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
- B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.6 MISCELLANEOUS MATERIALS

- A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- A. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - 2. Urethane Joint Sealant: Single component, nonsag, traffic grade.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints in unit masonry.
 - b. Joints in exterior insulation and finish systems.
 - c. Joints at perimeter of metal panel system trim.
 - d. Joints between adhered stone and adjacent materials.
 - e. Joints between different materials listed above.
 - f. Perimeter joints between materials listed above and frames of doors and windows.
 - 2. Urethane Joint Sealant: Single component, nonsag, Class 50.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - 2. Urethane Joint Sealant: Single component, nonsag, traffic grade.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.

- b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of walls.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - e. Joints between millwork countertops and adjacent walls.
 - f. Joints between wall protection trim components and mounted wall.
2. Joint Sealant: Latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors, including custom colors, to color match to dominant adjacent material.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Joints between toilet accessories and adjacent walls where accessories are intended to be permanently mounted.
 2. Silicone Joint Sealant: Single Component, nonsag, neutral curing, Class 50.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
 - 2. Section 134900 "Radiation Protection" for lead-lined, hollow-metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 16 gauge.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 16 gauge.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 14 gauge, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Polyurethane.
 - 1) Thermal-Rated Doors: Provide doors fabricated with U-Value not greater than .36.
3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 14 gauge, with minimum A40 coating.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 - 2. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 3. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.

4. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 5. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 5. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 7. Terminated Stops: When indicated in the schedule, terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.

- d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Solid-core doors with plastic-laminate faces.
- 2. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Requirements:

- 1. Section 088000 "Glazing" for glass view panels in flush wood doors.
- 2. Section 134900 "Radiation Protection" for lead-lined flush wood doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

- 1. Dimensions and locations of blocking.
- 2. Dimensions and locations of mortises and holes for hardware.
- 3. Dimensions and locations of cutouts.
- 4. Undercuts.
- 5. Requirements for veneer matching.
- 6. Fire-protection ratings for fire-rated doors.

- C. Samples for Verification:

- 1. Plastic laminate or veneer as applicable, 6 inches square, for each color, texture, and pattern selected.
- 2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

- a. Provide Samples for each color, texture, and pattern of plastic laminate required.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. **Environmental Limitations:** Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.
- B. **Environmental Limitations:** Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

- A. **Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.**
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. **Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.**
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS, GENERAL

- A. **Quality Standard:** In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

- B. Fire-Rated Wood Doors: When indicated in the schedule, provide doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
 3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- D. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-2.
 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c. 5-inch midrail blocking, in doors indicated to have exit devices.
- E. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
 - a. 5-inch top-rail blocking.
 - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch midrail blocking, in doors indicated to have armor plates.
 - d. 5-inch midrail blocking, in doors indicated to have exit devices.
 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

2.2 PLASTIC-LAMINATE-FACED DOORS

- A. Interior Solid-Core Doors:
1. Grade: Custom.

2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
3. Colors, Patterns, and Finishes: Refer to Finish and Materials Schedule Section 099999.
4. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.
5. Core: Particleboard.
6. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press.

2.3 LIGHT FRAMES

- A. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; with field painted, sprayed finish in a color to be determined by the Architect and approved for use in doors of fire-protection rating indicated.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- C. Openings: Factory cut and trim openings through doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 1. Install fire-rated doors according to NFPA 80.

2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Access doors and frames for walls and ceilings.

- B. Related Requirements:

- 1. Section 077200 "Roof Accessories" for roof hatches.
- 2. Section 099123 "Interior Painting" for field painting of access doors and frames.
- 3. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

- B. Shop Drawings:

- 1. Include plans, elevations, sections, details, and attachments to other work.
- 2. Detail fabrication and installation of access doors and frames for each type of substrate.

- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

- D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: For access doors located in fire-rated assemblies, provide units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

- 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.

2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- B. Flush Access Doors with Exposed Flanges:
 1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and ceiling of non-fire rated assemblies.
 3. Door Size: 2'x2'.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Lock.
- C. Fire-Rated, Flush Access Doors with Exposed Flanges:
 1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: All access doors located in fire-rated wall or ceiling assemblies.
 3. Fire-Resistance Rating: Not less than that of adjacent construction.
 4. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Lock.
- D. Hardware:
 1. Lock: Cylinder. **Coordinate keying with remainder of keyed building hardware and with Owner's requirements.**

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
 - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior High-Speed Service doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. Include description of automatic closing device and testing and resetting instructions.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - 5. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
 - 6. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Curtain slats or other system component with same finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with applicable provisions in the Texas Accessibility Standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 PERFORMANCE REQUIREMENTS FOR EXTERIOR DOORS

- A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 50 lbf/sq. ft., acting inward and outward.
 - 2. Testing: According to ASTM E 330.
 - 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 - 4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.

2.3 EXTERIOR DOOR ASSEMBLY

- A. High-speed Service Door: Overhead coiling door formed with curtain of interlocking slats. Opening speed up to 80"/sec and closing speed up to 20"/sec
- B. Basis of Design: **Overhead Door Company; RapidView Model 999**
- C. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 - 1. Include tamperproof cycle counter.

- D. Door Curtain Material: Aluminum and polycarbonate.
- E. Door Curtain Slats: Flat profile slats of standard height.
- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- G. Electric Door Operator:
 - 1. Usage Classification: Heavy duty, 25 or more cycles per hour and over 90 cycles per day.
 - 2. Operator Location: Wall.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
 - 4. Motor Exposure: Interior.
 - 5. Emergency Manual Operation: Push-up type.
 - 6. Obstruction-Detection Device: Automatic photoelectric sensor.
- H. Curtain Accessories:
 - 1. Equip door with weatherseals.
 - 2. Signaling devices – Red/Green LED Warning light
 - 3. Operator Switches – **Provide with (2) control buttons for each door. One at building interior (Testing room C02121) and one at wall adjacent to each door as indicated on the Drawings.**
- I. Door Finish:
 - 1. **Clear anodized aluminum finish on any aluminum components.**

2.4 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
 - 2. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch; and as required.
 - 3. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 - 4. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
 - 2. Stainless Steel: 0.025-inch- thick stainless-steel sheet, Type 304, complying with ASTM A 666.
 - 3. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
 - 4. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.7 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, nylon brushes.
- C. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- D. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.

- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Door Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf.
- C. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.10 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
 - 1. Electrical Characteristics:
 - a. Phase: Three phase.
 - b. Volts: 208-245 V.
 - c. Hertz: 60.
 - 2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at speeds listed.
 - 3. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- D. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- E. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.
 - 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

- a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
- F. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.13 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Fire-Rated Doors: Install according to NFPA 80.
- E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.
- F. Power-Operated Doors: Install according to UL 325.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior and interior storefront framing.
 - 2. Storefront framing for punched openings.
 - 3. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.

4. Glazing.
5. Flashing and drainage.

- F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.

- c. Noise or vibration created by wind and thermal and structural movements.
- d. Loosening or weakening of fasteners, attachments, and other components.
- e. Failure of operating units.

B. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

2.2 FRAMING

A. Basis of Design: The design for aluminum-framed systems is based on Kawneer 451

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.

2.3 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 5-inch nominal width. **Bottom stile is to be 10" tall.**
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.4 ENTRANCE DOOR HARDWARE

- A. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products **or approved equal with prior written approval obtained prior to bidding process.**
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbfto set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- C. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
 - 1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
 - 2. Exterior Hinges: Stainless steel, with stainless-steel pin.
 - 3. Quantities:
 - a. For doors up to 87 inches high, provide three hinges per leaf.
 - b. For doors more than 87 and up to 120 inches high, provide four hinges per leaf.
- D. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.
- E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- F. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- G. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- H. Cylinders: As specified in Section 087100 "Door Hardware."
 - 1. Keying: As specified in Section 087100 "Door Hardware."
- I. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- J. Operating Trim: BHMA A156.6.

- K. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- L. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- M. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- N. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- O. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.5 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.6 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using shear-block system.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

- D. Install components plumb and true in alignment with established lines and grades.

- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

- F. Install glazing as specified in Section 088000 "Glazing."

- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.

- b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 ENTRANCE DOOR HARDWARE SETS

Door Hardware Set No. A2				
Door No. 121B; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
1	Threshold	Mfr. Standard		Aluminum
1	Weather gasketing	Mfr. Standard		
1	Sweep	Mfr. Standard		Aluminum
Refer to Section 087100 for balance of hardware				

END OF SECTION 084113

SECTION 084229.23 - SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes exterior and interior, sliding, power-operated automatic entrances.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for forming recesses in concrete for recessed thresholds.
 - 2. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for swinging-sliding, manual ICU/CCU entrance door assemblies.

1.3 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- D. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

1.4 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks that control automatic entrances. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.
- C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.
- D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For automatic entrances.
1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
 2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
 4. Indicate locations of activation and safety devices.
 5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
- C. Samples for Initial Selection: For units with factory-applied finishes.
1. Include Samples of hardware and accessories involving color or finish selection.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Delegated-Design Submittal: For automatic entrances.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of automatic entrance. Include emergency-exit features of automatic entrances serving as a required means of egress.
- C. Product Test Reports: For each type of automatic entrance, for tests performed by a qualified testing agency.
- D. Sample Warranties: For manufacturer's special warranties.
- 1.7 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.
- 1.8 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A manufacturer with company certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
1. Maintenance Proximity: Not more than two (2) hours' normal travel time from Installer's place of business to Project site.
- C. Certified Inspector Qualifications: Certified by AAADM.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of operators, controls, and hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AUTOMATIC ENTRANCE ASSEMBLIES

- A. Source Limitations: Obtain sliding automatic entrances from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Power-Operated Door Standard: BHMA A156.10.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:
 - 1. Stanley Access Technologies

2.3 SLIDING AUTOMATIC ENTRANCES

- A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.
- B. Sliding Automatic Entrance:
 - 1. Model: Dura-Glide 3000
 - 2. Configuration: Biparting-sliding door with two sliding leaves sidelites on each side.
 - a. Traffic Pattern: Two way.
 - b. Emergency Breakaway Capability: Sliding leaves only.
 - c. Mounting: Between jambs.
 - 3. Operator Features:
 - a. Power opening and closing.

- b. Adjustable opening and closing speeds.
 - c. Adjustable hold-open time between zero (0) and thirty (30) seconds.
 - d. Obstruction recycle.
 - e. On-off/hold-open switch to control electric power to operator.
4. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
- a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
5. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless-steel, ball-bearing-center roller wheels.
- a. Configuration: Saddle-type threshold across door opening and surface-mounted guide-track system at sidelites.
6. Controls: Activation and safety devices according to BHMA standards.
- a. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
 - b. Safety Device: Presence sensor mounted on each side of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.
 - c. Sidelite Safety Device: Presence sensor, mounted above each sidelite on side of door opening through which doors travel, to detect obstructions and to prevent door from opening.
 - d. Opening-Width Control: Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.
7. Finish: Finish framing, door(s), and header with Class I, clear anodic finish.

2.4 ENTRANCE COMPONENTS

- A. Framing Members: Extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads.
1. Nominal Size: 1-3/4 by 4-1/2 inches.
 2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch wall thickness.
- B. Stile and Rail Doors: 1-3/4-inch- thick, glazed doors with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 2. Stile Design: Medium stile, 3-1/2-inch nominal width.
 3. Bottom Rail Design: 10-inch nominal height.
 4. Muntin Bars: Horizontal tubular rail member for each door; match stile design and finish.

- C. Sidelite(s): 1-3/4-inch- deep sidelite(s) with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members matching door design.
 - 1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
 - 2. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.

- D. Headers: Fabricated from minimum 0.125-inch- thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
 - 1. Mounting: Concealed, with one side of header flush with framing.
 - 2. Capacity: Capable of supporting doors up to 175 lb per leaf over spans up to 14 feet without intermediate supports.
 - a. Provide sag rods for spans exceeding 14 feet.

- E. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.

- F. Signage: As required by cited BHMA standard.
 - 1. Application Process: Door manufacturer's standard process.
 - 2. Provide sign materials with instructions for field application after glazing is installed.

2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B 221.
 - 2. Sheet: ASTM B 209.

- B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

- C. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

- D. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

- E. Glazing: As specified in Section 088000 "Glazing."

- F. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."

- G. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107/C 1107M; of consistency suitable for application.

- H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

- I. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.6 DOOR OPERATORS AND CONTROLS

- A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.
 - 1. Door Operator Performance: Door operators shall open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
 - 2. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off.
- C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by its plastic housing; adjustable to provide detection-field sizes and functions required by BHMA A156.10.
 - 1. Provide capability for switching between bidirectional and unidirectional detection.
 - 2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
- D. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.

2.7 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.
- B. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.
- C. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch- long throw bolt; BHMA A156.5, Grade 1.
 - 1. Cylinders: As specified in Section 087100 "Door Hardware."
 - a. Keying: As specified in Section 087100 "Door Hardware".
 - 2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
 - 3. Two-Point Locking for Stile and Rail Sliding Doors: Mechanism in stile of active door leaf that automatically extends second lockbolt into overhead carrier assembly or threshold.
- D. Weather Stripping: Replaceable components.
 - 1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.8 FABRICATION

- A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
 - 1. Form aluminum shapes before finishing.
 - 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 - 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 - 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
 - 1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - 3. Form profiles that are sharp, straight, and free of defects or deformations.
 - 4. Provide components with concealed fasteners and anchor and connection devices.
 - 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
 - 6. Fabricate exterior components to drain condensation and water passing joints within system to the exterior.
 - 7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
 - 8. Allow for thermal expansion of exterior units.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
- F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
 - 1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors and breakaway sidelites.
- G. Controls:
 - 1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.

2.9 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
 - 1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 - 2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
 - 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
 - 4. Level recesses for recessed thresholds using nonshrink grout.
- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Access-Control Devices: Connect access-control devices to access-control system as specified in Section 281300 "Access Control."

- E. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- F. Guide Rails: Install rails according to BHMA A156.10, including Appendix A, and manufacturer's written instructions unless otherwise indicated.
- G. Glazing: Install glazing as specified in Section 088000 "Glazing."
- H. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.
 - 1. Set thresholds, bottom-guide-track system, framing members and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.
- I. Signage: Apply signage on both sides of each door and breakaway sidelite as required by cited BHMA standard for direction of pedestrian travel.
- J. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 ADJUSTING

- A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust exterior doors for weathertight closure.
- B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.4 CLEANING

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
 - 1. Comply with requirements in Section 088000 "Glazing" for cleaning and maintaining glass.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 084229.23

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glazed aluminum curtain wall systems:
 - a. Conventionally glazed.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
 - 2. Section 088000 "Glazing" for curtain wall glazing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Installer .
 - 2. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.
- B. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency .

1.5 CLOSEOUT SUBMITTALS

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors.
- B. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed curtain wall assemblies.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

- A. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 - 2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.

- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings .
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans of greater than 13 feet 6 inches .
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch .
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. .
- G. Structural-Sealant Joints:
1. Designed to carry gravity loads of glazing.
- H. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 SOURCE LIMITATIONS

- A. Obtain all components of curtain-wall system and storefront system, including framing entrances and accessories, from single manufacturer.

2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. EFCO Corporation.
 2. Kawneer North America, an Arconic company.
 3. Oldcastle BuildingEnvelope (OBE); CRH Americas.
 4. YKK AP America Inc.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken .
 2. Glazing System: Retained mechanically with gaskets on four sides .
 3. Glazing Plane: Front .
 4. Finish: Clear anodic finish .
 5. System: Either stick or unitized system .
 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 7. Steel Reinforcement: As required by manufacturer.
 8. 2" Sightline with system depth of 7 – 1/2"
- C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
1. Include snap-on aluminum trim that conceals fasteners.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Entrance Door Systems: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts" .

2.4 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard .
1. Color: Black .

2.5 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.6 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads , finished to match framing system .
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials .

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior .
 - 6. Provisions for safety railings mounted .
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - 8. Components curved to indicated radii.
- D. Fabricate components to resist water penetration as follows:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 - 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using shear-block system .
- F. Factory-Assembled Frame Units:
 - 1. Rigidly secure nonmovement joints.
 - 2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 3. Seal joints watertight unless otherwise indicated.
 - 4. Install glazing to comply with requirements in Section 088000 "Glazing."
 - 5. Install structural glazing.
 - a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.

- b. Set glazing with proper orientation so that coatings face exterior or interior as specified.
 - c. Apply structural silicone sealant to completely fill cavity, in accordance with sealant manufacturers written instructions with the framing and glazing in a fully supported position.
 - d. Brace or stiffen framing and glazing in such a manner to prevent undue stresses on the glass edge seal and structural joints or movement of the glazing, until sealant is fully cured in accordance with manufacturer's recommendations.
 - e. After structural sealant has completely cured, insert backer rod between lites of glass as recommended by sealant manufacturer.
 - f. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.
 - g. Clean and protect glass as indicated in Section 088000 "Glazing."
 - h. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.
- H. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.5 INSTALLATION OF STRUCTURAL GLAZING

- A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- B. Set glazing into framing in accordance with sealant manufacturer's and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
- C. Set glazing with proper orientation, so that coatings face exterior or interior as specified.
- D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
- E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer's and framing manufacturer's written instructions and in compliance with local codes.
- F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
- G. Allow structural sealant to cure in accordance with manufacturer's recommendations.
- H. Clean and protect glass as indicated in Section 088000 "Glazing."

3.6 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass, as recommended by sealant manufacturer.
- B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.7 ERECTION TOLERANCES

- A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.

- c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 084413

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:

1. Mechanical door hardware for the following:
 - a. Swinging doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

- B. Related Sections:

1. Section 064116 "Plastic-Laminate-Faced Architectural Cabinets" for cabinet door hardware provided with cabinets.
2. Section 081416 "Flush Wood Doors" for astragals and integral intumescent seals provided as part of labeled fire-rated assemblies.
3. Section 083113 "Access Doors and Frames" for access door hardware, cylinders.
4. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, except cylinders.
5. Section 134900 "Radiation Protection" for lead-lined astragals provided as part of labeled fire-rated assemblies.
6. Section 283111 "Digital, Addressable Fire-Alarm System" for connections to building fire-alarm system.

- C. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.

1. Permanent lock cores to be installed by Owner when applicable.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and building safety and security systems.
 - b. Schematic diagram of systems that interface with electrified door hardware.

- c. Point-to-point wiring.
 - d. Risers.
 - e. Elevations doors controlled by electrified door hardware.
 2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
 1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.
 - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Other Action Submittals:
 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - d. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - 5) Fastenings and other pertinent information.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) List of related door devices specified in other Sections for each door and frame.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For electrified door hardware, from the manufacturer.
 1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

- B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware schedule.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- D. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the Texas Accessibility Standards.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:

- a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- H. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Requirements for access control.
 5. Address for delivery of keys.
 6. **All locks shall be keyed per Owner's request.**

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.8 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products **or approved equal with prior written approval obtained prior to bidding process.**
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.3 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

2.5 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Manufacturer: Same manufacturer as for locking devices.
- B. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - 1. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - b. Re-key Owner's existing master key system into new keying system.
 - 2. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: Information to be furnished by Owner.

2.7 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated

frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

- B. Provide regular or parallel arms as needed to locate closers on room side of doors and not in corridors. Closers may be scheduled only as the Model Series and may not contain all designations required for arm designations. All closers are to include optional through-bolting on doors.**

2.8 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Provide gasketing at all rated doors whether scheduled or not. If rated doors are scheduled with silencers, replace this designation with gasketing as required for proper seal.**

2.9 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.10 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick base metal; with manufacturer's standard machine or self-tapping screw fasteners.

2.11 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:

- 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
- b. Steel Through Bolts: For the following unless door blocking is provided:
- 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
 5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.12 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.
- F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
 - 1. Configuration: Provide one power supply for each door opening with electrified door hardware.
- H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

Door Hardware Set No. A1 Automatic Sliding Door				
Door No. 101A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
1 Ea.	Deadlatch	MS1950-X5X	Adams Rite	
1 Ea.	Cylinder		Corbin Russwin	626

Door Hardware Set No. 1 Access Control with Power Operator				
Door No. 102A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Classroom Lockset	CLX3355 NZD	Corbin Russwin	626
1 Ea.	Closer with hold open arm	DC8210xA2xM54	Corbin Russwin	626
1 set	Silencers	608-RKW	Rockwood	Grey
1 Ea.	Wall Stop	RM861	Rockwood	626
1 ea.	Electric Strike	1006CLB	HES	630
3 ea.	Remote Push Button	TS-19	Alarm Controls	US32D
Connect Electric Strike to Remote Push Buttons at designated locations behind Registration Counter. Provide all required power supplies. Relays, harnesses, etc. for a complete and operable system.				

Door Hardware Set No. 2 Toilet Rooms				
Door No. 103A, 104A, 116A, 117A, 124A, 140A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Privacy Lockset	CLX3330 NZD	Corbin Russwin	626
1 Ea.	Closer	DC8200xM54	Corbin Russwin	626
1 Ea.	Gasketing	S88GR	Pemko	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626
1 Ea.	Auto Door Bottom	434ARL 36"	Pemko	

Door Hardware Set No. 3 Offices				
Door No. 108A, 127A, 129A, 130A, 141A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Office Set	CLX3351 NZD	Corbin Russwin	626
1 Set	Silencers	608	Rockwood	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626

Door Hardware Set No. 4 Exam Rooms				
Door No. 125A, 132A, 133A, 134A, 139A, 144A, 145A, 146A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Passage Set	CLX3310 NZD	Corbin Russwin	626
1 Ea.	Gasketing	S88GR	Pemko	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626
1 Ea.	Auto Door Bottom	434ARL 36"	Pemko	

Door Hardware Set No. 5 Storage Exterior				
Door No. 148A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Storage Lockset	CLX3357 NZD	Corbin Russwin	626
1 Ea.	Closer	DC8200xM54	Corbin Russwin	626
1 Ea.	Threshold	170 A x DW	Pemko	
1 Ea.	Door Bottom	315 CN x DW	Pemko	
1 Ea.	Weatherstrip	294 AV opg.	Pemko	
1 Ea.	Wall Stop	RM861	Rockwood	626

Door Hardware Set No. 6 Storage				
Door No. 118A, 143A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Classroom Lockset	CLX3355 NZD	Corbin Russwin	626
3 Ea.	Silencers	608	Rockwood	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626

Door Hardware Set No. 7 Double Door Storage				
Door No. 123A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
6 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Classroom Lockset	CLX3355 NZD	Corbin Russwin	626
1 Ea.	Combination Flush Bolt	2845	Rockwood	US26D
1 Ea.	Dustproof Strike	570	Rockwood	US26D
2 Ea.	Overhead Stop	OH100 Series	Rockwood	US32D
2 Ea.	Silencers	608	Rockwood	Gray

Door Hardware Set No. 8 Break Room				
Door No. 119A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 ½" x 4 ½"	McKinney	US26D
1 Ea.	Office Set	CLX3351 NZD	Corbin Russwin	626
3 Ea.	Silencers	608	Rockwood	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626
2 ea.	Door Viewer	622	Rockwood	DCRM

Door Hardware Set No. 9 ERD Exterior				
Door No. 120A, 122A, 122F; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 ½" x 4 ½" NRP	McKinney	US26D
1	Exit Rim Device w/ Keypad	PED5234-9134-NZD-IN120 BIKPS MB	Corbin Russwin	626
1 Ea.	Closer	DC8210xA4xM54	Corbin Russwin	626
1 Ea.	Threshold	170 A x DW	Pemko	
1 Ea.	Weatherstrip	294 AV opg.	Pemko	
1 Ea.	Door Bottom	315 CN x DW	Pemko	
1 Ea.	Floor Stop	RM851	Rockwood	US26D

Door Hardware Set No. 10 Janitorial				
Door No. 128A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 ½" x 4 ½"	McKinney	US26D
1 Ea.	Classroom Lockset	CLX3355 NZD	Corbin Russwin	626
1 Ea.	Closer	DC8200xM54	Corbin Russwin	626
1 Ea.	Gasketing	S88GR	Pemko	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626

Door Hardware Set No. 11 Changing Room				
Door No. 112A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
1 Ea.	Cont. Geared Hinge	CFM83HD1	Pemko	US26D
1 Ea.	Lead lined Privacy Set	CLX3330 NZDxM28	Corbin Russwin	626
3 Ea.	Silencers	608	Rockwood	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626
1 Ea.	Floor Stop	RM851	Rockwood	US26D

Door Hardware Set No. 12 X-ray Room				
Door No. 114A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
1 Ea.	Cont. Geared Hinge	CFM83HD1	Pemko	US26D
1 Ea.	Lead lined Passage Set	CLX3310 NZDxM28	Corbin Russwin	626
3 Ea.	Silencers	608	Rockwood	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626
1 Ea.	Floor Stop	RM851	Rockwood	US26D

Door Hardware Set No. 13 Lab				
Door No. 115A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Passage Set	CLX3310 NZD	Corbin Russwin	626
3 Ea.	Silencers	608	Rockwood	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626

Door Hardware Set No. 14 Keypad Access Control				
Door No. 137A, 138A, 147A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Keypad Lock Set	CLX33134 NZD IN120 BIKPS	Corbin Russwin	626
1 Ea.	Closer	DC8200xM54	Corbin Russwin	626
1 Ea.	Silencers	608	Rockwood	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626

Door Hardware Set No. 15 Testing				
Door No. 121A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4B3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Office Set	CLX3351 NZD	Corbin Russwin	626
1 Ea.	Closer	DC8200xM54	Corbin Russwin	626
3 Ea.	Silencers	608	Rockwood	Gray

Door Hardware Set No. 16				
Door No. 121B; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4B3786 4 1/2" x 4 1/2" NRP	McKinney	US26D
1 Ea.	Exit Rim Device w/ Keypad	PED5234-9134-NZD-IN120 BIKPS MB	Corbin Russwin	626
1 Ea.	Closer	DC8210xA4xM54	Corbin Russwin	626
Refer to Section 084113 for balance of hardware.				

Door Hardware Set No. 17				
Door No. 126A; each to have the following:				
Qty.	Item	Description	Manufacturer	Finish
3 Ea.	Hinges	T4A3786 4 1/2" x 4 1/2"	McKinney	US26D
1 Ea.	Keypad Lock Set	CLX33134 NZD IN120 BIKPS	Corbin Russwin	626
1 Ea.	Closer	DC8200xM54	Corbin Russwin	626
1 Ea.	Silencers	608	Rockwood	Gray
1 Ea.	Wall Stop	RM861	Rockwood	626
1 Ea.	Auto Door Bottom	434ARL 36"	Pemko	
1 Ea.	Gasketing	S88GR	Pemko	Gray

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Storefront framing.
4. Interior borrowed lites.

- B. Related Sections:

1. Section 084229.23 "Sliding Automatic Entrances."
2. Section 084113 Aluminum-Framed Entrances and Storefronts."
3. Section 084413 "Glazed Aluminum Curtain Wall."

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Accessory Samples: For gaskets and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass and glazing products, from manufacturer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, coated glass, insulating glass, glazing sealants, and glazing gaskets.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Source Limitations for Glass: Obtain all scheduled glass from single source from single manufacturer for each glass type.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having

jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

- G. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
- H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes enhanced-protection testing requirements in ASTM E 1996 for the applicable Wind Zone for the project location when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
 - 1. Large-Missile Test: For glazing located within 30 feet of grade.

2. Small-Missile Test: For glazing located more than 30 feet above grade.
 3. Large-Missile Test: For all glazing, regardless of height above grade.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
- C. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.
1. Tint Color: Blue.

2.3 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 2. Spacer: Aluminum with mill or clear anodic finish.
 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.4 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

- B. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category II materials.

2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 1. Neoprene complying with ASTM C 864.
 2. EPDM complying with ASTM C 864.
 3. Silicone complying with ASTM C 1115.
 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.8 MONOLITHIC-GLASS TYPES

- A. **Glass Type G-1:** Clear float glass or Fully tempered float glass where required by code.

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.

B. **Glass Type G-2:** Tinted float glass or Fully tempered float glass where required by code.

1. Solarblue Tint
2. Thickness: 6.0 mm.
3. Provide safety glazing labeling.

C. **Glass Type G-3:** Lead equivalent glazing for X-Ray Shielding..

1. Refer to Section 134900 "Radiation Protection" for requirements for lead equivalent glazing.

2.9 INSULATING-GLASS TYPES

A. **Glass Type G-4:** Low-e-coated, tinted insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Solarblue Tinted float glass or Fully tempered float glass where required by code.
4. Interspace Content: Air.
5. Indoor Lite: Clear float glass or Fully tempered float glass where required by code.
6. Low-E Coating: Pyrolytic or sputtered on second surface. (Solarban 60)
7. Visible Light Transmittance: 30 percent minimum.
8. U-Factor: 0.25 maximum.
9. Solar Heat Gain Coefficient: 0.25 maximum.
10. Provide safety glazing labeling.

B. **Glass Type G-5:** Low-e-coated, Laminated colored film insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm for outer lite and 8.0 mm for inner lite.
3. Outdoor Lite: Clear fully tempered float glass.
4. Low-E Coating: Pyrolytic sputtered on second surface. (Solarban 60)
5. Interspace Content: Air.
6. Indoor Lite: Clear laminated glazing with custom translucent blue film to match Architect's Sample. FGDglass.com 1/8" seamed tempered over 1/8" seamed tempered "Sky Blue" interlayer with clear EVA
7. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
- 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

- B. Related Requirements:

- 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For "Equivalent Gauge" steel studs and runners, from ICC-ES.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATION

- A. **For each of the Products listed below, each must come from a single approved manufacturer. Mixing of different manufacturer's similar products on the project is not acceptable.**

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

- C. Horizontal Deflection:
1. Walls surrounding stairs, elevator hoistways, or other shafts connecting floors, limited to L/240 based on horizontal loading of 10 lbf/sq. ft.
 2. Walls enclosing any interior spaces that are subject to exterior wind conditions such as lobbies, vestibules, loading docks, etc., limited to L/240 based on horizontal loading of 15 lbf/sq. ft.
 3. Walls scheduled to receive tile finishes, limited to L/360 based on horizontal loading of 5 lbf/sq. ft.
 4. Typical interior wall assemblies (not listed above), limited to L/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.
 5. Interior ceilings, soffits, or furrdowns, limited to L/360 based on horizontal loading of 5 lbf/sq. ft.

2.3 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or “equivalent gauge” steel studs and runners.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.0312 inch (30 mil) / 20 ga./ 33ksi
 - b. Flange Size: 1 1/4 inch
 - c. Depth: As indicated on Drawings
 2. “Equivalent Gauge” Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.0312 inch (30 mil)/ 33ksi
 - b. Flange Size: 1 1/4 inch
 - c. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs fit into pre-slotted slip track and secured per manufacturer’s written recommendations.
- D. Firestop Tracks: Where Fire-resistive rated walls are indicated on the Drawings or otherwise required.
1. Top runner manufactured to allow heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch.
2. Depth: As indicated on Drawings.

G. Radius Framing: Where curved walls are indicated on the Drawings.

1. Steel sheet runner for non-load bearing curves, bends, variable radii and arches using a work-hardened steel base strip.

2.4 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete where applicable:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 9ga/ 0.0114 inch dia.
- D. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
 2. Install additional hangers as may be indicated in the drawings or for ceiling grid attachments that may require additional support.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail. Install with a minimum of three tight turns within a 1 ½" length.
 4. Do not attach hangers to steel roof deck.
 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Interior gypsum board.
- 2. Tile backing panels.
- 3. Texture finishes.

- B. Related Requirements:

- 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
- 2. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
- 3. Section 093000 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
- 2. Textured Finishes: 12"x12" minimum for each textured finish indicated and on same backing indicated for Work.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATION

- A. **For each of the Products listed below, each must come from a single approved manufacturer. Mixing of different manufacturer's similar products on the project is not acceptable.**

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Low Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- B. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
 - 1. Core: 5/8 inch, Type X.
 - 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 - 1. Thickness: 5/8 inch.
 - 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Expansion (control) joint.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

2.9 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Non-Aggregate Finish: Pre-mixed, vinyl texture finish for spray application.
 - 1. Texture: Light Orange Peel unless noted otherwise or if matching existing adjacent finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- A. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, **including floor slabs**. Provide **1/8- to 1/4-inch-** wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
 - B. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
 - C. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
 - D. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - E. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 1. Type X: Vertical surfaces unless otherwise indicated.
 2. Moisture- and Mold-Resistant Type: **All areas subject to moisture that are scheduled to have a painted finish including, but not limited to, all toilet room walls, all kitchen area walls, on all walls on which a sink or water fountain is located (within six feet either side of the fixture).**
- B. Single-Layer Application:
 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws .

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and **install at locations indicated to receive tile other than at showers and tubs where required to be cementitious backer units**. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, **at showers, tubs, and where indicated**.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile or for acoustical tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved sample and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Wall and Floor Tiles.
2. Thresholds.
3. Crack isolation membrane.

- B. Related Sections:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for cementitious backer units and glass-mat, water-resistant backer board.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 1. Level Surfaces: Minimum 0.5.
 2. Step Treads: Minimum 0.6.
 3. Ramp Surfaces: Minimum 0.8.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
 - 4. Stone thresholds in 6-inch lengths.
 - 5. Metal edge strips in 6-inch lengths.

1.6 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type from one source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Thresholds.
 - 2. Membranes.
 - 3. Joint sealants.
 - 4. Cementitious backer units.
- D. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 1. Where tile is indicated for installation in swimming pools on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

- E. **Factory-Applied Temporary Protective Coating:** Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

- A. **Products: Refer to Finish and Materials Schedule in Section 099999 for selections. No substitutes.**

2.3 THRESHOLDS

- A. **General:** Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. **Metal Thresholds:** Provided materials in finishes as scheduled or matching the finish of other adjacent trim/hardware.
 - 1. **Transitions:** Provided in profiles appropriate to adjacent material types and finishes.

2.4 CRACK ISOLATION MEMBRANE

- A. **General:** Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. **Fabric-Reinforced, Fluid-Applied Membrane:** System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

2.5 SETTING MATERIALS

- A. **Latex-Portland Cement Mortar (Thin Set):** ANSI A118.4.
 - 1. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.6 GROUT MATERIALS

- A. **Polymer modified Cement Grout:** ANSI A118.7
 - 1. For grout joints from 1/16" – 1/8" use unsanded grout
 - 2. For grout joints from 1/8" – 1/2" use sanded grout
- B. **100% Solid Epoxy Grout:** ANSI 118.3.

1. Use Epoxy Grout for all floor tiles, unless noted otherwise, and at walls and floors in showers stalls and tubs.
2. Compressive Strength: 5,000 psi min.
3. Tensile Strength: 1,500 psi min.
4. Thermal Shock Resistance: 800 psi min.

2.7 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 079200 "Joint Sealants."
 1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
- E. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile swimming pool decks.
 - d. Tile floors in laundries.
 - e. Tile floors composed of tiles 8 by 8 inches or larger.
 - f. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths. For other installations not listed, install in accordance with Manufacturer's recommended joint width.
1. Ceramic Mosaic Tile: 1/16 inch.
 2. Quarry Tile: 1/4 inch.
 3. Paver Tile: 1/4 inch.
 4. Glazed Wall Tile: 1/8 inch.
 5. Decorative Thin Wall Tile: 1/16 inch.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

- I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.5 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.9 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. **Acoustical Ceiling Tiles: Furnish full-size, unused materials equal to 5% of amount installed. The materials are to be delivered to location as directed by Owner and the Contractor is to provide written documentation evidencing the amount of material required for the project and the amount of product delivered as extra material.**

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.

- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

- A. Manufacturers: **Unless a substitution is otherwise permitted, with written approval from the Architect obtained prior to bidding, provide the manufacturer and product named in the Finish Schedule.**
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type III, mineral base with painted finish.
- C. Colors and Patterns: **Refer to Finish and Materials Schedule in Section 099999 for selections.**
- D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
 - 1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

- a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.
- D. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.5 METAL SUSPENSION SYSTEM

- A. Manufacturers: **Subject to compliance with requirements, provide suspension systems by the same manufacturer as the acoustic panels.**
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
 2. End Condition of Cross Runners: Override (stepped) type.
 3. Face Design: Flat, flush.
 4. Cap Material: Steel cold-rolled sheet.
 5. Cap Finish: Painted white unless otherwise scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 11. **Do not splice hanger wires. System is to be supported by only individually continuous wires.**
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to long axis of space.
 - c. Install panels in a basket-weave pattern.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 - 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 6. Install hold-down clips in areas indicated, **within 20 feet of any exterior doorways**, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
- G. **For any ceiling tiles that are to have devices installed in/on/through the tile, i.e. fire sprinkler heads, speakers, fire alarm strobes, smoke detectors, etc. Install the devices in the center of the full tile nearest the location indicated on the Drawings.**

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. Forty-eight (48) hours before installation.
 - 2. During installation.
 - 3. Forty-eight (48) hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- A. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
- B. Thickness: 0.125 inch.
- C. Height: As scheduled.
- D. Lengths: **Coils in manufacturer's standard length.**
- E. Outside Corners: Job formed or preformed.
- F. Inside Corners: Job formed or preformed.
- G. Colors: **Refer to Finish and Materials Schedule in Section 099999 for selections. No substitutes.**

2.2 RUBBER MOLDING ACCESSORY

- A. Profile and Dimensions: As scheduled.
- B. Colors and Patterns: Refer to Finish and Materials Schedule in Section 099999 for selections. No substitutes.

2.3 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.

- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Tightly adhere to substrates throughout length of each piece.
 - 2. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes vinyl sheet flooring.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples: For each exposed product and for each color and texture specified in manufacturer's standard size, but not less than 6-by-9-inch sections.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- D. Samples for Initial Selection: For each type of resilient sheet flooring indicated.
- E. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of resilient sheet flooring required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- F. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- G. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor covering manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following time periods:
 - 1. Forty-eight (48) hours before installation.
 - 2. During installation.
 - 3. Forty-eight (48) hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic forty-eight (48) hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL SHEET FLOORING

- A. Product Standard: ASTM F 1913.
- B. Sheet Width: As standard with manufacturer.
- C. Seamless-Installation Method: Heat welded.
- D. Colors and Patterns: **Refer to Finish and Materials Schedule in Section 099999 for selections.** No substitutes.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: Match flooring unless scheduled otherwise.
 - 2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
 - a. Bonding compound shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Integral-Flash-Cove-Base Accessories:
 - 1. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
 - 2. Cap Strip: Square metal cap provided or approved by resilient sheet flooring manufacturer.
- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer or listed in this Section.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.
 - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
 - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
- J. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches up vertical surfaces unless noted otherwise. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.
 - 1. Apply five coats.
- E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl floor tile.
 - 2. Vinyl composition floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- D. Product Schedule: For floor tile. Use same designations indicated on Drawings.
- E. **Moisture Test: Submit report of results of moisture test to the architect 24 hours prior to installation.**

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. Forty-eight (48) hours before installation.
 - 2. During installation.
 - 3. Forty-eight (48) hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL FLOOR TILE

- A. Products: Refer to Finish and Materials Schedule in Section 099999 for selections. No substitutes.

2.3 VINYL COMPOSITION FLOOR TILE

- A. Products: Refer to Finish and Materials Schedule in Section 099999 for selections. No substitutes.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
 - c. **Perform alkalinity test according to ASTM 710 as recommended/required by the manufacturer.**
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis unless indicated otherwise.

- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern) unless indicated otherwise.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply five coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Thin-set, epoxy-resin terrazzo flooring.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for sealants installed with terrazzo.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to terrazzo including, but not limited to, the following:
 - a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Review special terrazzo designs and patterns.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:
 - 1. Divider strips.
 - 2. Accessory strips.
 - 3. Precast terrazzo jointing and edge configurations.
 - 4. Terrazzo patterns.
- C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- D. Samples for Initial Selection: NTMA's "Terrazzo Color Palette" showing the full range of colors and patterns available for each terrazzo type.
- E. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:
 - 1. Terrazzo: 6-inch- square Samples.
 - 2. Accessories: 6-inch- long Samples of each exposed strip item required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Material Certificates: For each type of terrazzo material or product.
- C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Engage an installer who is a contractor member of NTMA.
 - 2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for terrazzo including accessories.
 - a. Size: Minimum 100 sq. ft. of typical poured-in-place flooring condition for each color and pattern in locations as decided with Architect.
 - b. Include accessories and trim items.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
- C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
- E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
- B. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3 EPOXY-RESIN TERRAZZO

- A. Epoxy-Resin Terrazzo: Comply with manufacturer's written instructions for matrix and aggregate proportions and mixing.
- B. Mix Color and Pattern: Match Architect's sample
 - 1. **Refer to Materials and Finish Schedule Section 099999 for more information. Provide all colors/blends as scheduled.**
- C. Materials:
 - 1. Primer: Manufacturer's product recommended for substrate and use indicated.
 - 2. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - a. Physical Properties without Aggregates:
 - 1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
 - 2) Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
 - 3) Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
 - 4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
 - a) Distilled water.
 - b) Mineral water.
 - c) Isopropanol.
 - d) Ethanol.
 - e) 0.025 percent detergent solution.
 - f) 1.0 percent soap solution.
 - g) 5 percent acetic acid.
 - h) 10 percent sodium hydroxide.
 - i) 10 percent hydrochloric acid.
 - j) 30 percent sulfuric acid.
 - b. Physical Properties with Aggregates: For terrazzo blended according to manufacturer's recommendations with one part epoxy resin with three parts marble aggregate consisting of 60 percent No. 1 chips and 40 percent No. 0 chips that is ground and grouted to a 1/4-inch nominal thickness, and cured for seven (7) days at 75 deg F plus or minus 2 deg F and at 50 percent plus or minus 2 percent relative humidity.
 - 1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch according to ASTM D 635.

- 2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F according to ASTM C 531.
3. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
 - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131/C 131M.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
4. Finishing Grout: Resin based.

2.4 STRIP MATERIALS

- A. Thin-Set Divider Strips: L-type angle in depth required for topping thickness indicated.
 1. Material: White-zinc alloy.
 2. Top Width: 1/8 inch.

2.5 MISCELLANEOUS ACCESSORIES

- A. Moisture Mitigation: Two-component, high solids, moisture tolerant, high density, low odor, epoxy-based product produced by epoxy terrazzo resin manufacturer specifically recommended to reduce alkalinity levels and moisture emission to acceptable levels.
- B. Crack Suppression/Isolation Membrane: As recommended, produced and supplied by approved terrazzo resin formulator, having minimum 120 percent elongation potential per ASTM D 412.
- C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- D. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; and is recommended by sealer manufacturer.
 1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
 2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
- B. Concrete Slabs:
 1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written instructions.

- c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
- D. Preinstallation Moisture Testing:
 1. Testing Agency: Engage a qualified testing agency to perform tests.
 2. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Moisture-Vapor-Emission Test: Maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours when tested according to ASTM F 1869 using anhydrous calcium chloride.
- E. Regardless of moisture testing results, Terrazzo Contractor shall provide moisture mitigation materials according to instructions and recommendations of moisture mitigation materials manufacturer.
- F. Terrazzo Contractor shall provide flexible epoxy crack isolation/suppression membrane.
- G. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.
 1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

- A. Comply with NTMA's written recommendations for terrazzo and accessory installation.
- B. Strip Materials:
 1. Divider and Control-Joint Strips:
 - a. Locate divider strips in locations indicated and at one edge of filled concrete control joints below.
 - b. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 2. Accessory Strips: Install as required to provide a complete installation and/or in locations indicated. **Install metal transition strips/reducers to adjacent materials of different thicknesses.**
- C. Apply primer to terrazzo substrates according to manufacturer's written instructions.
- D. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions.
 1. Installed Thickness: 3/8 inch nominal.
 2. Terrazzo Finishing: Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
 - a. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond abrasives. Follow initial grind with 60/80-grit stones or with comparable diamond abrasives.
 - b. Grouting: Before grouting, clean terrazzo with water, rinse, and allow to dry. Apply and cure epoxy grout.
 - c. Fine Grinding/Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Grind with 120-grit stones or with comparable diamond abrasives until grout is removed from surface.
 3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.

- E. Install and finish poured-in-place terrazzo stairs at the same time the adjacent terrazzo flooring is installed.
- F. Install and finish poured-in-place terrazzo base at the same time the adjacent terrazzo flooring is installed.

3.4 REPAIR

- A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.5 CLEANING AND PROTECTION

- A. Cleaning:
 - 1. Remove grinding dust from installation and adjacent areas.
- B. Sealing:
 - 1. Seal surfaces according to NTMA's written recommendations.
 - 2. Apply sealer according to sealer manufacturer's written instructions.
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 096623

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes modular carpet tile.
- B. Related Requirements:
 - 1. Section 024119 "Selective Demolition" for removing existing floor coverings.
 - 2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. **Materials are to be delivered to location as directed by the Owner. The Contractor is to provide written documentation evidencing the amount of material required for the project and the amount of product delivered as extra material.**
 - 1. Carpet Tile: Full-size units equal to 6 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.7 QUALITY ASSURANCE

- A. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. **Products: Refer to Finish and Materials Schedule in Section 099999 for selections. No substitutes.**

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
- C. Transition Strips: Unless otherwise scheduled or indicated on the Drawings, provide resilient material transition strip of profile and width required, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097720 – DECORATIVE FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
 - 1. PVC trim.
- B. Products Not Furnished or Installed under This Section:
 - 1. Gypsum substrate board.
 - 2. Resilient Base.

1.2 RELATED SECTIONS

- A. Section 092900 “Gypsum Board” for substrate board.
- B. Section 092216 “Non-Structural Metal Framing”.
- C. Section 099123 “Interior Painting”.
- D. Section 096513 “Resilient Base and Accessories”.

1.3 REFERENCES

- A. American Society for Testing and Materials: Standard Specifications (ASTM)
 - 1. ASTM D 256 - Izod Impact Strengths (ft #/in)
 - 2. ASTM D 570 - Water Absorption (%)
 - 3. ASTM D 638 - Tensile Strengths (psi) & Tensile Modulus (psi)
 - 4. ASTM D 790 - Flexural Strengths (psi) & Flexural Modulus (psi)
 - 5. ASTM D 2583- Barcol Hardness
 - 6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
 - 7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

- A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.
- C. Selection Samples: Submit manufacturer’s standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

- D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
 - 1. Submit complete with specified applied finish.
 - 2. For selected patterns show complete pattern repeat.
 - 3. Exposed Molding and Trim: Provide samples of each type, finish, and color.
- E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.5 QUALITY ASSURANCE

- A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
 - 1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
 - a. Wall Required Rating – Class A.
- B. Sanitary Standards: System components and finishes to comply with:
 - 1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.
 - 2. Food and Drug Administration (FDA) 1999 Food Code 6-101.11.
 - 3. Canadian Food Inspection Agency (CFIA) requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials factory packaged on strong pallets.
- B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (range of 60 to 75°F) for 48 hours prior to installation.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
 - 1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.8 WARRANTY

- A. Furnish one year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. **Refer to Finish and Materials Schedule in Section 099999.**

2.2 PANELS

- A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
 2. Dimensions:
 - a. Thickness – 0.090 “ nominal
 - b. Width - 4'-0” nominal
 - c. **Length –8'-0” when scheduled for or indicated at areas up to 96 inches in height and 10'-0” when scheduled or indicated in areas above 96 inches in height.**
 3. Tolerance:
 - a. Length and Width: +/-1/8 “
 - b. Square - Not to exceed 1/8 “ for 8 foot panels or 5/32 “ for 10 foot panels
- B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
1. Flexural Strength - 1.0×10^4 psi per ASTM D 790.
 2. Flexural Modulus - 3.1×10^5 psi per ASTM D 790.
 3. Tensile Strength - 7.0×10^3 psi per ASTM D 638.
 4. Tensile Modulus - 1.6×10^5 psi per ASTM D 638.
 5. Water Absorption - 0.72% per ASTM D 570.
 6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
 7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256
- C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.
- D. Front Finish:
- a. Color: **Refer to Finish and Materials Schedule in Section 099999.**
 - b. Surface: **Refer to Finish and Materials Schedule in Section 099999.**
 - c. Fire Rating Class A (I) Fire Rating.

2.3 MOLDINGS

- A. PVC Trim: Thin-wall semi-rigid extruded PVC.
1. Inside Corner, **in length to match panels**
 2. Outside Corner, **in length to match panels**
 3. Division, **in length to match panels**
 4. Edge, **in length to match panels**
 5. 135° Inside Corner **in length to match panels**
 6. 135° Outside Corner **in length to match panels**
 7. Color: **To Match Panels or selected from standard when color cannot be matched.**
- B. Outside Corner Guard:
1. PVC Outside Corner Guard
 - a. Color: **To Match Panels or selected from standard when color cannot be matched.**

2.4 ACCESSORIES

- A. Fasteners: Non-staining nylon drive rivets.
1. Match panel colors.
 2. Length to suit project conditions.

- B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
 - 1. FRP Adhesive - Water- resistant, non-flammable adhesive.
 - 2. Construction Adhesive - Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
 - 3. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.
- C. Sealant:
 - 1. Clear Silicone Sealant.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
 - 1. Verify that stud spacing does not exceed 24" on-center.
- B. Repair defects prior to installation.
 - 1. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.

3.2 INSTALLATION

- A. Comply with manufacturer's recommended procedures and installation sequence.
- B. Cut sheets to meet supports allowing 1/8" clearance for every 8 foot of panel.
 - 1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
 - 2. Pre-drill fastener holes 1/8" oversize with high speed drill bit.
 - a. Space at 8" maximum on center at perimeter, approximately 1" from panel edge.
 - b. Space at in field in rows 16" on center, with fasteners spaced at 12" maximum on center.
- C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
 - 1. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
 - b. Drive fasteners for snug fit. Do not over-tighten.
- D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
 - 1. All moldings must provide for a minimum 1/8 " of panel expansion at joints and edges, to insure proper installation.
 - 2. **Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.**

3.3 CLEANING

- A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

- B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION 097720

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
 - 2. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.

1.3 DEFINITIONS

- A. Gloss Level 1 (matte): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3 (eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4 (satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5 (semi-gloss): 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6 (gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7 (high gloss): More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

- D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: **Refer to Drawings and Finish and Materials Schedule in Section 099999.**

2.2 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.3 PRIMERS/SEALERS

- A. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

2.4 METAL PRIMERS

- A. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

2.5 WOOD PRIMERS

- A. Primer, Alkyd for Exterior Wood: MPI #5.

2.6 WATER-BASED PAINTS

- A. Latex, Exterior Flat (Gloss Level 1): MPI #10.
- B. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.
- C. Latex, Exterior, Gloss (Gloss Level 6): MPI #119.

2.7 SOLVENT-BASED PAINTS

- A. Alkyd, Exterior Flat (Gloss Level 1): MPI #8.
- B. Alkyd, Exterior, Semi-Gloss (Gloss Level 5): MPI #94.
- C. Alkyd, Exterior Gloss (Gloss Level 6): MPI #9.

2.8 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Masonry (Clay and CMU): 12 percent.
 - 2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards.
 - b. Uninsulated piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
 - 1. Alkyd System:
 - a. Prime Coat: Primer, alkyd, anticorrosive for metal, MPI #79.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - d. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.
- B. Galvanized-Metal Substrates:
 - 1. Alkyd System:
 - a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.
- C. Wood Substrates: Including wood trim.
 - 1. Alkyd System:
 - a. Prime Coat: Primer, alkyd for exterior wood, MPI #5.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 2. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 DEFINITIONS

- A. Gloss Level 3 (eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 5 (semi-gloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Colors: **Refer to Finish and Materials Schedule in Section 099999.**

2.2 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.3 PRIMERS/SEALERS

- A. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.
- B. Primer Sealer, Alkyd, Interior: MPI #45.

- C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.4 METAL PRIMERS

- A. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79.
- B. Primer, Alkyd, Quick Dry, for Metal: MPI #76.
- C. Primer, Galvanized, Water Based: MPI #134.

2.5 WATER-BASED PAINTS

- A. **Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 3): MPI #145.**
- B. **Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5): MPI #147.**

2.6 SOLVENT-BASED PAINTS

- A. Alkyd, Interior, Semi-Gloss (Gloss Level 5): MPI #47.

2.7 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.

5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

- a. Equipment, including panelboards.
- b. Uninsulated metal piping.
- c. Pipe hangers and supports.
- d. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

- a. Uninsulated metal piping.
- b. Pipe hangers and supports.
- c. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
- d. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. [Steel Substrates:
 - 1. Alkyd System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79 or primer, alkyd, quick dry, for metal, MPI #76.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, semi-gloss (Gloss Level 5), MPI #47.
- B. Galvanized-Metal Substrates:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.
- C. Wood Substrates: Including wood-based panel products.
 - 1. Alkyd System:
 - a. Prime Coat: Primer sealer, alkyd, interior, MPI #45.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, (Gloss Level 3), MPI #51.

D. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.

END OF SECTION 099123

SECTION 099999 – MATERIAL AND FINISH SCHEDULES

PART 1 - GENERAL

1.1 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.2 GENERAL

- A. This section covers the interior products, finishes and materials that are exposed to view in the finished construction. The specified manufacturer is based on performance standards and aesthetic qualities of products. All products are specified for appropriateness of application related to project criteria, as well as, structural integrity. The word “color” as used herein includes surface color, pattern and texture. Requirements for additional quality standards and method of installation are covered in other appropriate sections of the specifications. When required for clarification, specific material locations are shown on the drawings. Finish items not designated in this section may be specified in other sections. When material or color is not designated for an item, the contractor shall provide manufacturer’s standard color charts for selection and approval.

PART 2 - PRODUCTS

2.1 REFERENCE TO MANUFACTURER’S MATERIALS AND COLORS

- A. Where material is shown as being specific to one manufacturer, an equivalent by another manufacturer that meets or exceeds the performance and aesthetic specifications may be submitted for review and approval. Manufacturers and materials specified are not intended to limit the selection of equal materials and products from other manufacturers. It is the responsibility of the subcontractor to provide all pertinent manufacturers’ information proving the substituted material meets or exceeds the specified material.

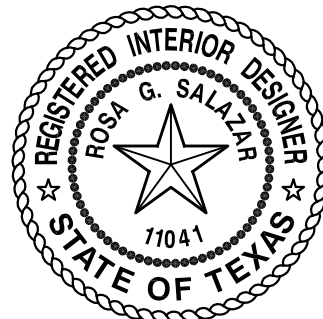
2.2 MATERIAL AND FINISH SCHEDULES

- A. See attached Material and Finish Schedules as developed by Condray Design Group. All finish materials are to be as scheduled. No substitutions allowed without prior approval.

PART 3 - EXECUTION

(NOT APPLICABLE)

END OF SECTION



		MATERIAL SCHEDULE	ORIGINAL ISSUE
Material	Code	Manufacturer's Description	
Wall Finishes			
Paint	P1	PPG, 1007-1 Willow Springs (ceiling & light field color)	
	P2	PPG, 1008-2 Storm's Coming (field color)	
	P3	PPG, 1025-4 Sharkskin (neutral accent color)	
	P4	PPG, 1040-3 Ocean Drive (light blue accent)	
	P5	PPG, 1166-7 Daring Indigo (dark blue accent)	
	P6	PPG, 1008-6 Artillery (dark neutral accent & door frame and trim color, unless noted otherwise)	
Wall Base	WB1	Johnsonite/Tarkett, Traditional wall base, 179 Steel, 4"H, continuous coiled lengths	
	WB2	Johnsonite/Tarkett, Millwork wall base, MW-179-F6 Reveal Profile, 179 Steel, 6"H, continuous lengths	
Wall Tile	WT1	Daltile, Fabrique, P686 Crème Linen, 12"x24"x3/8", straight grid horizontal install (1/8" grout)	
Decorative Tile	DT1	American Olean, Color Appeal, 5/8x random mosaic, C140 Mountain Morning Blend, 12-3/4"x11-3/4"x5/8" sheet cut into 6" strips	
	DT2	Surface Resources, Interstyle, custom glass mosaic, 1/2"x6", random staggered assembly, face-mounted on 12"x12" sheet, vertical gradient effect with colors in the following order from top to bottom, Moroccan Blue, Faraway Fez, Casablanca, Mykonos, Hint of Blue, Jasmine. Glossy finish and no texture. Vertical installation (to be used behind water fountains)	
Wall Protection	WP1	Koroseal, Korogard Traffic Patterns, Interloom, Fawn NM21-08, 0.06" thickness, install with trims along perimeter edges only, gap at seams to be sealed with color-matched caulk to allow for movement. (trim color to be InPro, Pebble Gray #0387)	
Decorative Wall Material	DWM1	Longboard Architectural Products, Link & Lock Batten System, Single Rail, Woodgrain finish Rock Elm 15REM (vertical installation)	
Decorative Glass Panel	DGP1	Forms & Surfaces, Visispectra VEKTR Glass (double sided view), 3mm/3mm, standard finish (graphic image TBD), to be installed in framed system	
Fiber Reinforced Panel	FRP1	Marlite, Standard FRP, Pebbled Surface, 145 Silver, 3/32" thickness x 10'H (include trim pieces for a complete installation)	
Trim Cap	TC1	InPro, Palladium, Notched Trim Cap, notched top cap for .06" thickness, 2"H profile, color Pebble Gray #0387 (to be installed where WP1 is used, unless noted otherwise)	

	MATERIAL SCHEDULE		ORIGINAL ISSUE
Material	Code	Manufacturer's Description	
Corner Guard	CG1	InPro, adhesive mounted Stainless Steel Corner Guard, 2" wings, 4' high (stop corner guard at bottom of trim cap where applicable)	
Flooring Finishes			
Carpet	CPT1	Mohawk Group, Learn and Live Plank, Sabbatical GT 433, Elective 558, 12"x36", ashlar installation	
Walk-Off Tile	WOT1	Tandus/Tarkett, Assertive Stria, 26213 Forge, 24"x24", ashlar installation	
Terrazzo Flooring	TF1	Epoxy-Resin System, 3/8" thickness, white epoxy background (equal to PPG1007-1 Willow Springs), 70% North American Mina White / Blanco Mexicano marble chips (Size 1 & 2), 20% Crystal Clear glass chips (Size 1 & 2), 10% Modern / Fresh Water Mother of Pearl chips (Size 1 & 2) (White)	
	TF2	Epoxy-Resin System, 3/8" thickness, white epoxy background (equal to PPG1007-1 Willow Springs), 60% North American Tan / Pepper Harvest marble chips (Size 1 & 2), 20% North American Mina White / Blanco Mexicano marble chips (Size 1 & 2), 10% Modern / Fresh Water Mother of Pearl chips (Size 1 & 2) (Tan)	
	TF3	Epoxy-Resin System, 3/8" thickness, white epoxy background (equal to PPG1007-1 Willow Springs), 50% Cobalt / Midnight Blue recycled glass chips (Size 1 & 2), 30% North American Mina White / Blanco Mexicano marble chips (Size 1 & 2), 10% Crystal Clear recycled glass chips (Size 1 & 2), 10% Modern / Fresh Water Mother of Pearl chips (Size 1 & 2) (Blue & White)	
	TF4	Epoxy-Resin System, 3/8" thickness, blue epoxy background (equal to Sherwin Williams, SW6966 Blueblood), 70% Cobalt / Midnight Blue recycled glass chips (Size 1 & 2), 20% Crystal Clear recycled glass chips (Size 1 & 2), 10% Modern / Freshwater Mother of Pearl chips (Size 1 & 2) (Blue)	
Luxury Vinyl Tile	LVT1	Armstrong, Duo, Spettro, Caspian Sand, ST931, 18"x36", ashlar installation (textile look)	
	LVT2	Armstrong, Biome, Montane Kilimanjaro, ST525, 6"x48" (wood look)	
	LVT3	Armstrong, Coalesce, Oxidize Tin, ST881, 18"x36" (stone look)	
	LVT4	Armstrong, Duo, Mixer 2, Blue Hawaiian, ST523, 6"x36" (blue accent)	
	LVT5	Mannington, Bond, Crystal, 12"x12" (straight-lay; no quarter turn)	
Sheet Vinyl	SV1	Mannington, Paradigm II Collection, Intersect, Foundation PD111 (neutral accent) (weld rod color to be Foundation 842480)	
	SV2	Mannington, Paradigm II Collection, Flow, Foundation PD311 (linear neutral accent) (weld rod color to be Foundation 842480)	

		MATERIAL SCHEDULE	ORIGINAL ISSUE
Material	Code	Manufacturer's Description	
	SV3	Mannington, Realities III, Maple Grove, Pine 5627R (field color) (weld rod color to be Woodstown 842501)	
Floor Tile	FT1	Marazzi, Creativo, Ivory Square CV40, 12"x12"x3/8", diagonal install (1/8" grout)	
Traffic Coating System	TCS1	Sika, Sikalastic - 710/715/735 AL system installed for Heavy Vehicular Traffic - Seed and Backroll, color Gray. Refer to Project Manual for specification details	
Epoxy Paint Coating	EPC1	Sherwin Williams, Armorseal, 33WB Epoxy Primer Sealer with 1000 HS Epoxy coating, color Haze Gray with anti-slip aggregate	
Ceiling Finishes			
Acoustical Ceiling Panel	ACP1	Armstrong, Dune #1772, Square Lay-in ceiling panels, 24"x24"x5/8"	
	ACP2	Armstrong, Ultima #1910, Square Lay-in ceiling panels, 24"x24"x5/8" (Include #1910 Center-Cut tiles to be coordinated with lighting schedule)	
Decorative Ceiling Material	DCM1	Longboard Architectural Products, Dauntless Ceiling System, Single Rail, Woodgrain finish Rock Elm 15REM	
Gypsum Ceiling	GYP	Gypsum board to be painted P1 unless noted otherwise (epoxy paint as required). Refer to typical construction specifications in the project manual	
Door and Millwork Finishes			
Plastic Laminate	PL1	Wilsonart, Palisades Oak 7987-38, Fine Velvet finish (typical vertical millwork & door finish, unless noted otherwise)	
Solid Surface Material	SSM1	Wilsonart, Beige Travertine, 9236SS (horizontal millwork and windowsills)	
	SSM2	Wilsonart, Beachfront, 9233SS (millwork accent as scheduled)	
Quartz Surface Material	QSM1	Cambria, Luxury Series, Portrush (transaction counters and worksurfaces as scheduled)	
Miscellaneous Finishes			
Grout	G1	Custom Building Products, #386 Oyster Gray (use with FT1) (use epoxy grout on floors as specified)	
	G2	Custom Building Products, #545 Bleached Wood (use with WT1, DT1)	
	G3	Custom Building Products, #381 Bright White (use with DT2)	
Metal Trim	MT1	Schluter, Quadec, AT Anodized Aluminum Nickel Finish, install along exposed edges and outside corners (include corner and connector pieces for a complete installation)	
	MT2	Schluter, Reno-U, AT Anodized Aluminum Nickel finish, install at transitions from tile to lower material	

	MATERIAL SCHEDULE		ORIGINAL ISSUE
Material	Code	Manufacturer's Description	
Transition Strip	TS1	Johnsonite, Slim Line Transition, 179 Steel SLT-179-A (LVT transition to CPT)	
Privacy Curtain	PC1	CS Construction Specialties, Disposable Privacy curtain, pattern to be Beachgrass, Stormy Weather, 20"H continuous mesh top, disposable curtain panel with overlap snap closure system, bottom of curtain at 12" AFF	
Roller Shade	RS1	Equal to Draper, manual shade, square fascia, Mermet S Screen Origins light-filtering fabric, 4% percent openness, color Granite	
	RS2	Equal to Draper, Motorized FlexShade with Intelliflex Control System, square fascia, Mermet S Screen Origins light-filtering fabric, 4% percent openness, color Granite	
Metal Lockers	ML1	Republic Storage, metal lockers, 69 Monorail Gray (refer to project manual for more information)	

		FINISH SCHEDULE							ORIGINAL ISSUE
		Walls							
Room	Description	Floor	Base	Ceiling	North	East	South	West	Remarks
First Floor									
C02101	Vestibule	WOT1	WB2	DCM1	P5 DWM1	P1	P1	P1	<p>CEILING: DCM1 to be installed as ceiling material as scheduled. Refer to Project Manual for more information.</p> <p>WALLS: DWM1 to be installed as a wall finish from floor to ceiling. Paint wall P5 behind DWM1. Refer to ID sheets for wall finish locations.</p> <p>FLOORS: WOT1 to be installed ashlar in north/south direction.</p>
C02102	Waiting	TF1 TF2 TF3 TF4	WB2	ACP1	P1 TC1 WP1	P1 TC1 WP1	P1	P1 TC1 WP1 GPS1	<p>WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. Glass panel system GPS1 to be installed from top of partial wall to ceiling. Refer to ID sheets for wall finish locations.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02103	Public Toilet	TF1	-	ACP1	P1 DT1 WT1	P1 DT1 WT1	P1 DT1 WT1	P1 DT1 WT1	<p>WALLS: Install WT1 from top of terrazzo floor to approximately 78" AFF with DT1 as 6" decorative band at 60" AFF. Paint above tile. All outside corners and exposed edges of tile to be trimmed with MT1. Include corner and connector pieces.</p>
C02104	Public Toilet	TF1	-	ACP1	P1 DT1 WT1	P1 DT1 WT1	P1 DT1 WT1	P1 DT1 WT1	<p>WALLS: Install WT1 from top of terrazzo floor to approximately 78" AFF with DT1 as 6" decorative band at 60" AFF. Paint above tile. All outside corners and exposed edges of tile to be trimmed with MT1. Include corner and connector pieces.</p>

		FINISH SCHEDULE							ORIGINAL ISSUE
Room	Description	Floor	Base	Ceiling	Walls				Remarks
					North	East	South	West	
C02105	Corridor	TF1 TF4	WB2	ACP1	P1 TC1 WP1	P1 TC1 WP1	P1 TC1 WP1	DT2	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. DT2 to be installed vertically from floor to ceiling behind water fountains. Refer to ID sheets for wall finish locations. FLOORS: Refer to ID sheets for floor pattern.
C02106	Well Waiting	TF1 TF2 TF3	WB2	ACP1	P1 TC1 WP1	P1 TC1 WP1 GPS1	P1 TC1 WP1	P2 TC1 WP1	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. Glass panel system GPS1 to be installed from top of partial wall to ceiling. Refer to ID sheets for wall finish locations. FLOORS: Refer to ID sheets for floor pattern.
C02107	Wheelchair Storage	TF1 TF3 TF4	WB2	ACP1	-	P1	P1 TC1 WP1	P1 TC1 WP1	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. Refer to ID sheets for wall finish locations. FLOORS: Refer to ID sheets for floor pattern.
C02108	Recpt./Reg.	LVT1	WB2	ACP1	P6 TC1 WP1	P1	-	P1 TC1 WP1	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. MILLWORK: PL1 on vertical surfaces. SSM2 on worksurfaces with QSM1 as transaction counter.
C02109	Checkout	LVT1	WB1	ACP1	P2	P6	P2	P2	MILLWORK: PL1 on vertical surfaces. SSM1 on worksurfaces with QSM1 as transaction counter.
C02110	Corridor	LVT1 LVT4	WB1	ACP1	P2	-	P2	-	FLOORS: Refer to ID sheets for floor pattern.
C02111	X-Ray Waiting	LVT2 LVT4	WB1	ACP1	P2 TC1 WP1	P4 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above.
C02112	Changing Room	SV1	WB1	ACP1	P2	P4	P2	P2	MILLWORK: SSM1 to be used as bench seat with PL1 as vertical surfaces.

		FINISH SCHEDULE							ORIGINAL ISSUE
Room	Description	Floor	Base	Ceiling	Walls				Remarks
					North	East	South	West	
C02113	Control	SV1	WB1	ACP1	P2	P2 TC1 WP1	P3 TC1 WP1	P2	<p>WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above.</p> <p>MILLWORK: SSM1 on countertop.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02114	X-Ray	SV1 SV3	WB1	ACP1	P2 TC1 WP1	P2 TC1 WP1	P3 TC1 WP1	P2 TC1 WP1	<p>WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02115	Lab	SV1 SV2	WB1	ACP1	P2	P2 P3 TC1 WP1	P2 P4 TC1 WP1	P2 P3 TC1 WP1	<p>WALLS: Install WP1 with top of trim cap aligned with top of counter at millwork. Paint above. Refer to ID sheets for paint locations.</p> <p>MILLWORK: PL1 on vertical surfaces and SSM1 on countertop.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02116	Lab Toilet	FT1	-	ACP1	P2 DT1 WT1	P2 DT1 WT1	P2 DT1 WT1	P2 DT1 WT1	<p>WALLS: Install WT1 from top of floor tile to approximately 78" AFF with DT1 as 6" decorative band at 60" AFF. Paint above tile. All outside corners and exposed edges of tile to be trimmed with MT1. Include corner and connector pieces.</p> <p>FLOORS: FT1 to be installed in a diagonal pattern before wall tile so that wall tile sits on top of floor tile. Include transition strip.</p>
C02117	Staff Toilet	FT1	-	ACP1	P2 DT1 WT1	P2 DT1 WT1	P2 DT1 WT1	P2 DT1 WT1	<p>WALLS: Install WT1 from top of floor tile to approximately 78" AFF with DT1 as 6" decorative band at 60" AFF. Paint above tile. All outside corners and exposed edges of tile to be trimmed with MT1. Include corner and connector pieces.</p> <p>FLOORS: FT1 to be installed in a diagonal pattern before wall tile so that wall tile sits on top of floor tile. Include transition strip.</p>

		FINISH SCHEDULE							ORIGINAL ISSUE
Room	Description	Floor	Base	Ceiling	Walls				Remarks
					North	East	South	West	
C02118	Storage	LVT5	WB1	ACP1	P2	P2	P2	P2	FLOORS: Install straight-lay. Do not quarter turn.
C02119	Break Room	LVT1 LVT2 LVT3 LVT4	WB1	ACP1	P4	P2	P4	P2	MILLWORK: PL1 on vertical surfaces and SSM1 on countertop.
C02120	Corridor	LVT1	WB1	ACP1	P2	P2	P2	P2	
C02121	Testing	SV1	WB1	ACP1	P2	P3	P2	P2	MILLWORK: PL1 on vertical surfaces and SSM1 on countertop.
C02122	Drive-Through	TCS1	WB1	-	P2	P2	P2	P2	WALLS: Walls to be painted with epoxy paint as specified. Refer to Project Manual for more information. FLOORS: Refer to Project Manual for more information.
C02123	Storage	TCS1	WB1	ACP1	P2	P2	P2	P2	WALLS: Walls to be painted with epoxy paint as specified. Refer to Project Manual for more information. FLOORS: Refer to Project Manual for more information.
C02124	Drive-Through Toilet	FT1	-	ACP1	P2 DT1 WT1	P2 DT1 WT1	P2 DT1 WT1	P2 DT1 WT1	WALLS: Install WT1 from top of floor tile to approximately 78" AFF with DT1 as 6" decorative band at 60" AFF. Paint above tile. All outside corners and exposed edges of tile to be trimmed with MT1. Include corner and connector pieces. FLOORS: FT1 to be installed in a diagonal pattern before wall tile so that wall tile sits on top of floor tile. Include transition strip.
C02125	Drive-Through Exam	SV1 SV2	WB1	ACP1	P3 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. MILLWORK: PL1 on vertical surfaces and SSM1 on countertop. FLOORS: Refer to ID sheets for floor pattern.

		FINISH SCHEDULE							ORIGINAL ISSUE
Room	Description	Floor	Base	Ceiling	Walls				Remarks
					North	East	South	West	
C02126	Corridor	TCS1	WB1	ACP1	P2	P2	P2	-	<p>WALLS: Walls to be painted with epoxy paint as specified. Refer to Project Manual for more information.</p> <p>FLOORS: Refer to Project Manual for more information.</p>
C02127	Provider Office	CPT1	WB1	ACP1	P2	P2	P3	P2	
C02128	Janitor	LVT5	WB1	ACP1	FRP1	FRP1	FRP1	FRP1	<p>WALLS: FRP1 to be installed in full sheets from 1/2" below top of wall base to ceiling. Include trim pieces for a complete and sanitary installation. Provide clear sealant between wall base and FRP.</p>
C02129	Biller Office	CPT1	WB1	ACP1	P2	P3	P2	P2	
C02130	Manager	CPT1	WB1	ACP1	P2	P3	P2	P2	
C02131	Intake	SV2 SV4	WB1	ACP1	P2	P2 TC1 WP1	P2 TC1 WP1	P4 TC1 WP1	<p>WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above.</p> <p>MILLWORK: PL1 on vertical surfaces and SSM1 on countertop.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02132	Exam 1	SV1 SV2	WB1	ACP1	P2 TC1 WP1	P3 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	<p>WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above.</p> <p>MILLWORK: PL1 on vertical surfaces and SSM1 on countertop.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02133	Exam 2	SV1 SV2	WB1	ACP1	P2 TC1 WP1	P3 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	<p>WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above.</p> <p>MILLWORK: PL1 on vertical surfaces and SSM1 on countertop.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>

		FINISH SCHEDULE							ORIGINAL ISSUE
Room	Description	Floor	Base	Ceiling	Walls				Remarks
					North	East	South	West	
C02134	Procedure	SV1 SV2	WB1	ACP1	P2 TC1 WP1	P3 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	<p>WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above.</p> <p>MILLWORK: PL1 on vertical surfaces and SSM1 on countertop.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02135	Corridor	LVT1 LVT4	WB1	ACP1	-	P2	P2	P2	
C02136	Nurse Station	LVT2 LVT3	WB1	ACP1 GYP P5	P2	-	P2	P3	<p>CEILINGS: All sides of furrdown to be painted P5.</p> <p>MILLWORK: PL1 on vertical surfaces. SSM1 on worksurfaces with QSM1 as transaction counter.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02137	Med./Stor.	LVT5	WB1	ACP1	P2	P2	P2	P2	
C02138	Med./Stor.	LVT5	WB1	ACP1	P2	P2	P2	P2	
C02139	Exam 6	SV1 SV2	WB1	ACP1	P2 TC1 WP1	P2 TC1 WP1	P3 TC1 WP1	P2 TC1 WP1	<p>WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above.</p> <p>MILLWORK: PL1 on vertical surfaces and SSM1 on countertop.</p> <p>FLOORS: Refer to ID sheets for floor pattern.</p>
C02140	Patient Toilet	FT1	WB1	ACP1	P2 DT1 WT1	P2 DT1 WT1	P2 DT1 WT1	P2 DT1 WT1	<p>WALLS: Install WT1 from top of floor tile to approximately 78" AFF with DT1 as 6" decorative band at 60" AFF. Paint above tile. All outside corners and exposed edges of tile to be trimmed with MT1. Include corner and connector pieces.</p> <p>FLOORS: FT1 to be installed in a diagonal pattern before wall tile so that wall tile sits on top of floor tile. Include transition strip.</p>

		FINISH SCHEDULE							ORIGINAL ISSUE
Room	Description	Floor	Base	Ceiling	Walls				Remarks
					North	East	South	West	
C02141	Provider Office	CPT1	WB1	ACP1	P3	P2	P2	P2	
C02142	Corridor	LVT1 LVT2 LVT4	WB1	ACP1	P2	-	P2	-	FLOORS: Refer to ID sheets for floor pattern.
C02143	Storage	LVT5	WB1	ACP1	P2	P2	P2	P2	
C02144	Exam 3	SV1 SV2	WB1	ACP1	P3 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. MILLWORK: PL1 on vertical surfaces and SSM1 on countertop. FLOORS: Refer to ID sheets for floor pattern.
C02145	Exam 4	SV1 SV2	WB1	ACP1	P3 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. MILLWORK: PL1 on vertical surfaces and SSM1 on countertop. FLOORS: Refer to ID sheets for floor pattern.
C02146	Exam 5	SV1 SV2	WB1	ACP1	P3 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	P2 TC1 WP1	WALLS: Install WP1 with top of trim cap at approximately 34" AFF. Paint above. MILLWORK: PL1 on vertical surfaces and SSM1 on countertop. FLOORS: Refer to ID sheets for floor pattern.
C02147	Elec./IT	LVT5	WB1	ACP1	FRP1	FRP1	FRP1	FRP1	WALLS: FRP1 to be installed, prior to equipment, in full sheets from 1/2" below top of wall base. Include trim pieces for a complete and sanitary installation. Provide clear sealant between wall base and FRP.
C02148	Fire Riser	EPC1	WB1	-	FRP1	FRP1	FRP1	FRP1	WALLS: FRP1 to be installed, prior to equipment, in full sheets from 1/2" below top of wall base. Include trim pieces for a complete and sanitary installation. Provide clear sealant between wall base and FRP.

		FINISH SCHEDULE							ORIGINAL ISSUE
		Walls							
Room	Description	Floor	Base	Ceiling	North	East	South	West	Remarks

General Notes:	
1	Refer to project manual and drawings for additional information. Should there be any discrepancies between the documents, such discrepancies are to be brought to the attention of the architect through a written RFI and then the contractor shall receive instruction prior to installation or performance of said work. Work performed in conflict with the drawings or schedule shall be corrected by the contractor at their own expense.
2	No substitutions will be accepted without prior written approval.
3	All work to be performed according to manufacturer's recommended methods.
4	Comply with manufacturer's recommendations for examination, testing, and preparation of substrate material (including subfloors) prior to installation. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
5	Comply with lighting, environmental, and other requirements specified in individual specification sections.
6	Refer to specifications for indications regarding epoxy paint and grout.
7	All wall base to be applied in full continuous lengths, as scheduled.
8	Wall base to wrap all millwork connections to floor (including end panels) as scheduled unless noted otherwise.
9	All inside/outside corners (and terminations if not intersecting a material of greater thickness) of profile wall base to be cleanly mitered.
10	A pre-installation meeting with the architect is required prior to the installation of tile, vinyl flooring, wall protective products, and materials where patterns are used.
11	All exposed corners and edges of wainscot material to be finished.
12	All tiled surfaces to be centered in space or adjusted to avoid small cut tiles.
13	All wall tile to be trimmed on outside corners and exposed edges with scheduled metal trim.
14	Floor tile is to be installed prior to wall tile so that wall tile sits on top.
15	Install top of trim cap at approximately 34" AFF (unless noted otherwise), location to be confirmed on site by Architect. Terminate at edge of wall faces with mitered returns. Do not wrap to window frames.
16	Install corner guards on all outside corners (unless noted otherwise) from top of base in full lengths or to underside of chair rail or trim cap where present.
17	Blinds/roller shades and window sills to be installed at all windows in scope of work unless noted otherwise.
18	Ensure that wall finishes do not prevent the operation of roller shades or window blinds and that shade material extends completely to window frames.
19	Chair rails, hand rails, and trim caps to extend as close to corners, edges, and door frames as possible without overextending.
20	Install all flooring material to wall under open millwork.
21	Ensure that millwork countertop seams are level, even, and align with support brackets.
22	Sheet vinyl to be installed in largest widths to minimize seams, especially in corridors and hallways.
23	Include transition strips or leveling systems between different flooring types as scheduled.
24	Use manufacturer recommended weld rod colors for sheet vinyl heat welds, unless noted otherwise.

		FINISH SCHEDULE							ORIGINAL ISSUE
		Walls							
Room	Description	Floor	Base	Ceiling	North	East	South	West	Remarks
25	Comply with specified cleaning and protection requirements at completion of installation.								
26	All gypsum celings to be painted P1 unless noted otherwise.								
27	All door frames in scope of work to be painted P6 unless noted otherwise.								
28	PPG is the facility standard paint manufacturer. Alternates must be approved in writing.								
29	WP1 to begin at approximately 1/2" below top of wall base without a trim piece or at top of sanitary or integral base with trim piece at edge.								
30	Materials to be installed with seams parallel to the largest wall in that particular room.								

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Panel signs.
2. Room-identification signs.
3. Field-applied, vinyl-character signs.

- B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
2. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
3. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
4. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
 1. Include fabrication and installation details and attachments to other work.

2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
1. Room-Identification Signs: Full-size Sample.
- E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and the Texas Accessibility Standards for signs.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SIGNS

- A. Product: Refer to images provided in the Signage Schedule at the end of this Section
 1. Finish Materials:
 - a. Face Color – Brushed Aluminum and Matte Acrylic
 - b. Text Color – Dark Grey with raised Braille
 - c. Backplate – Blue to match “UMC Blue”
 2. Mounting: Mount on concealed Celtec stand-off panel attached to wall with two-face tape.
 3. Text and Typeface: Accessible raised characters and Braille typeface as indicated by manufacturer's designation and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.
 4. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

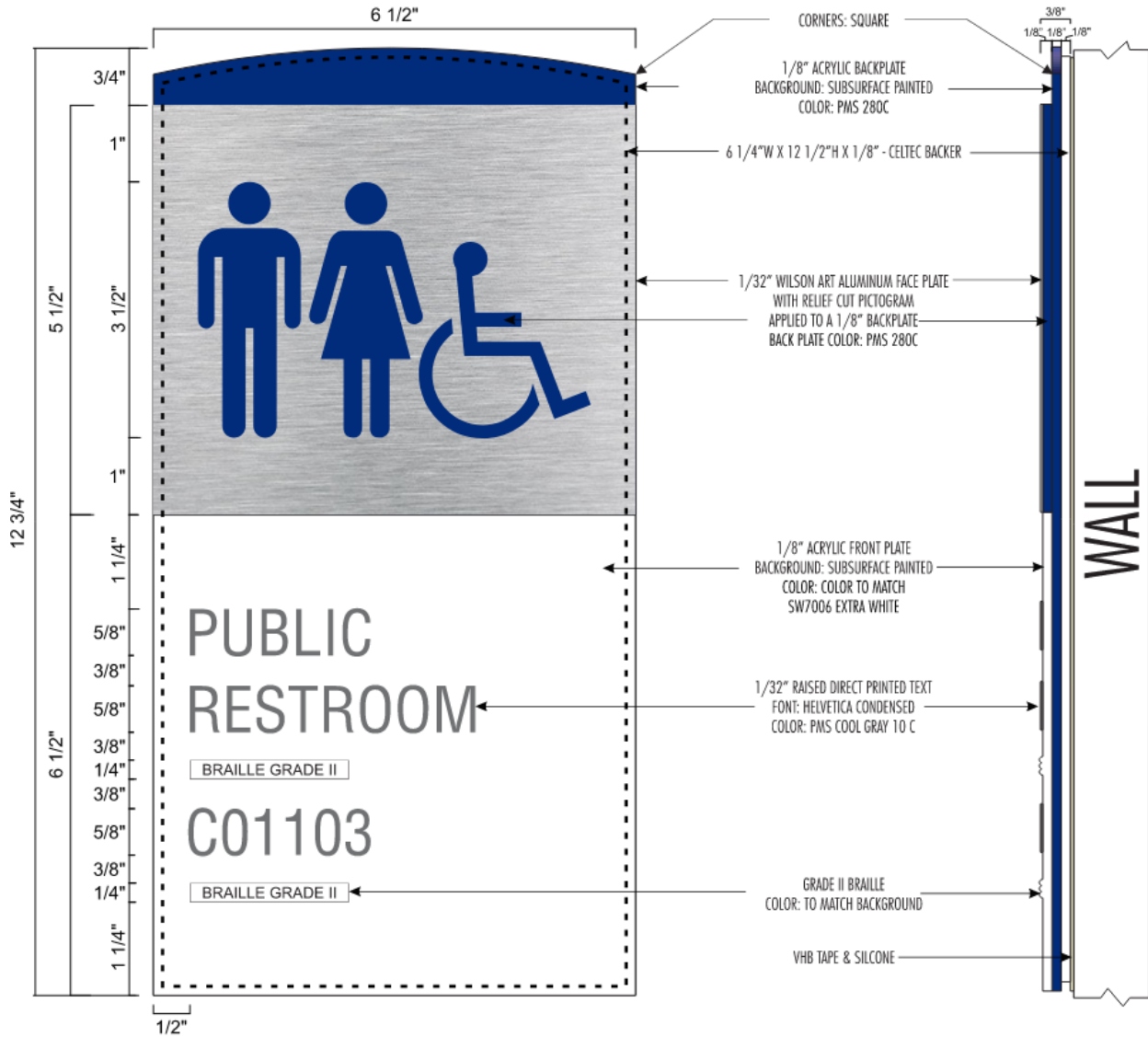
- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.
- C. Mounting Methods:
 - 1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- D. **Signs Mounted on Glass: For signs that must be mounted on glass adjacent to a door in order to comply with accessibility does, provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.**

3.3 ADJUSTING AND CLEANING

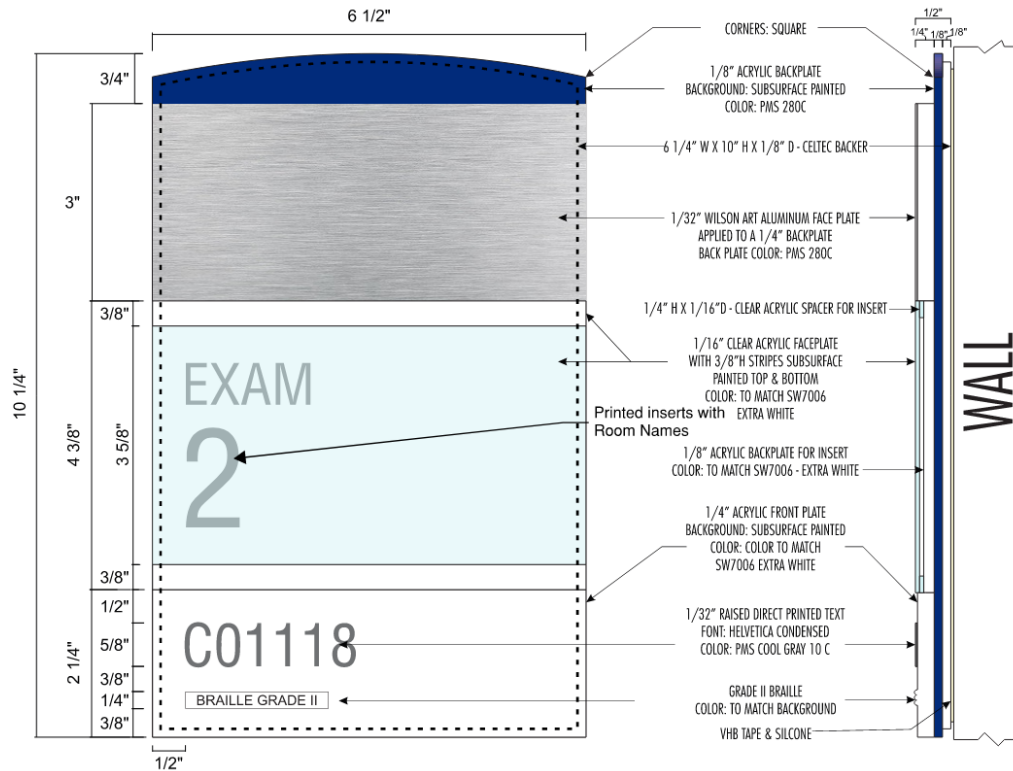
- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 SIGNAGE SCHEDULE

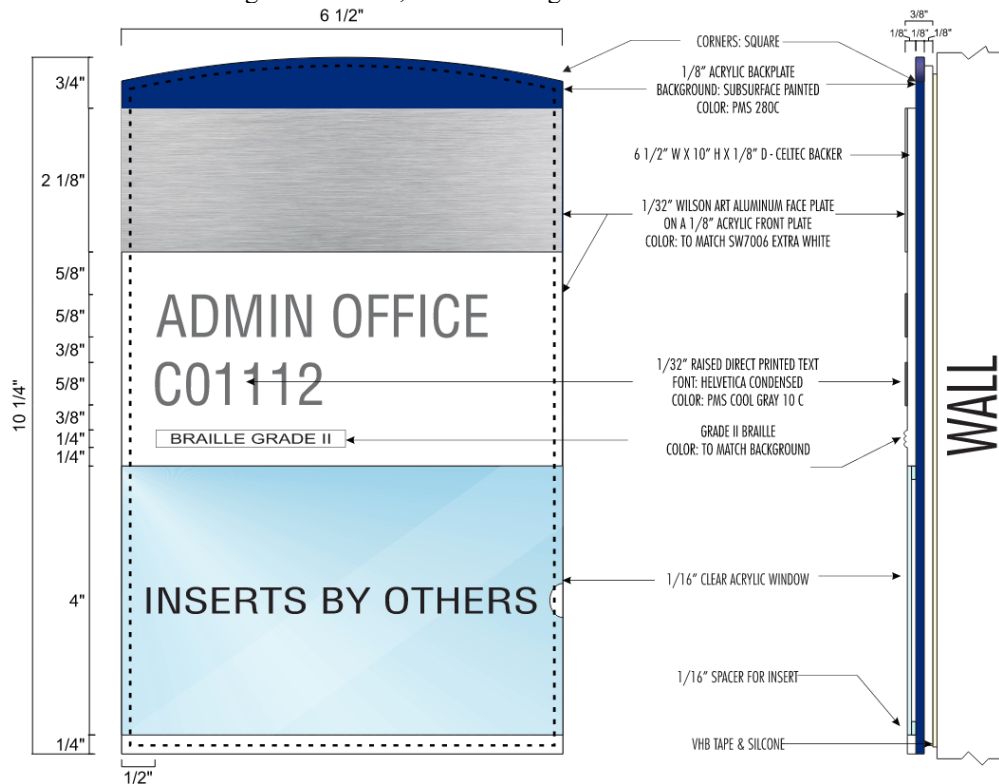
- A. Toilet Rooms: Provide (1) sign for each Toilet Room.
1. Pictogram with Universal Access symbol for MEN, WOMEN, or UNISEX as applicable



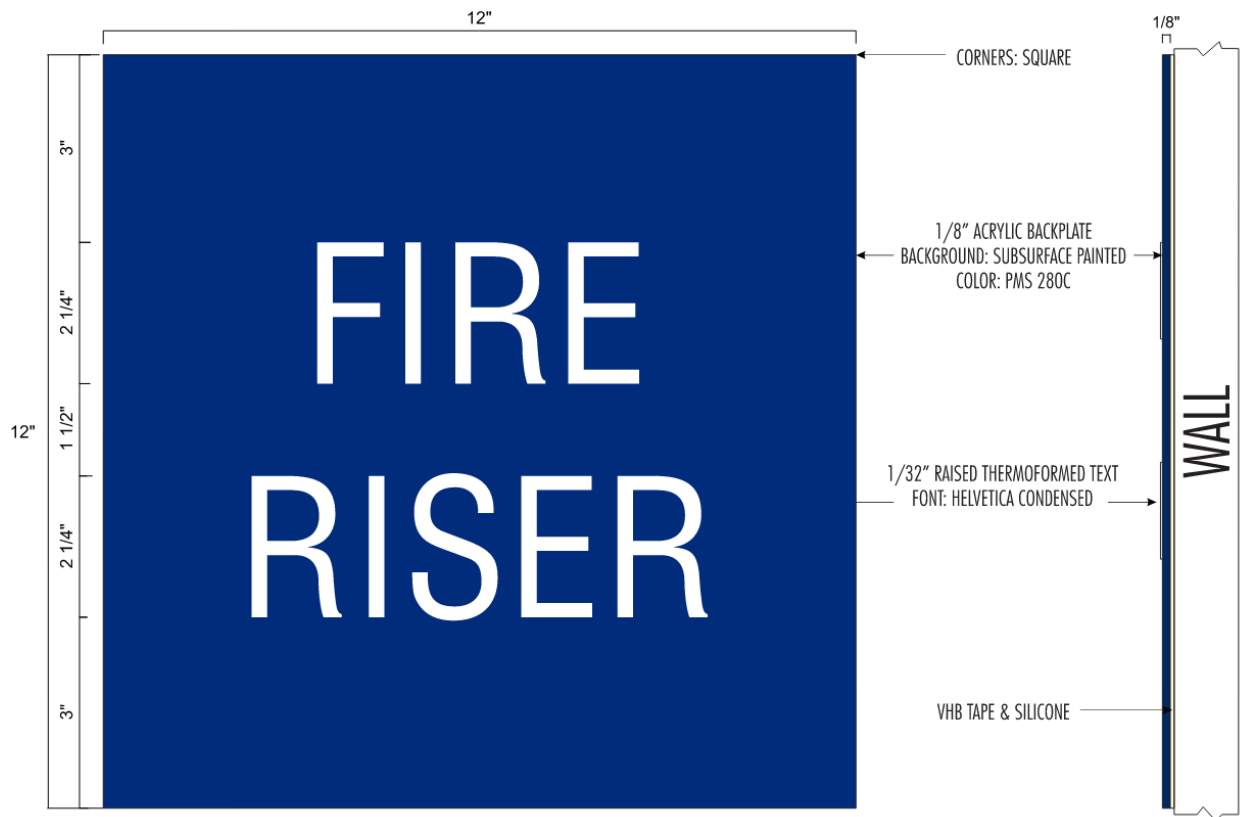
- B. Room ID: Room Name, Braille room name, sized as necessary.
1. Provide (1) sign for each interior door identified on the Drawings.



2. At signs for offices, include changeable window for name.



C. Fire Riser Room: Provide Exterior Rated Sign with raised letters.



END OF SECTION 101423

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Corner guards.
 - 2. Abuse-resistant wall coverings.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details. Show handrail design and support spacing required to withstand structural loads.
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.
 - 1. Include Samples of accent strips and accessories to verify color selection.
- D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
 - 1. Corner Guards: 12 inches long. Include example top caps.
 - 2. Abuse-Resistant Wall Covering: 6 by 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
 - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic materials out of direct sunlight.
 - 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F .
 - a. Store corner-guard covers in a vertical position.
 - b. Store wall-guard, bed-locator, and handrail covers in a horizontal position.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the Texas Accessibility Standards.

2.3 MATERIALS

- A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded and sheet material, thickness as indicated.
 - 1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
 - 2. Chemical and Stain Resistance: Tested according to ASTM D 543.
 - 3. Self-extinguishing when tested according to ASTM D 635.
 - 4. Flame-Spread Index: 25 or less.
 - 5. Smoke-Developed Index: 450 or less.

- B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M.

2.4 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - 1. Material: Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0625 inch.
 - b. Finish: Directional satin, No. 4.
 - 2. Wing Size: Nominal 1-1/2 by 1-1/2 inches.
 - 3. Corner Radius: 1/8 inch.
 - 4. Mounting: Double-faced, adhesive foam tape.

2.5 ABUSE-RESISTANT WALL COVERINGS

- A. Abuse-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
 - 1. Size: 48 by 96 inches for sheet when scheduled or indicated at areas up to 96 inches in height; 48 by 120 inches for roll when scheduled or indicated at areas more than 96 inches in height..
 - 2. Sheet Thickness: 0.06 inch.
 - 3. Color and Texture: Refer to Finish and Material schedule in Section 099999.
 - 4. Height: As indicated or scheduled.
 - 5. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color. All perimeter edges of Wall Covering system are to have J-trim unless concealed by some other means.
 - 6. Mounting: Adhesive.
 - 7. Panel Layout: Layout of Wall Covering system is to be designed to eliminate vertical and/or horizontal joints to the greatest extent possible and to provide a symmetrical layout of panels on walls unless indicated or scheduled otherwise.
 - 8. Termination: Wall covering system is to terminate approximately 1/2" below the top of rubber wall base. If Wall does not have rubber wall base, terminate above scheduled base with J-trim at bottom edge.
 - 9. Wall protection panels are to be installed using Interlock brand Spray-Lock FRP Adhesive. Follow manufacturer's recommended installation instructions.
 - 10. Wall projection panels are NOT to be installed on textured OR painted walls. If existing surfaces are textured and/or painted, those surfaces are to be properly sanded smooth. If surfaces are to be primed, they are to be primed with ONLY manufacturer recommended primers.

2.6 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.7 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Fabricate Preformed curved or bent semi-rigid, abuse resistant sheet wall coverings in the factory.
- C. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- D. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
- E. Wood Handrails: Miter corners and ends of wood handrails for returns.

2.8 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings. If not indicated on Drawings, install at heights indicated below (dimensions are to the bottom except for handrail which is to the top):
1. Crash Rails: 8" and above finished floor.
 2. Chair Rails: 36" above finished floor.
 3. Handrails: 34" above finished floor.
 4. Bed Locators: 8" above finished floor.
 5. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:
 - a. 48" a.f.f. for wainscot applications
 - b. Full height of wall to ceiling when no other finish is scheduled above.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
1. Provide anchoring devices and suitable locations to withstand imposed loads.
 2. Where splices occur in horizontal runs of more than 20 feet , splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
 3. Adjust end and top caps as required to ensure tight seams.
- D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Accessories found in public and private toilet and shower room facilities, childcare accessories, custodial accessories, and healthcare accessories as scheduled at the end of this Section.
- B. Owner-Furnished Material: As Scheduled.
- C. Related Sections:
 - 1. Section 093000 "Tiling" for ceramic toilet and bath accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Products are to be as scheduled. Any product substitutions must be submitted to and approved by the Architect prior to bid. Refer to the
- B. Proposed substitute products must match those scheduled in appearance, construction, function, and quality.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

Lab 115, Breakroom 119, Testing 121, Intake 131, Nurse Station 136, Procedure 134, Exam 125, 132, 133, 139, 144, 145, 146

1 ea. Paper Towel Dispenser	Owner furnished, Contractor installed
1 ea. Soap Dispenser	Owner furnished, Contractor installed

Toilet 103, 104

1 ea. Paper Towel Dispenser	Owner furnished, Contractor installed
1 ea. Soap Dispenser	Owner furnished, Contractor installed
1 ea. Framed Mirror	B-165 1836 Bobrick
1 ea. Toilet Paper Dispenser	Owner furnished, Contractor installed
1 ea. 36" Grab Bar	B-6806 x 36 Bobrick
1 ea. 42" Grab Bar	B-6806 x 42 Bobrick
1 ea. Diaper Changing Station (Horizontal)	KB310-SSWM Koala Kare

Toilet 116

1 ea.	Paper Towel Dispenser	Owner furnished, Contractor installed	
1 ea.	Soap Dispenser	Owner furnished, Contractor installed	
1 ea.	Framed Mirror	B-165 1836	Bobrick
1 ea.	Toilet Paper Dispenser	Owner furnished, Contractor installed	
1 ea.	24" Grab Bar	B-6806 x 36	Bobrick
1 ea.	42" Grab Bar	B-6806 x 42	Bobrick
1 ea.	Recessed Specimen Pass-through Cabinet	B-505	Bobrick
1 ea.	Recessed Stainless Steel Shelf	0412	ASI

Toilet 117, 124, 140

1 ea.	Paper Towel Dispenser	Owner furnished, Contractor installed	
1 ea.	Soap Dispenser	Owner furnished, Contractor installed	
1 ea.	Framed Mirror	B-165 1836	Bobrick
1 ea.	Toilet Paper Dispenser	Owner furnished, Contractor installed	
1 ea.	24" Grab Bar	B-6806 x 36	Bobrick
1 ea.	42" Grab Bar	B-6806 x 42	Bobrick

Janitorial 128

1 ea.	Mop Rack	B-224x36	Bobrick
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END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
 - 1. Show location of knockouts for hose valves.
- B. Product Schedule: For fire-protection cabinets. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. J. L. Industries, Inc., a division of Activar Construction Products Group;.
 - b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;.
 - c. Larsen's Manufacturing Company;.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Steel with baked enamel finish.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Stainless-steel sheet.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Tempered float glass (clear).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- K. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: White.
2. Stainless Steel: ASTM A 666, Type 304.
 - a. Finish: No. 4 directional satin finish.
3. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 - 1. Fire-Protection Cabinets: 48 inches above finished floor to the centerline of the cabinet latch or opening handle.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Provide inside latch and lock for break-glass panels.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six (6) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - c. Larsen's Manufacturing Company.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container FEC: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. **Contractor shall have the fire extinguisher inspected within 30 days prior to fire marshal inspection and/or project final completion and provide a signed and dated inspection tag attached to the extinguisher to document this.**

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Knocked-down corridor lockers.
 - 2. Locker benches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of metal locker.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples: For each color specified, in manufacturer's standard size.
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- E. Samples for Verification: For the following products, in manufacturer's standard size:
 - 1. Lockers and equipment.
 - 2. Locker benches.
- F. Product Schedule: For lockers. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the Texas Accessibility Standards.

2.3 LOCKERS

- A. Lockers are to be: Three-tier.
- B. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 - 1. Doors less than 12 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
 - 2. Doors for box lockers less than 15 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
 - 3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
 - 4. Door Style: Vented panel as follows:
 - a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier or three louver openings at top and bottom for double-tier lockers.
- C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - 1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
 - 2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.

3. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
 1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
 2. Frame Vents: Fabricate face frames with vents.
- E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
 1. Hinges: Manufacturer's standard, steel, continuous or knuckle type.
- F. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
 1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
 - a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- H. Hooks: Manufacturer's standard ball-pointed type hooks, aluminum or steel; zinc plated.
- I. Continuous Zee Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.
 1. Height: 4 inches.
- J. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet.
 1. Closures: Vertical-end type.
 2. Sloping-top corner fillers, mitered.
- K. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- L. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet.
- M. Materials:
 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

- N. Finish: Baked enamel or powder coat.
 - 1. Color: Two colors, with door one color and frame and body another color; as selected by Architect from manufacturer's full range.

2.4 LOCKS

- A. Combination Padlocks: Provided by Owner.
- B. Materials:
 - 1. Stainless Steel: ASTM A 666, Type 304.
 - 2. Plastic Laminate: NEMA LD 3, Grade HGP.
 - 3. Extruded Aluminum: ASTM B 221, alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
 - 4. Steel Tube: ASTM A 500/A 500 M, cold rolled.
 - 5. Particleboard: ANSI A208.1, Grade M-2.

2.5 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
 - 1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
 - 2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.
- E. Accessible Lockers: Fabricate as follows:
 - 1. Locate bottom shelf no lower than 15 inches above the floor.
 - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- F. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
 - 1. Sloping-top corner fillers, mitered.

- H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- I. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.6 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
 - 3. Anchor back-to-back metal lockers to floor.
- B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Equipment:
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

- b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach recess trim to recessed metal lockers with concealed clips.
 - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 - 3. Attach sloping-top units to metal lockers, with closures at exposed ends.
 - 4. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
- E. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.
- F. Freestanding Locker Benches: Place benches in locations indicated on Drawings.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 108213 – ROOF SCREENS AND LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Stand-alone roof equipment screens and supporting steel framework. Screens shall be designed to attach to the roof structure and not the equipment being screened.
 - 2. Roof screen accessories.

1.3 RELATED SECTIONS

- A. Section 051200, "Structural Steel Framing:" Metal Framing.
- B. Section 077200, "Roof Accessories."
- C. Section 099113, "Exterior Painting:" Field applied paint finish.
- D. Division 23 - Roof Top HVAC Equipment.

1.4 REFERENCES

- A. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM A 1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- E. ASTM A 1057 - Standard Specification for Steel, Structural Tubing, Cold Formed, Welded, Carbon, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. ASTM B 749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- G. ASTM D 4811 - Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing.
- H. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
- I. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- K. AWS D1.1 - Structural Welding Code - Steel.
- L. AWS D1.6 - Structural Welding Code - Stainless Steel.

1.5 COORDINATION

- A. Coordinate Work with other operations and installation of roofing materials to avoid damage to installed insulation and membrane materials.

1.6 ACTION SUBMITTALS

- A. Submit under provisions of Section 013300, "Submittal Procedures."
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Layout and erection drawings showing typical cross sections and dimensioned locations of all frames and base supports. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, shape, and patterns.

1.7 INFORMATIONAL SUBMITTALS

- A. Design Calculations: 3 copies of structural design calculations for structural components and components resisting wind loads with seal and signature of professional engineer licensed in the State of Texas.
- B. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous twelve (12) months.
- D. Warranties: 3 signed copies.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with a minimum five (5) years documented experience in producing pre-manufactured metal-framed equipment screens.
- B. Design Qualifications: Provide structural design calculations stamped by a structural engineer licensed in the state in which this project is located.
- C. Welders: AWS certified within previous twelve (12) months.
- D. Pre-Installation Meeting:
 - 1. Convene at job site, at least seven (7) calendar days prior to scheduled beginning of construction activities of this section, to review requirements of this section.
 - 2. Require attendance by representatives of the installing subcontractor (who will represent the system manufacturer), the mechanical subcontractors and other entities affected by construction activities of this section.
 - 3. Notify Architect four (4) calendar days in advance of scheduled meeting date.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the project site clearly marked for proper identification.
- B. Receive, handle and store materials in conformance with the manufacturers printed instructions.
- C. Store products under cover, in manufacturer's unopened packaging until ready for installation.
- D. Protect materials from exposure to moisture.
- E. Store materials in a dry, warm, ventilated weathertight location.
- F. Protect metal fabrications from damage by exposure to weather.
- G. Handling: Use a forklift or crane to move material. Do not lift the bundles by the metal bands.
 - 1. Fork Lift: Spread the forks as far as possible to balance the load. Drive slowly when moving long bundles over uneven surfaces to avoid tipping the load
 - 2. Crane: Position the canvas sling straps so that the space between the straps is at least 1/3 the length of the bundle. Use sling straps with looped ends running one end of the strap through the loop at the other end to cinch the bundle when lifted. When setting the load on the roof, put wood blocks under it to protect the roof and allow space to remove the sling straps.
 - 3. Roof Placement: Spread the bundles and crates out as much as possible to avoid overloading the roof structure. Place the material directly over major supports such as beams or trusses.
 - 4. Position bundles of tubing parallel to the slope of the roof and block prior to opening to prevent the tubing from rolling down the roof slope when unbundled.

1.10 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Field Measurements: Verify roof screen dimensions and conditions of the installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating equipment enclosure without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.11 WARRANTY

- A. Framing System: Provide manufacturer's standard written limited warranty stating that the complete framing system shall be warranted against structural failure due to cracking, buckling, bending, tearing or corrosion arising under normal use and environmental conditions for the coverage period applicable.
 - 1. Products installed on projects located 2 miles or greater from salt or brackish bodies of water shall be warranted for twenty (20) years.
 - 2. Products installed on projects located greater than 1 mile but less than 2 miles from salt or brackish bodies of water will be warranted for five (5) years, except for aluminum, stainless steel or copper Products which will be warranted for twenty (20) years.

3. Products installed on projects located 1 mile or less from salt or brackish bodies of water will be warranted for three (3) years, except for aluminum, stainless steel or copper Products which will be warranted for twenty (20) years.
- B. Louvers:
1. Provide written warranty, stating that the louvers, exclusive of paint finish, will be free of faults and defects for a period of twenty (20) years.
 2. Provide warranty signed by the louver manufacturer and installing contractor.
- C. Paint Finish:
- a. Provide written warranty stating that the paint finish applied on all louver components will retain its film integrity, color and chalk as defined by AAMA 2605 for a period of ten (10) years.
 - b. Provide warranty signed by the louver manufacturer and paint finish applicator (if separate from manufacturer).
- D. The above warranties are in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design Loads: Comply with Building Code for site location and building height.
1. Design to resist ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
 2. Design all materials, assembly and attachments to resist snow, wind, suction and uplift loading at any point without damage or permanent set.
- B. Structural Design: Prepare structural design calculations for screen framing and attachment to structure including reactions at base supports for verification of roof structure by Architect.
- C. All welds to be performed by an AWS certified welder. Valid certification to be provided.

2.2 MANUFACTURERS

- A. Acceptable Manufacturer include, but are not limited to: RoofScreen Mfg., which is located at: 347 Coral St.; Santa Cruz, CA 95060; Toll Free Tel: 866-766-3727; Tel: 831-421-9230; Fax: 866-253-0738; Email: request info (info@roofscreen.com); Web: www.roofscreen.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 012500, "Substitutions Procedures."

2.3 MATERIALS

- A. Square Base Supports: Weldments fabricated from cold rolled steel conforming to ASTM A 1008, fabricated with pre-punched holes in base plate for fastening to roof structure. After fabrication, apply minimum 2 to 4 mil baked on powder coat primer.

- B. Height: As required to provide adequate height for flashing for system in all instances through tapered insulation.
- C. Square Base Support Extensions: Fabricated from same material and finish as base supports. Provide as necessary to accommodate insulation thickness.
- D. Square Base Cap: Weldments fabricated from AISI Type 304 stainless steel with mill finish, and fabricated to overlap base support and flashing boot a minimum of 2 inches (51 mm). Provide moment resisting adjustable connection to attach framing to base cap.
- E. Square TPO Roof Flashing: Fabricated from 60 mil, white, single ply TPO sheet conforming to ASTM D 6878. Provide with base flange that extends a minimum of 5 inches (127 mm) onto the roof surface on all four sides. Riser shall be tapered to allow easy fit over Square Base Supports with minimal gap at top of flashing. Hot weld all seams for water tightness.
- F. Base Cap Gasket: EPDM with self-adhesive closed cell foam.
- G. Framing: Carbon steel structural tubing in manufacturer's standard sizes, conforming to ASTM A 500 with manufacturer's standard galvanized coating conforming to ASTM A 1057. Provide with wall thickness as determined by structural calculations.
- H. Connector Fittings: Fabricated from AISI Type 304 stainless steel with mill finish.
- I. Steel Hat Channel: Steel sheet conforming to ASTM A 653, Class SS, with a G90 hot-dip galvanized coating.
- J. Hardware: Bolts, nuts and washers: 18-8 stainless steel.
- K. Self-Drilling Screws: Carbon steel with factory applied protective coating conforming to ASTM B 117 salt spray testing.
- L. Welding Materials: AWS D1.1; type required for materials being welded.
- M. Louvers:
 - 1. Basis-of-Design Manufacturer and Louver: RoofScreen Mfg.
 - a. VisionGuard L10 Angled Louver.
 - 2. Fabrication
 - a. Fabricate louvers with close-fitting, field-made splice joints in blades designed to permit expansion and contraction without deforming blades or framework and with supporting members and hardware concealed from front edges of blades so blades have continuous appearance.
 - b. General:
 - 1) Fabricate all units to produce uniform sight lines and to be level, plumb and in same plane as adjacent panels.
 - 2) Accurately fabricate all joints for proper fit.
 - 3) Protect exposed surfaces against damage from scratches and discoloration.
 - c. Louvers:

- 1) Fabricate continuous blade louvers from minimum 0.1 inch thick extruded aluminum to shapes and configurations shown on the Drawings.
 - 2) Provide support clips from minimum 0.125 inch thick extruded aluminum to comply with specified performance criteria and manufacturer's fabrication procedures and standards.
 - 3) Provide vertical supports ("trees") from minimum 3 inch by 3 inch by 0.188 inch thick extruded aluminum angles to comply with specified performance criteria and manufacturer's fabrication procedures and standards, at spacings not further apart than recommended by manufacturer.
 - 4) Corners:
 - a) Provide inside and outside corners fabricated from 6 inch by 6 inch by 0.100 inch thick aluminum trim, painted to match louver blades, to be fastened with exposed fasteners.
 - b) Provide inside and outside mitered louver blades 24 inches in length to be installed butted together in field to form louver corners.
 - c) Provide inside and outside corners fabricated from mitered and welded louver blades that extend 24 inches in each direction. Finish corners after welding is complete.
- d. Provide all accessories and materials for fabrication, assembly and installation required to provide a complete and warranted louver installation.

2.4 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Fabricate system components so that portions of screen can be dismantled for repairs to equipment being screened and for future roof replacement.
- F. Trim and Closures: Fabricated from 24 gauge metal and finished with the manufacturer's standard coating system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine area where work will be installed to verify the installation can be performed in accordance with the Drawings and structural calculation requirements without interference from other equipment or trades.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Do not begin installation until conditions have been properly prepared.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain indicated alignment until completion of erection and installation of permanent attachments.
- D. Anchor fabrications to structure as indicated.
- E. Separate dissimilar metals and use gasketed fasteners, isolation shim, or isolation tape to eliminate possibility of corrosive or electrolytic action between metals.
- F. Exercise care when installing components so as not to damage finish surfaces. Touch up as required to repair damaged finishes.
- G. Install flashing boots at base supports as required to provide a watertight connection. Install as recommended by the roof membrane manufacturer.
- H. Remove all protective masking from material immediately after installation.

3.4 CLEANING AND PROTECTION

- A. Remove all protective masking from framing and trim material immediately after installation. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. Maintain in a clean condition during construction.
- B. Protect installed products until completion of project.
 - 1. Ensure that finishes and structure of installed systems are not damaged by subsequent construction activities.
 - 2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.
- C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.
- D. Replace metal wall panels and framing members that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 108213

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Manually operated roller shades with single rollers.
- 2. Motor-operated roller shades with single rollers.

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
- 2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

- 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

- D. Samples for Initial Selection: For each type and color of shadeband material.

- 1. Include Samples of accessories involving color selection.

- E. Samples for Verification: For each type of roller shade.

- 1. Shadeband Material: Not less than 3 inches square. Mark inside face of material if applicable.
- 2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
- 3. Installation Accessories: Full-size unit, not less than 10 inches long.

- F. Roller-Shade Schedule: Use same designations indicated on Drawings. **Indicate type of shade, size, handing of controls or location if motorized.**

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Draper Inc.
 - 2. Lutron Electronics Co., Inc.
 - 3. MechoShade Systems, Inc.
 - 4. Nysan Solar Control Inc.; Hunter Douglas Company.
- B. Source Limitations: Obtain all roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Stainless steel.

- a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: **Spring-loaded chain tension device, jamb mount.**
 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
 - B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 1. Roller Drive-End Location: **As determined by the Architect, submit proposed locations in submittal schedule.**
 2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
 - C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
 - D. Shadebands:
 1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Exposed with endcaps.
 - b. Color and Finish: Refer to Finish and Materials Schedule Section 099999..
 - E. Installation Accessories:
 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
 2. Installation Accessories Color and Finish: As selected from manufacturer's full range.
- 2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES
- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 1. **Shade control intent: The intent of shade control on this project is to be able to control the shades independently in two zones with different sun orientations. The zones are to be controlled by a sun sensor mounted at selected areas within each zone. The shades are to**

operate automatically using these controls. There are to be manual controls of the shades in these same zones that are controlled by individual wall switch controls located near an area accessible to employees. Contractor is to coordinate rough-in of these controls with the electrical contractor and confirm locations with Architect/Owner. Contractor is to coordinate all electrical requirements with electrical contractor to provide a complete and operational system.

2. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 - a. Electrical Characteristics: Single phase, **110 V**, 60 Hz.
 - b. Sound rating: ≤ 42 dBA
 4. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
 - a. Sun Sensor Control: Adjustable system consisting of digital displays detecting sun intensity and responding by automatically adjusting.
 - b. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
 - c. Control Stations: **Provide one Dual-zone controller.**
 - d. Color: White.
 5. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
 6. Operating Features:
 - a. Capable of interface with lighting and daylight harvesting control system.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: **As determined by the Architect, submit proposed locations in submittal schedule.**
 2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- E. Shadebands:
1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

- a. Type: Exposed with endcaps.
- b. Color and Finish: Refer to Finish and Materials Schedule Section 099999.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
2. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 - a. Closure-Panel Width: 2 inches.
3. Installation Accessories Color and Finish: Clear anodized aluminum.

G. Basis of Design: Draper Motorized FlexShade I/O AC

1. IntelliFlex I/O AC Motor: 120V AC, single phase, 60 HZ, 3-wire, 6nm or 15nm, at the manufacturer's discretion, instantly reversible, lifetime lubricated smart motor. Tubular motor concealed inside each shade roller tube. Equipped with internal thermal overload protector, and electric brake. Thermal protection: 4 minutes.
 - a. Rated current: 1.0 Amps. Motors drawing greater than 1.0 amps shall not be acceptable without prior approval by Architect responsible for electrical design of project.
 - b. Speed: 28RPM. All motors within a discrete control zone must operate at same speed.
 - c. Sound level: 42dBA.
 - d. UL Listing: UL325 & CSA C22.2 No. 247. Motors not listed as part of an entire shade assembly and control system shall not be acceptable.
 - e. Encoded motors with two-way communication to network control devices. Motor/control networks that do not support two-way communication shall not be acceptable.
 - f. Limits: Intermediate stopping points and presets.
2. IntelliFlex I/O User Input Devices.
 - a. Dual Zone Wall Switch. Allows user to control two independent zones of roller shades, moving them to any position with a single touch. Swipe gestures must also be recognized to move shades to fully open or closed positions. Power for switch must be provided through the IntelliFlex I/O network using a single Ethernet cable for power and communication. Each zone must be configured to control any number of shades on an IntelliFlex I/O network using the onboard programming buttons, without rewiring or the use of external configuration devices. Unlimited number of preset alignment positions. Push button switches not permitted.
3. IntelliFlex I/O Sensors.
 - a. Internal Brightness Sensor. To be mounted on the interior side of the window with adhesive or with provided mounting bracket. For use with Sensor/Schedule Interface.

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Material: **As scheduled, refer to Section 099999 Finish and Materials Schedules. Provide as scheduled, no substitutions.**

2.5 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
 - 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 - 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.
 - 3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123661 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Resin-based solid-surface-material countertops and backsplashes.
 - 2. Quartz agglomerate countertops and backsplashes.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.6 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
1. Front: Full thickness of the material, or laminated material to create 1 ¼" - 1 ½" thick edge profile with slightly eased edges (1/8" radius) and 3/8" radiused corners unless noted otherwise.
 2. Backsplash: Straight, slightly eased (1/8" radius) at top and exposed edges, 4" tall unless noted otherwise.
- B. Countertops: 1/2-inch- thick for resin-based materials and 1 ¼" (3 cm) for all others.
- C. Backsplashes: 1/2-inch- thick for resin-based materials and at least 3/4" (2 cm) for all others.
- D. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
1. Fabricate with loose backsplashes for field assembly.
- E. Joints:
1. Fabricate countertops in sections for joining in field, with joints at locations indicated.
 - a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.

2.2 COUNTERTOP MATERIALS

- A. Subtop Material: Medium-density fiberboard or Medium-density fiberboard made with exterior glue.
- B. Subtop Material at Sinks: **Medium-density fiberboard made with exterior glue.**
- C. Countertop Products: **Refer to Finish and Materials Schedule in Section 099999. No Substitutions.**

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Secure countertops to subtops with adhesive according to material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

- a. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Pre-drill holes for screws as recommended by manufacturer.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - a. **Seal edges of cutouts in subtops by saturating with varnish.**
- H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661

SECTION 134900 - RADIATION PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Lead-lined gypsum board.
 - 2. Lead glass.
 - 3. Lead-lined, hollow-metal doors and door frames.
 - 4. Lead-lined flush wood doors.
 - 5. Lead-lined, observation-window frames.

1.3 DEFINITIONS

- A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.
 - 1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to radiation protection including, but not limited to, the following:
 - a. Sequence and schedule of radiation protection work in relation to other work.
 - b. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
 - c. Methods of attaching other construction and equipment to lead-lined finishes.
 - d. Notification procedures for work that requires modifying radiation protection.
 - e. Requirements for field quality control.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.

1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.

C. Product Schedule: For observation windows, doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For flush wood door manufacturer and testing agency.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Flush Wood Door Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Testing Agency Qualifications: Licensed by authorities having jurisdiction to perform radiation shielding surveys.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Lead-Lined Gypsum Panels: Neatly stack panels flat to prevent deformation.

B. Lead-Lined, Hollow-Metal Doors and Frames: Comply with requirements in Section 081113 "Hollow Metal Doors and Frames" for delivery, storage, and handling.

C. Lead-Lined, Hollow-Metal Doors and Frames: Deliver doors and frames cardboard wrapped or crated to provide protection during delivery and storage. Inspect for damage on delivery. Minor damage may be repaired provided the refinished repair matches new work and is approved by Architect; otherwise, remove and replace damaged items as directed.

D. Lead-Lined Flush Wood Doors: Comply with requirements in Section 081416 "Flush Wood Doors" for delivery, storage, and handling.

E. Lead-Lined Flush Wood Doors: Comply with manufacturer's written instructions and requirements in WDMA I.S.1-A.

1. Package doors individually in plastic bags or cardboard cartons.

2. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install radiation protection until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings for all items by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.
 - 1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.
- B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.
- C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain each type of radiation protection product from single source from single manufacturer.

2.3 MATERIALS

- A. Lead-Lined Gypsum Board: 5/8-inch- thick gypsum board complying with Section 092900 "Gypsum Board," of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.
 - 1. Lead Sheet Lining: Full width of board and length necessary to extend from floor to 84 inches above floor.
 - 2. Furnish 3-inch-wide lead strips for wrapping metal stud flanges.
 - 3. Furnish gypsum veneer plaster, accessories, and trim for lead-lined gypsum base complying with Section 092613 "Gypsum Veneer Plastering."
 - 4. Furnish finishing materials, accessories, and trim for lead-lined gypsum board complying with Section 092900 "Gypsum Board."
- B. Lead Glass: Lead-barium, polished glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.
 - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amerope Enterprises, Inc.
 - b. McGrory Glass, Inc.
 - c. Schott Corporation; Technical Glass Div.; Subsidiary of Schott Glas; a company of the Carl-Zeiss-Stiftung
 - 2. Safety Glass: Tempered lead glass.
 - a. Outer Ply: Clear float glass.
 - b. Interlayer: Clear polyvinyl butyral.
 - c. Inner Ply: Lead glass; thickness as needed to provide lead equivalence as indicated in Owner's Physicist report.

- C. Glazing Compounds, Gaskets, and Accessories: Comply with requirements in Section 088000 "Glazing."
- D. Accessories and Fasteners: Manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.
- E. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Asphalt Felt: ASTM D 226/D 226M.

2.4 LEAD-LINED, HOLLOW-METAL DOOR FRAMES

- A. General: Steel door frames complying with NAAMM-HMMA 861, lined with lead sheet of thickness not less than that required for doors and walls where frames are used.
 - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Steel Products Corp.
 - b. Deronde Products.
 - c. Karpen Steel Custom Doors & Frames.
 - d. Kewanee Corp.
 - e. Pioneer Industries.
 - f. Precision Metals, Inc.
 - g. Security Metal Products Corp.
 - h. A & L Shielding Inc.
 - i. El Dorado Metals, Inc.
 - j. Lead Shield, Inc./LSI Sales, Inc.
 - k. Mayfield Manufacturing Company.
 - l. NELCO, Inc.
 - m. Radiation Protection Products, Inc.
 - n. Ray-Bar Engineering Corp.
 - 2. Furnish with additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
 - 3. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
 - 4. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.5 LEAD-LINED FLUSH WOOD DOORS

- A. Lead-Lined Flush Wood Doors: Solid-core wood doors with lead lining, thickness not less than that required for partition in which door is installed.
 - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Algoma Hardwoods, Inc.
 - b. Eggers Industries.
 - c. VT Industries Inc.
 - 2. Door Construction: Plastic-laminate face, five ply, bonded particleboard core.
 - 3. Lead Lining: One or more continuous sheets of lead extending from top to bottom and edge to edge, constructed either in the core or between the core and faces, at manufacturer's option.

4. Comply with Section 081416 "Flush Wood Doors" for grade, faces, veneer matching, performance grade, fabrication, finishing, and other requirements unless otherwise indicated.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Prepare doors to receive observation windows; cut and trim openings through doors in factory. Provide removable wood stops for glazed openings.
- D. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.
- E. Furnish lead-lined astragals for pairs of doors.
- F. Factory fit doors to suit frame openings indicated with 1/16-inch clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.

2.6 LEAD-LINED, OBSERVATION-WINDOW FRAMES

- A. General: Fabricate from 0.043-inch-thick, formed-steel sheet or 0.064-inch-thick aluminum extrusions with mitered corners, welded or bolted with concealed fasteners.
 1. Line with lead sheet formed to match frame contour, continuous in each jamb and across head and sill, lapping the stops, and fabricated wide enough to maintain an effective lap with lead of adjoining assemblies.
 2. Construct so lead lining overlaps glazing material perimeter by at least 3/8 inch and furnish removable stops.
 3. Form sill with an opening for sound transmission. Offset sound passage to make opening lightproof and to maintain required lead equivalence at all points and in all directions.

2.7 DOOR AND DOOR FRAME FABRICATION

- A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 "Door Hardware."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LEAD-LINED GYPSUM BOARD

- A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.

- B. Two-Layer System: Apply a facing sheet of gypsum board vertically over base sheet using laminating adhesive recommended in writing by gypsum board manufacturer. Offset joints in finish layer from joints in base layer, and fasten at top and bottom of sheet to support finish panel until adhesive has set.
 - 1. Locate fasteners above ceiling or behind wall base.
- C. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least 1 inch . Arrange board around openings so neither horizontal nor vertical joints occur at corners of openings.
- D. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.
- E. Finish lead-lined gypsum board to comply with Section 092900 "Gypsum Board."

3.3 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

- A. Install lead-lined steel doors and door frames according to Section 081113 "Hollow Metal Doors and Frames."
 - 1. Apply a coat of asphalt mastic or paint to lead lining in door frames where lead comes in contact with masonry or grout.
- B. Install lead-lined wood doors according to Section 081416 "Flush Wood Doors."
- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with door manufacturer's written instructions.
- D. Frames: Comply with HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.
 - 1. Provide three anchors per jamb, located adjacent to hinge on hinge jamb and at corresponding heights on strike jamb.
 - 2. In masonry construction, use wire or T-strap anchors and apply a coat of asphalt mastic or paint to lead lining where lead comes in contact with masonry or grout.
 - 3. In metal stud construction, use wall anchors attached to studs with screws.
 - 4. In wood stud construction, use strap anchors attached to studs with screws.
- E. Lap lead lining of frames over lining in walls at least 1 inch .
- F. Lead Lining of Frames: Line inside of frames with lead of thickness not less than that required in doors and walls where frames are used. Form lead to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Lap lining over lining in walls at least 1 inch .
- G. Install doors in frames level and plumb, aligned with frames and with uniform clearance at each edge.
- H. Line astragals with lead sheet.
- I. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Section 087100 "Door Hardware" for other installation requirements.
- J. Touch up damaged finishes with compatible coating after sanding smooth.

- K. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

3.4 INSTALLATION OF LEAD-LINED OBSERVATION WINDOWS

- A. Install observation windows according to manufacturer's written installation instructions.
 - 1. Apply a coat of asphalt mastic or paint to lead lining in frames where lead comes in contact with masonry or grout.
- B. Install windows level, plumb, square, true to line, and anchored securely in place to structural support.
- C. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least 1 inch .
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with manufacturer's written instructions.

3.5 PROTECTION

- A. Lock radiation-protected rooms once doors and locks are installed, and limit access to only those persons performing work in the rooms.

END OF SECTION 134900

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SECTION 210510 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

- A. In general, the lines to be installed by the various trades under these specifications shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards as to complete the work in a neat and satisfactorily workable manner. The following is a general outline concerning the running of various lines and ducts and is to be excepted where the drawings or conditions at the building necessitate deviating from these standards.
- B. The Contractor shall thoroughly acquaint himself with the details of the construction and finishes before submitting his bid as no allowances will be made because of the Contractor's unfamiliarity with these details. Place all inserts in masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.
- C. The plans do not give exact details as to elevations of lines, exact locations, etc., and do not show all the offsets, control lines, pilot lines and other installation details. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to provide proper grading of lines, to avoid all obstruction, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.
- D. The plans do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with other sections. Minor relocations necessitated by the conditions at the site or as directed by the Architect shall be made without any additional cost accruing to the Owner.
- E. The contractor for the work under each section of these specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- F. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.
- G. The Contractor shall be responsible for the proper fitting of his material and apparatus into the space. Should the particular equipment which any bidder proposes to install require other space conditions than those indicated on the drawings, he shall arrange for such space with the Architect before submitting his bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such necessary changes at his (the Contractor's) own expense.

- H. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans. The drawings shall be checked by the Architect before the work is started. Any conflict with the building conditions shall be corrected by the Contractor before the work proceeds.
 - I. Order of precedence shall be observed in laying out the pipe, ductwork, material, and conduit in order to fit the material into the space above the ceiling and in the chases and walls. The following order shall govern:
 - 1. Items affecting the visual appearance of the inside of the building such as lighting fixtures, diffusers, grilles, outlets, panelboards, etc. Coordinate all items to avoid conflicts at the site.
 - 2. Lines requiring grade to function such as sewers, roof drains and condensate drains.
 - 3. Large ducts and pipes with critical clearances.
 - 4. Conduit, water lines, and other lines whose routing is not critical and whose function would not be impaired by bends and offsets.
 - J. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before the contract is signed. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus, material, or equipment.
 - K. The Contractor shall distinctly understand that the work described herein and shown on the accompanying drawings shall result in a finished and working job, and any item required to accomplish this intent shall be included whether specifically mentioned or not.
 - L. Each bidder shall examine the plans and specifications for the General Construction. If these documents show any item requiring work under Division 21 and that work is not indicated on the respective "FP" drawings, he shall notify the Architect in sufficient time to clarify before bidding. If no notification is received, the Contractor is assumed to require no clarification, and shall install the work as indicated on the General Plans in accordance with the specifications.
 - M. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings. Any difference which may be found shall be submitted to the Architect for consideration before proceeding with the work.
 - N. The accompanying plans do not indicate completely the existing installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.
- 1.3 SUBMITTALS
- A. Wherever shop drawings/submittals are called for in these specifications, they shall be furnished by the Contractor for the work involved after review by the Architect as to the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary details. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary and should there be any charges in connection with this, they shall be borne by the Contractor.

- B. Shop drawings will be reviewed by the Architect for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Review by the Architect and any action by the Architect in marking shop drawings is subject to the requirements of the entire contract documents. Contractor will be held responsible for quantities, dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of all trades and the satisfactory performance of his work.
- C. Shop drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission of individual items shall designate the exact item offered and shall clearly identify the item with the project.
- D. All shop drawings shall be submitted at one time and shall consist of a bound catalogue of all shop drawings under each section, properly indexed and certified that they have been checked by the Contractor.
- E. The omissions of any material from the shop drawings which has been shown on the contract drawings or specified, even though reviewed by the Architect, shall not relieve the Contractor from furnishing and erecting same.

1.4 PERMITS, FEES, ETC.

- A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall arrange for all utility services, including sewer, water and gas services as applicable. If any charges are made by any of the utility companies due to the work on this project, the Contractor shall pay these charges, including charges for metering, connection, street cutting, etc. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.5 LAWS, CODES, AND ORDINANCES

- A. All work shall be executed in strict accordance with all local, state and national codes, ordinances and regulations governing the particular class of work involved, as interpreted by the inspecting authority. The Contractor shall be responsible for the final execution of the work under this heading to suit those requirements. Where these specifications and the accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect, shall prepare any supplemental drawings required illustrating how the work may be installed so as to comply and, on approval, make the changes at no cost to the Owner. On completion of the various portions of the work the installation shall be tested by the constituted authorities, approved and, on completion of the work, the Contractor shall obtain and deliver to the Owner a final certificate of acceptance.

1.6 TESTING

- A. The Contractor under each division shall at his own expense perform the various tests as specified and required by the Architect and as required by the State and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests. Notify the Architect a minimum of 24 hours in advance of all tests.

1.7 COORDINATION OF TRADES

- A. The Contractor shall be responsible for resolving all coordination required between trades. For example, items furnished under Division 21 which require electrical connections shall be coordinated with Division 26 for:
 - 1. Voltage
 - 2. Phase
 - 3. Ampacity
 - 4. No. and size of wires
 - 5. Wiring diagrams
 - 6. Starter size, details and location
 - 7. Control devices and details
- B. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- C. Items furnished under various sections which require plumbing connections shall be coordinated for services, pressure, size and location of connections, type of fuel, clearances for service, auxiliary devices required, etc.
- D. Items requiring insulation shall be fully insulated and that insulation shall be checked against manufacturer's directions and job requirements for suitability, coverage, thickness and finish.
- E. Items installed in/on finished ceilings shall be coordinated with the ceiling construction. The Contractor under each section shall conform to the reflected ceiling plan and shall secure details and/or samples of the ceiling materials as necessary to insure compatibility. Any device not conforming to this requirement shall be replaced by the Contractor at his expense.
- F. All items specified under Division 21 shall be installed tight, plumb, level, square and symmetrically placed in relation to the work of other trades.
- G. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- H. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- I. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified by Architect.

1.8 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.9 SUBSTITUTIONS

- A. Where a definite material or only one manufacturer's name is mentioned in these specifications, it has been done in order to establish a standard. The product of the particular manufacturer mentioned is of satisfactory construction and any substitution must be of quality as good as or better than the named article. No substitution shall be made without review by the Architect, who will be the sole judge of equality.
- B. The Contractor shall submit for approval a complete list of the materials he proposes to use. This list shall give manufacturers' names and designations corresponding to each and every item and the submission shall be accompanied by complete descriptive literature and/or any supplementary data, drawings, etc., necessary to give full and complete details.
- C. Should a substitution be accepted under the provisions of the conditions of these specifications, and should this substitute prove to be defective or otherwise unsatisfactory for the service for which it is intended within the guarantee period, the Contractor who originally requested the substitution shall replace the substitute material with the specified material.

1.10 INSTALLATION DRAWINGS

- A. It shall be incumbent upon the Contractor to prepare special drawings as called for elsewhere herein or as directed by the Architect to coordinate the work under each section, to illustrate changes in his work, to facilitate its concealment in finished spaces to avoid obstructions or to illustrate the adaptability of any item of equipment which he proposes to use.
- B. These drawings shall be used in the field for the actual installation of the work. Unless otherwise directed, they shall not be submitted for approval but three copies shall be provided to the Architect for his information.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.12 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

2.2 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.3 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.4 ACCESS DOORS

- A. Wherever fire suppression equipment is installed and where future access is required through either walls or ceilings and such cannot be obtained through the removable ceiling or through other means, the Contractor shall provide Milcor Style "M" access doors at least 12 inches by 12 inches in size or larger if required for access. Provide access doors for all valves, etc. Provide Milcor Style "UFR" rated access panels as required for installation in rated construction.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

END OF SECTION

SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Valve tags.
 - 5. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- C. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

- C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, with predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Fasteners: Stainless-steel rivets.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.
- D. Pipe-Label Colors:
 - 1. Background Color: Red.
 - 2. Letter Color: White.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Fasteners: Brass beaded chain or S-hook.

3. Valve-Tag Color: Red.
 4. Letter Color: White.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

- A. 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: Reinforced grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 LABEL INSTALLATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. Piping Color-Coding: Painting of piping shall be as required by Architect.
- F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 20 feet in areas of congested piping and equipment.

3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
 1. Valve-Tag Size and Shape:
 - a. Fire-Suppression Standpipe: 1-1/2 inches round.
 - b. Wet-Pipe Sprinkler System: 1-1/2 inches round.

3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 211313 - FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Fire-department connections.
 - 4. Sprinklers.
 - 5. Alarm devices.
 - 6. Manual control stations.
 - 7. Control panels.
 - 8. Pressure gages.

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Sprinkler system piping designed to operate at working pressure 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if required.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified person, using performance requirements and design criteria indicated.
 - 1. Fire-hydrant flow tests not available during production of construction documents. It is the responsibility of the Contractor to acquire flow test records for project prior to bid. The Contractor shall include all components required for fire protection system to properly operate with flow data found.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:
 - a. Automobile Parking Areas: Ordinary Hazard, Group 1.
 - b. Building Service Areas: Ordinary Hazard, Group 1.
 - c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - d. General Storage Areas: Ordinary Hazard, Group 1.
 - e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - f. Office and Public Areas: Light Hazard.
3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified Installer.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- E. Fire-hydrant flow test report.
- F. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional services needed to assume responsibility. Base calculations on results of fire-hydrant flow test.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
 - 3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - 1. Notify Architect no fewer than seven days in advance of proposed interruption of sprinkler service.
 - 2. Do not proceed with interruption of sprinkler service without Architect's written permission.

1.9 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

- B. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- C. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- D. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed or FM approved.
 - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
- B. Manufacturers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Clow Valve Company; a division of McWane, Inc.
 - c. Fire-End & Croker Corporation.
 - d. NIBCO INC.
 - e. Potter Roemer.
 - f. Reliable Automatic Sprinkler Co., Inc.
 - g. Tyco Fire & Building Products LP.
 - h. Victaulic Company.

C. Ball Valves:

1. Standard: UL 1091 except with ball instead of disc.
2. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
3. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
4. Valves NPS 3: Ductile-iron body with grooved ends.

D. Iron Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Style: Lug or wafer.
5. End Connections: Grooved.

E. Check Valves:

1. Standard: UL 312.
2. Pressure Rating: 250 psig minimum.
3. Type: Swing check.
4. Body Material: Cast iron.
5. End Connections: Flanged or grooved.

F. Iron OS&Y Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Cast or ductile iron.
4. End Connections: Flanged or grooved.

G. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig minimum.
3. Valves NPS 2 and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
4. Valves NPS 2-1/2 and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
5. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.

H. NRS Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Cast iron with indicator post flange.

4. Stem: Nonrising.
5. End Connections: Flanged or grooved.

I. Indicator Posts:

1. Standard: UL 789.
2. Type: Horizontal for wall mounting.
3. Body Material: Cast iron with extension rod and locking device.
4. Operation: Wrench.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Standard: UL 193.
2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
4. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-End & Croker Corporation.
 - b. Fire Protection Products, Inc.
 - c. Guardian Fire Equipment, Inc.
 - d. Tyco Fire & Building Products LP.
 - e. Potter Roemer.
2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Escutcheon Plate Marking: Similar to " AUTO SPKR."
11. Finish: Polished chrome plated.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

B. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

C. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

D. Flexible, Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fivalco Inc.
 - b. FlexHead Industries, Inc.
 - c. Gateway Tubing, Inc.
2. Standard: UL 1474.
3. Flexible connectors shall have materials suitable for system fluid. Include 250-psig minimum working-pressure rating and ends according to the following:
 - a. NPS 2 and Smaller: Threaded.
 - b. NPS 2-1/2 and Larger: Flanged.
 - c. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.
4. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid and UL Listed or FM Approved. Include steel nipples or flanges, welded to hose.

2.9 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Reliable Automatic Sprinkler Co., Inc.
 2. Tyco Fire & Building Products LP.
 3. Venus Fire Protection Ltd.
 4. Victaulic Company.
- B. General Requirements:
 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
 1. Early-Suppression, Fast-Response Applications: UL 1767.
 2. Nonresidential Applications: UL 199.
 3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Open Sprinklers with Heat-Responsive Element Removed: UL 199.
- E. Sprinkler Finishes:
 1. Chrome plated.
 2. Bronze.
 3. Painted.
- F. Special Coatings:
 1. Wax.
 2. Lead.
 3. Corrosion-resistant paint.

- G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- H. Sprinkler Guards:
1. Standard: UL 199.
 2. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
1. Standard: UL 464.
 2. Type: Vibrating, metal alarm bell.
 3. Finish: Red-enamel factory finish, suitable for outdoor use.
- C. Water-Flow Indicators:
1. Standard: UL 346.
 2. Water-Flow Detector: Electrically supervised.
 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 4. Type: Paddle operated.
 5. Pressure Rating: 250 psig.
 6. Design Installation: Horizontal or vertical.
- D. Pressure Switches:
1. Standard: UL 346.
 2. Type: Electrically supervised water-flow switch with retard feature.
 3. Components: Single-pole, double-throw switch with normally closed contacts.
 4. Design Operation: Rising pressure signals water flow.
- E. Valve Supervisory Switches:
1. Standard: UL 346.
 2. Type: Electrically supervised.
 3. Components: Single-pole, double-throw switch with normally closed contacts.
 4. Design: Signals that controlled valve is in other than fully open position.
- F. Indicator-Post Supervisory Switches:
1. Standard: UL 346.
 2. Type: Electrically supervised.
 3. Components: Single-pole, double-throw switch with normally closed contacts.
 4. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.11 PRESSURE GAGES

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0 to 250 psig minimum.
- D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- E. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Drain dry-pipe sprinkler piping.
- N. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices.
- O. Fill wet pipe sprinkler system piping with water.

3.5 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
 - 3. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.7 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.8 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install building mounted, fire-department connection in location directed by local authority.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.9 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Coordinate with fire-pump tests. Operate as required.
 - 7. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.11 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.12 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.13 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
 - 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be the following:
 - 1. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.14 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 3. Wall Mounting: Sidewall sprinklers.
 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as required.
 5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where required.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 2. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 3. Residential Sprinklers: Dull chrome.
 4. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

SECTION 220510 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Plumbing demolition.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

1.5 GENERAL REQUIREMENTS

- A. In general, the lines to be installed by the various trades under these specifications shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards as to complete the work in a neat and satisfactorily workable manner. The following is a general outline concerning the running of various lines and ducts and is to be excepted where the drawings or conditions at the building necessitate deviating from these standards.
- B. All piping for the plumbing trade shall be concealed in chases in finished areas, except as indicated on the drawings. Horizontal lines run in areas that have ceilings shall be run concealed in those ceilings, unless otherwise specifically indicated or directed.
- C. Piping may be run exposed in machinery and equipment spaces, where serving as connections to equipment items in finished rooms where exposed connections are required, and elsewhere as indicated on the drawings or required.
- D. The Contractor shall thoroughly acquaint himself with the details of the construction and finishes before submitting his bid as no allowances will be made because of the Contractor's unfamiliarity with these details. Place all inserts in masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.
- E. The plumbing plans do not give exact details as to elevations of lines and ducts, exact locations, etc., and do not show all the offsets, control lines, pilot lines and other installation details. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to provide proper grading of lines, to avoid all obstruction, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.
- F. The plumbing plans do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with other sections. Minor relocations necessitated by the conditions at the site or as directed by the Architect shall be made without any additional cost accruing to the Owner.
- G. The contractor for the work under each section of these specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- H. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.
- I. The Contractor shall be responsible for the proper fitting of his material and apparatus into the space. Should the particular equipment which any bidder proposes to install require other space conditions than

those indicated on the drawings, he shall arrange for such space with the Architect before submitting his bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such necessary changes at his (the Contractor's) own expense.

- J. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans. The drawings shall be checked by the Architect before the work is started. Any conflict with the building conditions shall be corrected by the Contractor before the work proceeds.
- K. Order of precedence shall be observed in laying out the pipe, ductwork, material, and conduit in order to fit the material into the space above the ceiling and in the chases and walls. The following order shall govern:
 - 1. Items affecting the visual appearance of the inside of the building such as lighting fixtures, diffusers, grilles, outlets, panelboards, etc. Coordinate all items to avoid conflicts at the site.
 - 2. Lines requiring grade to function such as sewers, roof drains and condensate drains.
 - 3. Large ducts and pipes with critical clearances.
 - 4. Conduit, water lines, and other lines whose routing is not critical and whose function would not be impaired by bends and offsets.
- L. Piping serving outlets on items of equipment shall be run in the most appropriate manner. Where the equipment has built-in chases, the lines shall be contained therein. Where the equipment is of the open type, the lines shall be run as close as possible to the underside of the top and in a neat and inconspicuous manner.
- M. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through windows, doorways or shafts, shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed.
- N. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before the contract is signed. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus, material, or equipment.
- O. The Contractor shall distinctly understand that the work described herein and shown on the accompanying drawings shall result in a finished and working job, and any item required to accomplish this intent shall be included whether specifically mentioned or not.
- P. Each bidder shall examine the plans and specifications for the General Construction. If these documents show any item requiring work under Division 22 and that work is not indicated on the respective "P" drawings, he shall notify the Architect in sufficient time to clarify before bidding. If no notification is received, the Contractor is assumed to require no clarification, and shall install the work as indicated on the General Plans in accordance with the specifications.
- Q. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings. Any difference which may be found shall be submitted to the Architect for consideration before proceeding with the work.
- R. The accompanying plans do not indicate completely the existing mechanical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any

additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

1.6 SUBMITTALS

- A. Wherever shop drawings/submittals are called for in these specifications, they shall be furnished by the Contractor for the work involved after review by the Architect as to the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary details. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary and should there be any charges in connection with this, they shall be borne by the Contractor.
- B. Shop drawings will be reviewed by the Architect for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Review by the Architect and any action by the Architect in marking shop drawings is subject to the requirements of the entire contract documents. Contractor will be held responsible for quantities, dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of all trades and the satisfactory performance of his work.
- C. Shop drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission of individual items shall designate the exact item offered and shall clearly identify the item with the project.
- D. All shop drawings shall be submitted at one time and shall consist of a bound catalogue of all shop drawings under each section, properly indexed and certified that they have been checked by the Contractor.
- E. The omissions of any material from the shop drawings which has been shown on the contract drawings or specified, even though reviewed by the Architect, shall not relieve the Contractor from furnishing and erecting same.

1.7 PERMITS, FEES, ETC.

- A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall arrange for all utility services, including sewer, water and gas services as applicable. If any charges are made by any of the utility companies due to the work on this project, the Contractor shall pay these charges, including charges for metering, connection, street cutting, etc. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.8 LAWS, CODES, AND ORDINANCES

- A. All work shall be executed in strict accordance with all local, state and national codes, ordinances and regulations governing the particular class of work involved, as interpreted by the inspecting authority. The Contractor shall be responsible for the final execution of the work under this heading to suit those requirements. Where these specifications and the accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect, shall prepare any supplemental drawings required illustrating how the work may be installed so as to comply and, on approval, make the changes at no cost to the Owner. On completion of the various portions of the work the installation shall

be tested by the constituted authorities, approved and, on completion of the work, the Contractor shall obtain and deliver to the Owner a final certificate of acceptance.

1.9 TESTING

- A. The Contractor under each division shall at his own expense perform the various tests as specified and required by the Architect and as required by the State and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests. Notify the Architect a minimum of 24 hours in advance of all tests.

1.10 COORDINATION OF TRADES

- A. The Contractor shall be responsible for resolving all coordination required between trades. For example, items furnished under Division 22 which require electrical connections shall be coordinated with Division 26 for:
 - 1. Voltage
 - 2. Phase
 - 3. Ampacity
 - 4. No. and size of wires
 - 5. Wiring diagrams
 - 6. Starter size, details and location
 - 7. Control devices and details
- B. Items furnished under various sections which require plumbing connections shall be coordinated for services, pressure, size and location of connections, type of fuel, clearances for service, auxiliary devices required, etc.
- C. Items requiring insulation shall be fully insulated and that insulation shall be checked against manufacturer's directions and job requirements for suitability, coverage, thickness and finish.
- D. Items installed in/on finished ceilings shall be coordinated with the ceiling construction. The Contractor under each section shall conform to the reflected ceiling plan and shall secure details and/or samples of the ceiling materials as necessary to insure compatibility. Any device not conforming to this requirement shall be replaced by the Contractor at his expense.
- E. All items specified under Division 22 shall be installed tight, plumb, level, square and symmetrically placed in relation to the work of other trades.
- F. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- G. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- H. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified by Architect.

1.11 CUTTING AND PATCHING

- A. All cutting and patching for work under Division 22 shall be done by the Contractor under the section for which the trade is specified.

1.12 QUALITY ASSURANCE

- A. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.13 SUBSTITUTIONS

- A. Where a definite material or only one manufacturer's name is mentioned in these specifications, it has been done in order to establish a standard. The product of the particular manufacturer mentioned is of satisfactory construction and any substitution must be of quality as good as or better than the named article. No substitution shall be made without review by the Architect, who will be the sole judge of equality.
- B. The Contractor shall submit for approval a complete list of the materials he proposes to use. This list shall give manufacturers' names and designations corresponding to each and every item and the submission shall be accompanied by complete descriptive literature and/or any supplementary data, drawings, etc., necessary to give full and complete details.
- C. Should a substitution be accepted under the provisions of the conditions of these specifications, and should this substitute prove to be defective or otherwise unsatisfactory for the service for which it is intended within the guarantee period, the Contractor who originally requested the substitution shall replace the substitute material with the specified material.

1.14 INSTALLATION DRAWINGS

- A. It shall be incumbent upon the Contractor to prepare special drawings as called for elsewhere herein or as directed by the Architect to coordinate the work under each section, to illustrate changes in his work, to facilitate its concealment in finished spaces to avoid obstructions or to illustrate the adaptability of any item of equipment which he proposes to use.
- B. These drawings shall be used in the field for the actual installation of the work. Unless otherwise directed, they shall not be submitted for approval but three copies shall be provided to the Architect for his information.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.16 OPERATING INSTRUCTIONS

- A. The Contractor for each section of the work hereunder shall, in cooperation with the representatives of the manufacturers of the various equipment items, carefully instruct the Owner's representatives in the proper operation of each item of equipment and of each system. During the balancing and adjusting of systems, the Owner's representative shall be made familiar with all procedures.

1.17 OPERATING MANUALS

- A. Prepare and submit 3 copies of the operating manuals bound in hard covers. Three weeks prior to completion of the work, the Architect will check the manuals and any additional material necessary to complete the manuals shall be furnished and inserted by the Contractor.
- B. Manuals shall contain the following data:
 - 1. Catalogue data of all equipment.
 - 2. Shop drawings of all equipment.
 - 3. Temperature control drawings (reduced in size)
 - 4. Start-up instructions for major equipment.
 - 5. Trouble shooting procedures for major equipment.
 - 6. Wiring diagrams.
 - 7. Recommended maintenance schedule for equipment.
 - 8. Parts list for all items.
 - 9. Name and address of each vendor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Solvent Cements for Joining Plastic Piping:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 3. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.7 ACCESS DOORS

- A. Wherever plumbing equipment is installed and where future access is required through either walls or ceilings and such cannot be obtained through the removable ceiling or through other means, the Contractor shall provide Milcor Style "M" access doors at least 12 inches by 12 inches in size or larger if required for access. Provide access doors for all valves, etc. Provide Milcor Style "UFR" rated access panels as required for installation in rated construction.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump

sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

- a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- ### 3.2 PLUMBING DEMOLITION
- A. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- C. There are portions of the existing plumbing system, heating, ventilating and air conditioning system which shall remain in use to serve the finished building in conjunction with the indicated new installations. By actual examination at the site, each bidder shall determine those portions of the remaining present installations which must be relocated to avoid interferences with the installations of new work of his particular trade and that of all other trades. All such existing installations which interfere with new installations shall be relocated by the Contractor under the Division in which the existing material normally belongs, and in a manner as directed by the Architect.
- D. Failure to become familiar with the extent of the relocation work involved shall not relieve the Contractor of responsibility and shall not be used as a basis for additional compensation.
- E. The Contractor shall remove existing equipment, piping, duct, grilles, and other items associated with the mechanical and plumbing systems where shown on the drawings. Where such items are exposed to view or uncovered by any cutting or removal of general construction and has no continuing function (as determined by the Architect), they shall be removed by the contractor under the section in which the item normally falls. Existing items (see above) where concealed in/above construction which is not disturbed, abandon in place. Plug, cap, disconnect or otherwise render harmless all such items. All items or materials removed from the project shall be made available for the Owner's inspection. The Owner retains the option to claim any item or material. Contractor shall deliver any claimed item or material in good condition to the place designated by the Owner. All items not claimed become the property of the contractor and shall be removed from the site.

3.3 LOCATION AND DETECTION

- A. Below ground:
 1. Non-Metallic: Non-metallic pipe installed below ground shall have installed in the same trench a detectable plastic tape that conforms in to the APWA color coding as follows:
 - a. Orange – Telecommunications
 - b. Blue – Water
 - c. Green – Sanitary and Sewer Systems
 - d. Yellow – Gas
 2. Such tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be approved 2 1/8" wide and shall be imprinted with a continuous traceable for a minimum of eight years after direct burial. Product shall be Terra Tape Detectable or approved equal. Tape shall be installed per manufacturer's instructions, but no less than 12" above the buried line.
 3. Provide 16 gauge direct burial tracer wire with all non-metallic underground pipe. Wire shall be single strand, 14 gauge minimum with 4/64" vinyl insulation which is UL approved for direct underground burial when used in a National Electric Code Class II circuit.
- B. Metallic:
 1. Below ground metallic piping shall have identifying tape similar to that specified for below ground non-metallic except that the aluminum foil for location is not required.

3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.5 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.7 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish
- C. Paint all exposed pipe, cabinets, hangers and supports, and miscellaneous metal.
- D. Paint all insulated surfaces exposed to view, including piping, equipment, etc. size surfaces until a smooth, non grainy surface is obtained.
- E. Generally, painting is required on all surfaces such that no exposed bare metal or insulation surface is visible.
- F. Paint all surfaces above or behind perforated return air grilles or other open spaced air outlet devices with flat black paint. All pipes, conduits, ductwork and structural members shall be painted. These surfaces shall be painted a distance away from the grille such that no unpainted surfaces are visible to a person standing on the room side and viewing through the device.

END OF SECTION 220510

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
 - 2. Bronze swing check valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- 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 and plug 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.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Manufacturers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bray Controls; a division of Bray International.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. Mueller Steam Specialty; a division of SPX Corporation.
 - h. NIBCO INC.
 - i. Tyco Valves & Controls; a unit of Tyco Flow Control.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - k. Victaulic Company

B. Refer to valve schedule articles for applications of valves.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

D. Valve Sizes: Same as upstream piping unless otherwise indicated.

E. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.

F. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

G. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Lead-Free, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

- A. Class 150, Lead-Free, Bronze Swing Check Valves with Bronze Disc:

1. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.

- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball valves.
 - 2. Throttling Service: Ball valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
- B. 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.

END OF SECTION [220523](#)

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fastener systems.
 - 5. Pipe stands.
 - 6. Pipe positioning systems.
 - 7. Equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturred lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick 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.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 1-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: 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-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for

erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

- a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
 - P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
 - Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
 - R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 30 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.

END OF SECTION [220553](#)

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the plumbing piping.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 - 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - 4. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.

5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 1. All Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick. Vapor seal all insulation.
- B. Domestic Hot and Recirculated Hot Water:
 1. All Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.

1.3 SUBMITTALS

- A. Product Data: For the following products:
 - 1. Piping.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 5. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) NIBCO INC.
 - 2) Viega; Plumbing and Heating Systems.
 - b. ProPress Bronze Fittings: ½" thru 4" - ASME B16.18 and NSF 61, or NSF 61-G or cNSF@us-pw with Smart Connect (SC) feature and EPDM sealing element.
 - c. ProPress Copper Fittings: ½" thru 4" - ASME B16.22 and NSF 61, or NSF 61-G or cNSF@us-pw, with Smart Connect (SC) feature and EPDM sealing element.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- C. ProPress fittings shall be joined utilizing appropriately sized Ridged Press Tools.

2.4 TRANSITION FITTINGS

- A. General Requirements:
 1. Same size as pipes to be joined.
 2. Pressure rating at least equal to pipes to be joined.
 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Plastic-to-Metal Transition Fittings:
 1. Description: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install domestic water piping level with 0.25 percent slope downward toward drain.
- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping adjacent to equipment and specialties to allow service and maintenance.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

- R. Install thermostats in hot-water circulation piping.
- S. Install thermometers on inlet and outlet piping from each water heater.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
- U. Install sleeve seals for piping penetrations of concrete walls and slabs.
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- F. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.
- G. ProPress Joints: shall be installed per the following installation guidelines:
 - 1. Copper tube ends shall be cut square. The inside of the tube end shall be reamed to the full inside diameter of the tube and the outside of the tube end chamfered to remove any outside burrs. The outside of the tube end shall be cleaned with a clean cotton cloth to remove grease oil or dirt.
 - 2. Fittings shall be inspected to make sure the sealing element is properly seated into the fitting. The sealing element is pre lubricated with a food grade lubricant. No field lubrication shall be applied to the sealing element.
 - 3. Copper tube ends shall be inserted into the fitting to the full insertion depth of the fitting cup. A mark shall be made on the tube wall at the interface of the tube and fitting. Always insure the tube is fully inserted into the fitting prior to pressing the joint.
 - 4. Always make sure the appropriately sized jaw or ring and actuator is selected for the joint being pressed. The Ridged XL Ring Kit shall be used to press 2-1/2" thru 4" bronze fittings. A Ridged XLC Ring Kit shall be used to press 2-1/2" thru 4" copper fittings.
 - 5. Installers shall attend a Viega installation training class prior to installation.
- H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.11 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.12 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Clean non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.

- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 PIPING SCHEDULE

- A. Under-building-slab, domestic water, building service piping shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and brazed joints.
- B. Aboveground domestic water piping shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
 - 2. ½" thru 4" ProPress fittings with Smart Connect (SC) feature and EPDM sealing element.

3.14 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves.
 - 2. Throttling Duty: Use ball valves.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Backflow preventers.
 - 2. Drain valves.
 - 3. Water hammer arresters.
 - 4. Air vents.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. 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.
- B. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 REFER TO PLUMBING FIXTURE SCHEDULE ON DRAWINGS FOR ADDITIONAL SPECIALTIES

2.2 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.3 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. PPP Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper Shell, hydro-pneumatic air cushion and O-Ring sealed piston.
4. Size: PDI WH-2010 Sizes A through F.

2.4 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- E. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- F. Install water hammer arresters in water piping according to PDI-WH 201.
- G. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly, and, double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- C. Cast Iron Soil Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval from the engineer.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install steel piping according to applicable plumbing code.
- N. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.
- O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- P. Install aboveground PVC piping according to ASTM D 2665.
- Q. Install underground PVC piping according to ASTM D 2321.
- R. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- S. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors.
- V. Install sleeve seals for piping penetrations of concrete walls and slabs.
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

- A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting[, **valve,**] and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 2. NPS 3: 48 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- F. Install supports for vertical PVC piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.5 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection (8 hours), water level must not drop more than 1". Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.7 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.8 PIPING SCHEDULE

- A. Aboveground, soil and waste piping shall be the following:
 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Underground, soil, waste, and vent piping shall be the following:
 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION [221316](#)

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Miscellaneous sanitary drainage piping specialties.
 - 5. Flashing materials.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 REFER TO PLUMBING FIXTURE SCHEDULE ON DRAWINGS FOR ADDITIONAL SPECIALTIES

2.2 ROOF FLASHING ASSEMBLIES

A. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

2.4 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Install deep-seal traps on floor drains and other waste outlets.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Install wood-blocking reinforcement for wall-mounting-type specialties.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Direct-vent, gas-fired, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: One year.

PART 2 - PRODUCTS

2.1 GAS WATER HEATERS

- A. Direct-Vent, Storage, Gas Water Heaters: Comply with ANSI Z21.10.1/CSA 4.1.
 1. Manufacturers:
 - a. Lochinvar Corp.
 - b. Rheem Water Heater Div.; Rheem Manufacturing Company.
 - c. Ruud Water Heater Div.; Rheem Manufacturing Company.
 - d. Smith, A. O. Water Products Company.
 - e. State Industries, Inc.
 2. Natural gas water heater(s) shall meet scheduled capacities on drawings.
 3. Water heater(s) shall:
 - a. Modulating gas burner that automatically adjusts the input based on demand.
 - b. Powered anodes that are non sacrificial and maintenance free.
 - c. Have seamless glass-lined steel tank construction, with glass lining applied to all waterside surfaces after the tank has been assembled and welded;
 - d. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1;
 - e. Have foam insulation and a CSA Certified and ASME rated T&P relief valve;
 - f. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up; 7. Be approved for 0" clearance to combustibles.
 4. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. 1. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 – CSA 4.3 standards governing storage type water heaters; 2. Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.
 5. Water heater should incorporate the iCOMM™ system for remote monitoring, leak detection and fault alert.
 6. Direct-Vent System: Through-wall or roof, coaxial- or double-channel, concentric vent assembly with water heater manufacturers' outside intake/exhaust screen.

2.2 COMPRESSION TANKS

- A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - 1. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.

2.3 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
 - 1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
- E. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- F. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4. Drain pans shall be a minimum of 3" deep.
- G. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- H. Mixing Valve:
 - 1. Lead free digital water temperature control and monitoring system shall feature 3.5" full-color touchscreen interface which is configurable on location and does not require factory pre-programming. System shall control water temperature to +/- 2°F in accordance with ASSE 1017 and resist "temperature creep" during periods of low/zero demand. Controller shall be password protected and feature a user-adjustable outlet temperature range of 60 - 180°F with high and low temperature alerts, and an approach temperature of 2°F. System shall digitally control and monitor mixed outlet temperature. Controller shall integrate with building automation systems (separate module not required) through BACnet and Modbus protocols and feature local and remote temperature alarms. System will feature a user-set, high-temperature sanitization mode for thermal disinfection of bacteria and a programmable temperature set back feature to improve energy efficiency. System will also feature high speed actuator with override feature. In the event of a power failure, system will open full cold supply. In case of a loss of cold water, the system will close hot water supply. Valve and controller shall be listed/approved to ASSE 1017, cUPC, NSF, CSA 24/UL873 and BTL (BACnet Testing Laboratories) System shall be equal to a pre-piped Powers LFIS100VLSYS100RTN as shown on drawings. Provide with circulating pump as shown on drawings.

2.4 PLASTIC VENT MATERIALS

- A. CPVC Plastic, Schedule 40 Pipe: ASTM F 441/F 441M.
 - 1. CPVC Plastic, Schedule 40 Fittings: ASTM F 438, socket type.
 - 2. CPVC Solvent Cement: ASTM F 493.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Domestic-Water Heater Mounting
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
 - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- F. Install thermometer on outlet piping of domestic-water heaters.
- G. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Division 22 Section "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 224100 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes plumbing fixtures and related components:

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. 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.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

PART 2 - PRODUCTS

2.1 REFER TO DRAWINGS FOR PLUMBING FIXTURE SCHEDULE

2.2 GENERAL REQUIREMENTS

A. Manufacturers for plumbing fixtures and related trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Fixtures:
 - 1) Kohler Co.
 - 2) American Standard Co.
 - 3) Sloan Valve Company
 - 4) Toto
- b. Faucets:
 - 1) T&S Brass
 - 2) Chicago Faucet
 - 3) Delta Commercial
 - 4) Sloan Valve Company
 - 5) Moen Commercial
- c. Flushometers
 - 1) Sloan Valve Company
 - 2) Zurn Industries (AV)
 - 3) Toto
 - 4) American Standard
- d. Seats
 - 1) Bemis Manufacturing
 - 2) Centoco Manufacturing
 - 3) Church
- e. Sinks
 - 1) Elkay Manufacturing Co
 - 2) Just Manufacturing Co
 - 3) Sloan
- f. Carriers
 - 1) Josam Company
 - 2) MIFAB, Inc.
 - 3) Smith, Jay R. Mfg
 - 4) Tyler Pipe; Wade Div
 - 5) Watts Drainage Products
 - 6) Zurn Plumbing Products Group
- g. Mop Basins
 - 1) Stern-Williams
 - 2) Fiat
- h. P-Traps, Stops and Supplies

- 1) McGuire Manufacturing
- 2) Kohler Co.
- 3) Brasscraft
- 4) Chicago Faucet
- 5) T&S Brass

2.3 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Piping Enclosures, provide on all sinks and lavatories with exposed trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Plumberex
 - b. TRUEBRO, Inc.
 2. Description: Insulate per ADA 4.19.4 and or IBC all exposed lavatories drain piping, hot/cold stops and supplies. Protectors will consist of molded closed cell PVC, with anti-fungal and anti-microbial properties. To be one piece continuous smooth design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- D. Install wall-mounting fixtures with tubular waste piping attached to supports.
- E. Install counter-mounting fixtures in and attached to casework.
- F. Install fixtures level and plumb according to roughing-in drawings.

- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 15 Section "Valves."
- H. Install semi cast brass trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. Install trap-seal liquid in dry urinals.
- N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- P. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- Q. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 16 Section "Grounding and Bonding."
- D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.
- D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 230510 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Escutcheons.
 - 3. HVAC demolition.
 - 4. Equipment installation requirements common to equipment sections.
 - 5. Painting and finishing.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

1.5 GENERAL REQUIREMENTS

- A. In general, the lines and ducts to be installed by the various trades under these specifications shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards as to complete the work in a neat and satisfactorily workable manner. The following is a general outline concerning the running of various lines and ducts and is to be excepted where the drawings or conditions at the building necessitate deviating from these standards.
- B. All piping and ductwork for the mechanical trade shall be concealed in chases in finished areas, except as indicated on the drawings. Horizontal lines run in areas that have ceilings shall be run concealed in those ceilings, unless otherwise specifically indicated or directed.
- C. Piping and ductwork may be run exposed in machinery and equipment spaces, where serving as connections to equipment items in finished rooms where exposed connections are required, and elsewhere as indicated on the drawings or required.
- D. The Contractor shall thoroughly acquaint himself with the details of the construction and finishes before submitting his bid as no allowances will be made because of the Contractor's unfamiliarity with these details. Place all inserts in masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.
- E. The mechanical plans do not give exact details as to elevations of lines and ducts, exact locations, etc., and do not show all the offsets, control lines, pilot lines and other installation details. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to provide proper grading of lines, to avoid all obstruction, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.
- F. The mechanical plans do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with other sections. Minor relocations necessitated by the conditions at the site or as directed by the Architect shall be made without any additional cost accruing to the Owner.
- G. The contractor for the work under each section of these specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- H. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.
- I. The Contractor shall be responsible for the proper fitting of his material and apparatus into the space. Should the particular equipment which any bidder proposes to install require other space conditions than those indicated on the drawings, he shall arrange for such space with the Architect before submitting his bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such necessary changes at his (the Contractor's) own expense.
- J. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans. The drawings shall be checked by the Architect before the work is started. Any conflict with the building conditions shall be corrected by the Contractor before the work proceeds.

- K. Order of precedence shall be observed in laying out the pipe, ductwork, material, and conduit in order to fit the material into the space above the ceiling and in the chases and walls. The following order shall govern:
1. Items affecting the visual appearance of the inside of the building such as lighting fixtures, diffusers, grilles, outlets, panelboards, etc. Coordinate all items to avoid conflicts at the site.
 2. Lines requiring grade to function such as sewers, roof drains and condensate drains.
 3. Large ducts and pipes with critical clearances.
 4. Conduit, water lines, and other lines whose routing is not critical and whose function would not be impaired by bends and offsets.
- L. Piping and ducts serving outlets on items of equipment shall be run in the most appropriate manner. Where the equipment has built-in chases, the lines shall be contained therein. Where the equipment is of the open type, the lines shall be run as close as possible to the underside of the top and in a neat and inconspicuous manner.
- M. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through windows, doorways or shafts, shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed.
- N. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before the contract is signed. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus, material, or equipment.
- O. The Contractor shall distinctly understand that the work described herein and shown on the accompanying drawings shall result in a finished and working job, and any item required to accomplish this intent shall be included whether specifically mentioned or not.
- P. Each bidder shall examine the plans and specifications for the General Construction. If these documents show any item requiring work under Division 23 and that work is not indicated on the respective "M" drawings, he shall notify the Architect in sufficient time to clarify before bidding. If no notification is received, the Contractor is assumed to require no clarification, and shall install the work as indicated on the General Plans in accordance with the specifications.
- Q. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings. Any difference which may be found shall be submitted to the Architect for consideration before proceeding with the work.
- R. The accompanying plans do not indicate completely the existing mechanical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

1.6 SUBMITTALS

- A. Wherever shop drawings/submittals are called for in these specifications, they shall be furnished by the Contractor for the work involved after review by the Architect as to the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job and failure on the part of the Contractor to comply shall render him liable to stand the expense of

any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary details. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary and should there be any charges in connection with this, they shall be borne by the Contractor.

- B. Shop drawings will be reviewed by the Architect for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Review by the Architect and any action by the Architect in marking shop drawings is subject to the requirements of the entire contract documents. Contractor will be held responsible for quantities, dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of all trades and the satisfactory performance of his work.
- C. Shop drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission of individual items shall designate the exact item offered and shall clearly identify the item with the project.
- D. All shop drawings shall be submitted at one time and shall consist of a bound catalogue of all shop drawings under each section, properly indexed and certified that they have been checked by the Contractor.
- E. The omissions of any material from the shop drawings which has been shown on the contract drawings or specified, even though reviewed by the Architect, shall not relieve the Contractor from furnishing and erecting same.

1.7 PERMITS, FEES, ETC.

- A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall arrange for all utility services, including sewer, water and gas services as applicable. If any charges are made by any of the utility companies due to the work on this project, the Contractor shall pay these charges, including charges for metering, connection, street cutting, etc. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.8 LAWS, CODES, AND ORDINANCES

- A. All work shall be executed in strict accordance with all local, state and national codes, ordinances and regulations governing the particular class of work involved, as interpreted by the inspecting authority. The Contractor shall be responsible for the final execution of the work under this heading to suit those requirements. Where these specifications and the accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect, shall prepare any supplemental drawings required illustrating how the work may be installed so as to comply and, on approval, make the changes at no cost to the Owner. On completion of the various portions of the work the installation shall be tested by the constituted authorities, approved and, on completion of the work, the Contractor shall obtain and deliver to the Owner a final certificate of acceptance.

1.9 TESTING

- A. The Contractor under each division shall at his own expense perform the various tests as specified and required by the Architect and as required by the State and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests. Notify the Architect a minimum of 24 hours in advance of all tests.

1.10 COORDINATION OF TRADES

- A. The Contractor shall be responsible for resolving all coordination required between trades. For example, items furnished under Division 23 which require electrical connections shall be coordinated with Division 26 for:
 - 1. Voltage
 - 2. Phase
 - 3. Ampacity
 - 4. No. and size of wires
 - 5. Wiring diagrams
 - 6. Starter size, details and location
 - 7. Control devices and details
- B. Items furnished under various sections which require plumbing connections shall be coordinated for services, pressure, size and location of connections, type of fuel, clearances for service, auxiliary devices required, etc.
- C. Items requiring insulation shall be fully insulated and that insulation shall be checked against manufacturer's directions and job requirements for suitability, coverage, thickness and finish.
- D. Items installed in/on finished ceilings shall be coordinated with the ceiling construction. The Contractor under each section shall conform to the reflected ceiling plan and shall secure details and/or samples of the ceiling materials as necessary to insure compatibility. Any device not conforming to this requirement shall be replaced by the Contractor at his expense.
- E. All items specified under Division 23 shall be installed tight, plumb, level, square and symmetrically placed in relation to the work of other trades.
- F. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- G. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- H. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified by Architect.

1.11 CUTTING AND PATCHING

- A. All cutting and patching for work under Division 23 shall be done by the Contractor under the section for which the trade is specified.

1.12 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.13 SUBSTITUTIONS

- A. Where a definite material or only one manufacturer's name is mentioned in these specifications, it has been done in order to establish a standard. The product of the particular manufacturer mentioned is of satisfactory construction and any substitution must be of quality as good as or better than the named article. No substitution shall be made without review by the Architect, who will be the sole judge of equality.
- B. The Contractor shall submit for approval a complete list of the materials he proposes to use. This list shall give manufacturers' names and designations corresponding to each and every item and the submission shall be accompanied by complete descriptive literature and/or any supplementary data, drawings, etc., necessary to give full and complete details.
- C. Should a substitution be accepted under the provisions of the conditions of these specifications, and should this substitute prove to be defective or otherwise unsatisfactory for the service for which it is intended within the guarantee period, the Contractor who originally requested the substitution shall replace the substitute material with the specified material.

1.14 USE OF SYSTEMS

- A. It is considered that it will be necessary to operate the mechanical systems to provide heating and ventilation in portions of the building that are enclosed. As systems or portions of systems become operable, they shall be operated as required to maintain habitable conditions in enclosed portions of the building that are still under construction and portions that are fully complete as may be required to properly protect installed piping, equipment and finishes.
- B. In order to provide protection to ducts, plenums, etc. install temporary filters over or in return air openings until all finished painting is completed. Protect supply outlets, coils, etc. as necessary in each case.
- C. Except for operation of cooling equipment to prove its performance and to adjust and balance the systems, that equipment will not be operated for comfort of construction workers.
- D. During warm weather the Contractor shall arrange for the operation of systems to supply 100 percent outside air. The systems controls shall be reset to their normal cycle of operation in each case during the times that heating is required and when the cooling equipment is operated.
- E. Immediately prior to the time that the systems are to be accepted by the Owner, each system shall be carefully examined and if ductwork is dirty, it shall be carefully cleaned by men skilled in that type of work. All filters shall be put in first class condition by replacement of filters and/or other procedures as directed.
- F. The use of the equipment for maintaining environmental and/or protective temperature conditions shall in no way constitute acceptance of that equipment and the connected piping, ducts, insulation, finishes, etc. by the Owner. Furthermore, it shall in no way shorten the guarantee period hereinafter specified. The Contractor shall either secure extended warranties from the vendors of equipment or shall purchase insurance to provide proper coverage on the equipment through the guarantee period and shall file with the Architect substantiating affidavits from equipment manufacturers or a copy of the insurance policy

covering the equipment through the guarantee period. The personal underwriting of the Contractor for equipment manufacturers' warranties is not acceptable, but his personal underwriting of piping, ductwork, insulation and associated materials is acceptable subject to the provisions of the contract.

- G. The Contractor shall provide such labor as may be required in the operation of the systems and shall pay all costs.

1.15 INSTALLATION DRAWINGS

- A. It shall be incumbent upon the Contractor to prepare special drawings as called for elsewhere herein or as directed by the Architect to coordinate the work under each section, to illustrate changes in his work, to facilitate its concealment in finished spaces to avoid obstructions or to illustrate the adaptability of any item of equipment which he proposes to use.
- B. These drawings shall be used in the field for the actual installation of the work. Unless otherwise directed, they shall not be submitted for approval but three copies shall be provided to the Architect for his information.

1.16 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.17 OPERATING INSTRUCTIONS

- A. The Contractor for each section of the work hereunder shall, in cooperation with the representatives of the manufacturers of the various equipment items, carefully instruct the Owner's representatives in the proper operation of each item of equipment and of each system. During the balancing and adjusting of systems, the Owner's representative shall be made familiar with all procedures.

1.18 OPERATING MANUALS

- A. Prepare and submit 3 copies of the operating manuals bound in hard covers. Three weeks prior to completion of the work, the Architect will check the manuals and any additional material necessary to complete the manuals shall be furnished and inserted by the Contractor.
- B. Manuals shall contain the following data:
 - 1. Catalogue data of all equipment.
 - 2. Shop drawings of all equipment.
 - 3. Temperature control drawings (reduced in size)
 - 4. Start-up instructions for major equipment.
 - 5. Trouble shooting procedures for major equipment.
 - 6. Wiring diagrams.
 - 7. Recommended maintenance schedule for equipment.
 - 8. Parts list for all items.
 - 9. Name and address of each vendor.

PART 2 - PRODUCTS

2.1 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.2 ACCESS DOORS

- A. Wherever mechanical and/or plumbing equipment is installed and where future access is required through either walls or ceilings and such cannot be obtained through the removable ceiling or through other means, the Contractor shall provide Milcor Style "M" access doors at least 12 inches by 12 inches in size or larger if required for access. Provide access doors for all fire dampers, smoke dampers, valves, etc. Provide Milcor Style "UFR" rated access panels as required for installation in rated construction.

2.3 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to

2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

- 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 MECHANICAL DEMOLITION

- A. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- C. There are portions of the existing plumbing system, heating, ventilating and air conditioning system which shall remain in use to serve the finished building in conjunction with the indicated new installations. By actual examination at the site, each bidder shall determine those portions of the remaining present installations which must be relocated to avoid interferences with the installations of new work of his particular trade and that of all other trades. All such existing installations which interfere with new installations shall be relocated by the Contractor under the Division in which the existing material normally belongs, and in a manner as directed by the Architect.
- D. Failure to become familiar with the extent of the relocation work involved shall not relieve the Contractor of responsibility and shall not be used as a basis for additional compensation.
- E. The Contractor shall remove existing equipment, piping, duct, grilles, and other items associated with the mechanical and plumbing systems where shown on the drawings. Where such items are exposed to view or uncovered by any cutting or removal of general construction and has no continuing function (as determined by the Architect), they shall be removed by the contractor under the section in which the item normally falls. Existing items (see above) where concealed in/above construction which is not disturbed,

abandon in place. Plug, cap, disconnect or otherwise render harmless all such items. All items or materials removed from the project shall be made available for the Owner's inspection. The Owner retains the option to claim any item or material. Contractor shall deliver any claimed item or material in good condition to the place designated by the Owner. All items not claimed become the property of the contractor and shall be removed from the site.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish
- C. Paint all exposed pipe, cabinets, hangers and supports, and miscellaneous metal.
- D. Paint all exposed sheet metal.
- E. Paint all insulated surfaces exposed to view, including piping, equipment, etc. size surfaces until a smooth, non grainy surface is obtained.
- F. Generally, painting is required on all surfaces such that no exposed bare metal or insulation surface is visible.

- G. Paint all surfaces above or behind perforated return air grilles or other open spaced air outlet devices with flat black paint. All pipes, conduits, ductwork and structural members shall be painted. These surfaces shall be painted a distance away from the grille such that no unpainted surfaces are visible to a person standing on the room side and viewing through the device.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

END OF SECTION 230510

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fastener systems.
 - 5. Pipe stands.
 - 6. Pipe positioning systems.
 - 7. Equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturred lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick 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.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 1-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: 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-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for

erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

- a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
 - P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
 - Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
 - R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 30 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.

END OF SECTION 230553

SECTION 230590 – TEMPERATURE REGULATION

PART 1: GENERAL

1.1 Products Furnished but Not Installed Under This Section

- A. Section 23 09 13.43 - Control Dampers
 - 1. Automated Dampers

1.2 Description

- A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.
- B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet.
- C. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.
- D. System shall use the BACnet protocol for communication between the control modules and web server. Communication between the web server and the user's browser shall be HTTP or HTTPS protocol utilizing HTML5. Use of Adobe Flash technology is not acceptable.

1.3 Approved BMS Systems

- A. **Automated Logic by CCSI Controls Lubbock – No exceptions.**

1.4 Quality Assurance

- A. Installer and Manufacturer Qualifications
 - 1. Installer shall have an established working relationship with the Control System Manufacturer and have, as a minimum, 5 years demonstrated experience with installation and support of the manufacturer's product.
 - 2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.5 Codes and Standards

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to the receipt of bids of the following codes:
 - 1. National Electric Code (NEC)
 - 2. International Building Code (IBC)
 - 3. International Mechanical Code (IMC)
 - 4. Underwriters Laboratories (UL/CUL)
 - 5. ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Systems

1.6 System Performance

- A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for display through the user's web browser.
 - 1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
 - 2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
 - 3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.

4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the browser within 45 sec.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each user, connected to network accessing the system through their browser (workstation), shall receive alarms within 5 seconds of one another.
9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

Table-1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C (±1°F)
Ducted Air	±0.5°C (±1°F)
Outside Air	±1.0°C (±2°F)
Dew Point	±1.5°C (±3°F)
Water Temperature	±0.5°C (±1°F)
Delta-T	±0.15° (±0.25°F)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO ₂)	±50 ppm

Note 1: Accuracy applies to 10%–100% of scale

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0–1.5 kPa (0–6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0°C (±2.0°F)	
Duct Temperature	±1.0°C (±2.0°F)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1.0 in. w.g.)	MPa (1–150 psi) 0–12.5 kPa (0–50 in. w.g.) differential

1.7 Submittals

- A. Product Data and Shop Drawings: The contractor shall provide shop drawings and product data on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide submittal data in a digital format on suitable digital media such as a USB drive. The submittal data shall be in standard Microsoft (Word, Excel, etc.) or PDF file formats. The shop drawings shall be formatted to fit on 11" x 17" pages and hardware/software product data shall be formatted to fit on 8.5" x 11" pages. When manufacturer's cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:
1. DDC System Hardware
 - a. A complete bill of materials to be used indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
 - b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
 - i. Direct digital controllers (controller panels)
 - ii. Transducers and transmitters
 - iii. Sensors (including accuracy data)
 - iv. Actuators
 - v. Valves
 - vi. Relays and switches
 - vii. Control panels
 - viii. Power supplies
 - ix. Batteries
 - x. Operator interface equipment
 - xi. Wiring
 - c. Wiring diagrams and layouts for each control panel. Show termination numbers.
 - d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware. Riser diagrams showing control network layout, communication protocol, and wire types.
 2. Central System Hardware and Software
 - a. A complete bill of material of equipment used indicating quantity, manufacturer, model number, and relevant technical.
 - b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:
 - i. Central Processing Unit (CPU) or web server
 - ii. Monitors
 - iii. Keyboards
 - iv. Power supplies
 - v. Battery backups
 - vi. Interface equipment between CPU or server and control panels
 - vii. Operating System software – web server
 - viii. Color graphic software
 - ix. Third-party software
 - c. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show interface wiring to control system.
 - d. Network riser diagrams of wiring between central control unit and control panels.
 3. Controlled Systems
 - a. Riser diagrams showing control network layout, communication protocol, and wire types.
 - b. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.

- c. A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
 - d. An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
 - e. A mounting, wiring, and routing plan-view drawing. The design shall take into account HVAC, electrical, and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.
 - f. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
 - g. A point list for each control system. List I/O points and software points required to provide specified sequence of operations. Indicate alarmed and trended points.
4. Quantities of items submitted shall be reviewed but are the responsibility of the Contractor.
 5. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.
- B. Project Documentation.
1. Upon completion of installation, submit record (as-built) documents for approval before final completion. Provide record documents in a digital format on suitable digital media such as a USB drive. The record documents shall be in standard Microsoft (Word, Excel, etc.) or PDF file formats except as noted below. Record documentation shall include the following:
 - a. Project Record Drawings.
 - b. Testing and Commissioning Reports and Checklists.
 - c. Operation and Maintenance (O&M) Manual.
 - d. As-built versions of submittal product data.
 - e. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
 - f. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
 - g. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - h. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 - i. Documentation of programs operating in the system and object database that can be viewed using technician software tools furnished with system.
 - j. Graphic files, programs, and database to be viewed using technician software tools furnished with system.
 - k. List of recommended spare parts with part numbers and suppliers.
 - l. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
 - m. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
 - n. Licenses, guarantees, and warranty documents for equipment and systems.
 - o. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
 2. Load into the control system for access by the operator through any operator workstation closeout documentation. There shall be a menu or navigation tab to access the documentation. The documentation can be loaded into the control system in a pdf format. The following documentation shall be included:
 - a. As-built control diagrams including wiring diagrams and sequences of operations for each controller/piece of equipment.
 - b. All IOM data as follows:
 - i. IOM from each equipment manufacturer for each piece of equipment (AHUs, FCUs, Chillers, pumps etc.)
 - ii. IOM for each control module and end device installed in the system.

- C. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.8 Warranty

A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If the engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. All Manufacturer's software/firmware for web server/workstation and controllers shall be updated to the latest versions that are available from the manufacturer within 30 days from the date of end of the warranty. These updates shall be installed and checked out before the end of the warranty.
5. Provide updates to web server software, project-specific software, graphic software, database software, and firmware that resolve the contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
6. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired and factory recertified. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.9 Ownership of Proprietary Material

- A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
 1. Graphics
 2. Record drawings
 3. Database
 4. Application programming code
 5. Documentation

PART 2: PRODUCTS

2.1 Wiring and Raceways

2.2 Materials

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.3 Communication

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
- B. All IP based controllers shall be capable of providing IPv4 and IPv6 protocol standards as defined by the Internet Data Communications Standard.
- C. The owner shall furnish and install all communication media, connectors, repeaters and network switches/routers, and network devices necessary to provide a complete and workable high speed Ethernet communications/LAN network meeting or exceeding recommended control network specifications. The owner will provide an active IP/Ethernet port/drop within patch distance to each BMS server and BMS controller for connection to owner's LAN. BMS contractor will furnish and install all communications media,

- connectors, repeaters, switches/routers, and network devices necessary to provide a complete and workable serial network. Established network requirements such as labeling, testing, administration, and documentation must be provided to controls vendor prior to start of project.
- D. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
 - E. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
 - 1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
 - 2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified sequences of operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
 - F. BACnet Secure Connect (BACnet/SC). BACnet/SC is a datalink option that makes the full use of TLS WebSocket connections as defined by addendum bj to the ANSI/ASHRAE Standard 135.
 - 1. The BMS contractor shall furnish and install a network designed to allow for implementation of BACnet/SC. The network shall be installed with as many devices capable of using BACnet/SC at time of installation.
 - 2. The BMS contractor shall furnish and install all BACnet workstations/servers, routers, and building controllers capable of using BACnet/SC. Any BACnet workstations/servers, routers, or building controllers that do not have BACnet/SC capability at time of installation shall have the ability to provide BACnet/SC capability with a software/firmware update/patch. BACnet/SC capability shall not require the physical replacement of the BACnet workstation/server, router, or building controller hardware.
 - G. Building Control Panels, and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.
 - H. System shall be expandable to at least twice the required BACnet objects. No additional licensing/software fees shall be required to add controllers, associated devices, and wiring.
 - I. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards. Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the system.
 - 1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.
 - 2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.
 - 3. For read or write requests, the system shall require user name and password authentication and shall support TLS (Transport Layer Security) or equivalent data encryption.
 - 4. System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.

2.4 Operator Interface

- A. Operator Interface. The web server shall reside on high-speed network with building controllers. Web pages generated by this server shall be compatible with the latest versions of Microsoft Internet Explorer or Edge, Google Chrome, Mozilla Firefox, and Apple Safari browsers. Any of these supported browsers connected to the server shall be able to access all system information. Mobile devices shall be recognized by the web server and shall supply the appropriate system content as needed. The Operator Interface (web server with client devices) shall conform to the BACnet Operator Workstation (B-OWS) or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L. This includes the ability to configure and/or reconfigure the system from the client device (change programs, graphics, labels, etc.).
- B. Communication. Web server and controllers shall communicate using BACnet protocol, including BACnet/SC. Web server and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

Communication between the web server and client (workstation) shall be HTTP or HTTPS protocol utilizing HTML5 language. Use of Adobe Flash in any part of the communication infrastructure is not acceptable.

C. Hardware.

1. Web server and/or workstation. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified elsewhere in this document. The web server may also be configured in client/server fashion to accommodate a "workstation" definition. In "workstation" configuration, the workstation will also perform as a server supplying additional clients as needed. The following hardware requirements apply:
 - a. System storage shall have sufficient memory to accommodate:
 - i. All required system software.
 - ii. A DDC database to accommodate, as a minimum, twice the size of the delivered system database.
 - iii. One year of archival trend data based on the points specified to be trended at their specified trend intervals.
 - b. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.
 - c. Minimum hardware configuration shall include the following:
 - i. Quad Core Processor
 - ii. 4-24 GB RAM (size dependent on size of system)
 - iii. 500 GB hard disk providing data at 3.0 Gb/sec (size dependent on historical data storage requirements)
 - iv. 16x DVD+/-RW drive
 - v. Qwerty Keyboard
 - vi. Optical Mouse
 - vii. 24-inch LED Color monitor with 75Hz refresh rate and 1080P resolution to provide a minimum screen resolution of 1920 x 1080 pixels.
 - viii. Serial (USB) and network communication ports, with cables as required for proper DDC system operation.

D. System Software.

1. Operating System. Web server shall have an industry-standard professional-grade operating system. Operating system shall meet or exceed the BMS manufacturer's minimum requirements for their software. Acceptable systems include Microsoft Windows 8.1 or 10, Windows Server 2012 R2 or 2016 or 2019 or 2020, Red Hat Enterprise Linux 8.3, or Ubuntu Desktop 18.04 or 20.04 LTS.
2. Security. The web server application shall support Transport Layer Security (TLS) 1.3 capable of encryption of up to 256 bit elliptical curve for transmitting private information over the Internet using HTTPS. Additionally, the web server shall have SHA-2 certificate support capability.
3. Database. System shall support any JDBC (Java DataBase Connectivity) compliant engine. This includes: MS SQL, My SQL, Apache Derby, PostgreSQL and Oracle.
4. The BMS system shall allow an unlimited number of concurrent users.
5. The BMS manufacturer shall provide all software and tools necessary to provide the following capabilities:
 - a. Create and/or edit any programming used in controllers
 - b. Create and/or edit any graphics used in the system
 - c. Software shall not be subscription based and be given to owner at time of turnover. If software is subscription based, manufacturer shall include 10 years of subscription service.
 - d. The owner shall have the ability to install software on a minimum of five (5) additional owner furnished computers without additional licenses or fees.
6. System Graphics. The operator interface software shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
 - a. Minimum graphics resolution shall be 1920 x 1080 for display of detailed system graphics.
 - b. Floor Plan Graphics. Floor plan graphics shall be capable of allowing the floor plan graphic to dynamically size relative to the end user's monitor resolution.

- c. **Functionality.** Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.
 - d. **Animation.** Graphics shall be able to animate by displaying different image files for changed object status.
 - e. **Alarm Indication.** Indicate areas or equipment in an alarm condition using color or other visual indicator.
 - f. **Format.** Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, GIF, or SVG. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in or shall only require widely available no-cost plug-ins.
 7. **Custom Graphics.** Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system used to create and modify graphics that are saved in the same formats as are used for system graphics.
 8. **Graphics Library.** Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
- E. **System Applications.** System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on a standard PC type personal computer with no limit on the number of copies that can be installed under the system license.
 1. **Automatic System Database Configuration.** Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.
 2. **Manual Controller Memory Download.** Operators shall be able to download memory from the system database to each controller.
 3. **System Configuration.** The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password.
 4. **On-Line Help.** Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
 5. **Security.** Each operator shall be required to log on to the system with user name and password in order to view, edit, add, or delete data.
 - a. **Operator Access.** The user name and password combination shall define accessible viewing, editing, adding, and deleting privileges for that operator. Users with system administrator rights shall be able to create new users and edit the privileges of all existing users. System administrators shall also be able to vary and deny each operator's privileges based on the geographic location, such as the ability to edit operating parameters in Building A, to view but not edit parameters in Building B, and to not even see equipment in Building C.
 - b. **Password Policy Rules.** System administrator shall invoke policies for minimum password strength, including number of characters, special characters and numbers, upper and lower case, etc.
 - c. **Automatic Log Out.** Automatically log out each operator if no keyboard or mouse activity is detected. This auto logoff time period shall be user-adjustable.
 - d. **Encrypted Security Data.** Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
 6. **System Diagnostics.** The system shall automatically monitor the operation of all building management panels and controllers. The failure of any device shall be annunciated to the operator.
 7. **Alarm Processing.** System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system

- object. Configure and enable alarm points as required by sequences of operation. Alarms shall be BACnet alarm objects and shall use BACnet alarm services. BMS system shall be capable of assigning alarm sources to categories such as HVAC Critical, or HVAC General. The BMS shall include at a minimum HVAC and FDD categories. BMS system shall allow user to create custom alarm categories.
8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying on acronyms or mnemonics.
 9. Alarm Reactions. Operator shall be able to configure (by object) what, if any actions are to be taken during an alarm. As a minimum, the workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send SMS text, and audibly annunciate.
 10. Alarm and Event log. Operators shall be able to view all system alarms and changes of state from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and delete alarms, and archive closed alarms to the workstation or web server hard disk.
 11. Trend Logs. The operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified by the sequences of operation. Trends shall be BACnet trend objects.
 12. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object or property in the system. The status shall be available by menu, on graphics, or through custom programs.
 13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.
 14. Audit and Security Detail. All users accessing the system shall have their actions recorded. Information recorded shall include:
 - a. Login/logout time and date
 - b. System modifications - with before and after values
 - c. Ability to report user activity based on individual and/or date and time.
 15. Standard Reports. Furnish the following standard system reports:
 - a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
 - b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
 - c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:
 - i. Alarm History.
 - ii. Trend Data. Operator shall be able to select trends to be logged.
 16. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface. Operator shall be able to schedule reports to automatically run and be emailed to recipients on a recurring basis from the BMS system.
 17. Logic Page. System shall allow operator to view all application software in real time for all controllers furnished and installed by BMS manufacturer.
 18. Environmental Index. System shall monitor all occupied zones and compile an index that provides a numerical indication of the environmental comfort within the zone. As a minimum, this indication shall be based upon the deviation of the zone temperature from the heating or cooling setpoint. If humidity is being measured within the zone then the environmental index shall be adjusted to reflect a lower comfort level for high or low humidity levels. Similarly, if carbon dioxide levels are being measured as an indication of ventilation effectiveness then the environmental index shall be adjusted to indicate degraded comfort at high carbon dioxide levels. Other adjustments may be made to the environmental index based upon additional measurements. The system shall maintain a trend of the environmental index for each zone in the trend log. The system shall also compute an average comfort index for every building included in this contract and maintain trendlogs of these building

environmental indices. Similarly, the system shall compute the percentage of occupied time that comfortable conditions were maintained within the zones. Through the UI the user shall be able to add a weighting factor to adjust the contribution of each zone to the average index based upon the floor area of the zone, importance of the zone, or other static criteria.

19. Indoor Environmental Quality Index (IEQ)
 - a. System shall monitor up to ten building conditions and compile an index that provides a numerical indication of the overall building environmental quality and health. A graphical dashboard indicating each measured building condition name, a description of each measured building condition, the current value of each measured building condition, and the overall building IEQ value. In addition, an historical trend graph of the IEQ Index and/or individual health components shall also be displayed. The IEQ numerical value indication shall be 0-100 with 0 being the worst and 100 the best. The IEQ shall be calculated using an algorithm that aggregates all of the selected building conditions and allows the user to define the acceptable ranges for each monitored building condition. In addition, the user shall have the ability assign a weighting/importance factor to each building condition that determines the impact the monitored building condition has on the overall IEQ index calculation. The IEQ value graphical representation shall have the ability to display one of a minimum of four (4) colors based on the IEQ value and the user adjustable range for each color. The default IEQ ranges and colors shall be as follows:
 - i. Less than 85 = Red
 - ii. 85 to 89.9 = Orange
 - iii. 90 to 94.9 = Yellow
 - iv. 95 to 100 = Green
 - b. The system shall allow the user to select from one of the following ten building conditions:
 - i. Temperature, average area
 - ii. Humidity, average area
 - iii. Carbon Dioxide, average area
 - iv. Volatile Organic Compounds, average area
 - v. % Dirty Filters, % dirty filter switches
 - vi. % Occupied, of expected occupants
 - vii. Air Purifiers, Total counted purifiers
 - viii. % OA of Design, % Total OA cfm of buildings design
 - ix. CFM per Person, Average outside air flow per occupant
 - x. % Time Above minimum, % of time outside air dampers are above the minimum when occupied (average of all)
20. Time Span Graphic Replay. Operator shall be able to “replay” any graphic in the system to see how key values changed over an operator-selected period of time. Operator shall be able to select the starting date/time for this display and the end date/time or the display period. System shall then display the graphic as it would have looked at the beginning of that period, displaying key data, dynamic colors, etc. based upon values recorded at the start time. When the operator starts the replay the graphics and key values shall dynamically change to produce the effect of “fast forwarding” through the designated period of time. Once the system has been operational for at least 30 days, the contractor shall demonstrate that up to 24 hours of data from within the last 30 days can be replayed on any graphic page. Owner’s representative shall choose the graphic pages for this demonstration at the time of the demonstration.
21. Semantic Tagging. The BMS system shall include a semantic tagging engine that uses the Project Haystack library of descriptive tagging for building equipment and systems used in the BMS. The Project Haystack naming tags used by the BMS shall be a library that includes a comprehensive list of standard tag names to address common equipment, building systems, and device types. The library of tag names shall include at a minimum the tag names listed in ASHRAE Standard 223P.
22. Network Health Monitoring.
 - a. The BAS shall allow for monitoring of the network system health through the use of a remote cloud based analytics platform. The BAS vendor shall provide to the owner a baseline report of the building network health at project completion and then once again at the end of the warranty period. The health monitoring application provides insights into the health of the BAS system for system maintenance and usage. This application will provide at a minimum the following information for the BAS network:

- i. BAS Server
 - 1) Online status/availability
 - 2) CPU and memory usage
 - 3) JAVA Container Health: Memory usage patterns and allocation to overall server resources
 - ii. BACnet Controllers
 - 1) Memory usage: Controller flash and database utilization
 - 2) Critical errors: Controller and watchdog errors
 - 3) Network communications health: Transmit and receive patterns and identification of controllers that may be causing errors
 - iii. Network System Inventory
 - 1) BAS Server software version
 - 2) Controller driver versions
 - 3) Controller upgrade requirements
 - b. At the completion of the warranty period, the owner shall have the option of continuing the remote network health monitoring service as part of an ongoing service contract negotiated with the BAS provider for an additional fee.
 23. Trend Export (add-on). The BMS shall allow user to specify, manage, and export trend source data to a .CSV file. User can export the files on-demand at any time or at scheduled intervals allowing user to process or analyze trend data outside of the building automation system. Up to two years of trend data can be exported.
- F. Workstation Application Editors. Each PC or browser workstation shall support editing of all system applications. The applications shall be downloaded and executed at one or more of the controller panels.
1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.
 2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and schedule type. Exception schedules and holidays shall be shown clearly on the calendar. The start and stop times for each object shall be adjustable from this interface.
 3. Custom Application Programming. Provide the tools to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:
 - a. Language. Language shall be graphically based or English oriented. If graphically based, language shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks. If English language oriented, language shall be based on the syntax of BASIC, FORTRAN, C, or PASCAL, and shall allow for free-form programming that is not column-oriented or "fill-in-the-blanks."
 - b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.
 - c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.
 - d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.
 - e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
 - f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.
 - g. Variables. Operator shall be able to use variable values in program conditional statements and mathematical functions.

- i. Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.
- ii. System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

2.5 Controller Software

- A. All controller software applications shall reside and operate in the system controllers.
- B. All application software in controllers furnished by BMS manufacturer shall be editable through operator workstation, web browser interface, or workstation.
- C. Each controller furnished by BMS manufacturer shall have all of its local on board software applications backed up and saved to the BMS web server. In the event of a controller failure, the BMS server shall download backed up software applications to replacement controller. Controllers furnished by others and integrated into the BMS are not required to be backed up to BMS server.
- D. Furnish the following applications for building and energy management:
 1. System Security.
 2. Scheduling. Provide the capability to execute control functions according to a user created or edited schedule. Each schedule shall provide the following schedule options as a minimum:
 - a. Weekly Schedule. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).
 - b. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule has executed, the system shall discard and replace the exception schedule with the standard schedule for that day of the week.
 - c. Holiday Schedules. Provide the capability for the operator to define up to 24 special or holiday schedules. These schedules will be repeated each year. The operator shall be able to define the length of each holiday period.
 3. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.
 4. Binary Alarms. Each binary object shall have the capability to be configured to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
 5. Analog Alarms. Each analog object shall have both high and low alarm limits. The operator shall be able to enable or disable these alarms.
 6. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display on graphics.
 7. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.
 8. Demand Limiting.
 - a. The demand-limiting program shall monitor building power consumption from a building power meter (provided by others) which generates pulse signals or a BACnet communications interface. An acceptable alternative is for the system to monitor a watt transducer or current transformer attached to the building feeder lines.
 - b. When power consumption exceeds adjustable levels, system shall automatically adjust setpoints, de-energize low-priority equipment, and take other programmatic actions to reduce demand as specified in in sequences of operation. When demand drops below adjustable levels, system shall restore loads as specified.
 9. Maintenance Management. The system shall be capable of generating maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified in sequences of operation.
 10. Sequencing. Application software shall sequence chillers, boilers, and pumps as specified in sequences of operation.
 11. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and

- PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs. The calculation interval, PID gains, and other tuning parameters shall be adjustable by a user with the correct security level.
12. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.
 13. Energy Calculations.
 - a. The system shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.
 - b. The system shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.
 14. Anti-Short Cycling. All binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.
 15. On and Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and a setpoint. The algorithm shall be direct-acting or reverse-acting.
 16. Runtime Totalization. Provide software to totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as required by sequences of operation.

2.6 Controllers

- A. General. Provide an adequate number of Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified by system performance. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L. Unless otherwise specified, hardwired actuators and sensors may be used in lieu of communicating actuators, communicating sensors, BACnet Smart Actuators and BACnet Smart Sensors.
- B. BACnet.
 1. Building Controllers (BCs). Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.
 2. Advanced Application Controllers (AACs). Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
 3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.
 4. Smart Actuators (SAs). An actuator which is controlled by a network connection rather than a binary or analog signal (0-10v, 4-20mA, relay, etc.). Each SA shall conform to BACnet Smart Actuator (B-SA) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SA in the BACnet Testing Laboratories (BTL) Product Listing.
 5. Smart Sensors (SSs). A sensor which provides information to the BAS via network connection rather than a binary or analog signal (0-10000 ohm, 4-20mA, dry contact, etc.). Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.
 6. BACnet Communication.
 - a. Building Controllers (BC). Each BC shall connect to a network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol using BACnet/IP or BACnet/SC.
 - b. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
 - c. Each AAC shall connect to a network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol using BACnet/IP or BACnet/SC.
 - d. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
 - e. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

- f. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.
- C. Security.
1. Provide BACnet firewall capability, as defined in the BACnet standard.
- D. Building Controllers (BC)
1. Communication
 - a. Network Connection. Controller shall support a single point ethernet connection.
 - b. Ethernet Port. Provide one (1) Gig-E port capable of full duplex communication up to 1000 Mbps
 - c. Service Port. Provide one (1) ethernet port for connection to a Portable Operator's Terminal.
 - d. Serial Port. Provide two (2) serial ports for communication to serial BACnet or serial Modbus networks.
 - e. Signal Management. BC shall have the ability to manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
 - f. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
 - g. Stand-Alone Operation. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network such as outdoor air conditions, supply air or water temperature coming from source equipment, etc.
 2. Environment. Controller hardware shall be suitable for anticipated ambient conditions.
 - a. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
 - b. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
 3. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to a field-removable modular terminal strip or to a termination card connected by a ribbon cable. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.
 4. Real-time Clock. Controller shall have a real-time clock to keep track of time in the event of a power failure for up to three (3) days.
 5. Memory
 - a. Controller memory shall support operating system, database, and programming requirements.
 - b. Each BC shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.
- E. Advanced Application/Specific Controllers (AAC/ASC)
1. Communication
 - a. Network Connection. Controller shall support a single point ethernet connection or a daisy-chained ethernet connection using the Spanning Tree Protocol (STP).
 - b. Ethernet Port. Provide two (2) 10/100 Base T ethernet ports with ethernet switching capability.
 - c. Service Port. Provide one (1) USB port for connection to a Portable Operator's Terminal or a display.
 - d. Serial Port. Provide two (2) serial ports for communication to serial BACnet or serial Modbus networks.
 - e. Stand-Alone Operation. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network such as outdoor air conditions, supply air or water temperature coming from source equipment, etc.

2. Environment. Controller hardware shall be suitable for anticipated ambient conditions.
 - a. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
 - b. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
3. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to a field-removable modular terminal strip or to a termination card connected by a ribbon cable. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.
4. Real-time Clock. Controller shall have a real-time clock to keep track of time in the event of a power failure for up to three (3) days.
5. Memory
 - a. Controller memory shall support operating system, database, and programming requirements.
 - b. Each AAC shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.
- F. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
- G. Transformer. Power supply shall be fused or current limiting and shall be rated at a minimum of 125% of controller power consumption.

2.7 Input and Output Interface

- A. General. Hard-wire input and output points to BCs, AACs, or ASCs.
- B. Protection. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground shall cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no controller damage.
- C. Binary Inputs. Binary inputs shall allow the monitoring of ON/OFF signals from remote devices. Binary inputs shall sense dry contact closure without application of power external to the controller.
- D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall also accumulate up to 10 pulses per second.
- E. Analog Inputs. Analog inputs shall monitor low-voltage (0–10 Vdc), current (4–20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary Outputs. Binary outputs shall provide for ON/OFF operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on Building Controllers shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.
- G. Analog Outputs. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0–10 Vdc or a 4–20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.
- H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.
- I. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.
- J. Communicating Sensors. Controller shall be capable of using hardwired sensors or an option of using communicating sensors connected to a dedicated sensor network port. The dedicated sensor network shall be capable of monitoring the following communicating sensors:
 1. Temperature
 2. Humidity
 3. CO₂
 4. VOC
 5. Occupancy
 6. Motion

2.8 Power Supplies and Line Filtering

- A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
 - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
 - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
 - b. Line voltage units shall be UL recognized and CSA listed.
- B. Power Line Filtering.
 - 1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
 - a. Dielectric strength of 1000 V minimum
 - b. Response time of 10 nanoseconds or less
 - c. Transverse mode noise attenuation of 65 dB or greater
 - d. Common mode noise attenuation of 150 dB or greater at 40–100 Hz

Features	Model				
	ZS Standard	ZS Plus	ZS Pro	ZS Pro-M	ZS Pro-F
Temp	×	×	×	×	×
RH Available		×	×	×	×
CO2 Available		×	×	×	×
VOC Available		×	×		×
Motion Sensing				×	
Fan Speed Control					×
Clg/Htg/Fan Only Mode Control					×
°F to °C Conversion Button					×
Push Button Override		×	×	×	×
Setpoint Adjust		×	×	×	×
LCD Display			×	×	×
Alarm Indicator			×	×	×

- 2. Duct Sensors
 - a. Duct Point Temperature Sensors
 - i. Sensor: Thermistor type
 - ii. Range: 20°F to 120°F (-5°C to 50°C)
 - iii. Environmental Operating Range: -40° to 158°F (-40°C to 70°C), 0-100% RH, non-condensing
 - iv. Accuracy: ±0.36°F (0.5°C)
 - v. Enclosure: Polycarbonate with NEMA 4, IP66 rating and UL94V-0 flammability rating, closed cell foam shall be utilized to seal the insertion hole and absorb vibration
 - vi. Probe: Stainless steel of sufficient length (4" or 8") for size of duct.
 - vii. Provide Automated Logic ZSD-B-X-6-B or approved equal
 - b. Duct Humidity Sensors
 - i. Sensor shall be integral to duct temperature sensor housing
 - ii. Range: 10 to 90% RH

- iii. Environmental Operating Range: -40°F to 158°F (-40°C to 70°C), 0-100% RH, non-condensing
- iv. Accuracy: ±2% at less than 0.5% drift per year
- v. Provide Automated Logic ZSD-BH-6-6-B or approved equal
- c. Averaging Temperature Sensors
 - i. Sensor: Thermistor type
 - ii. Range: 20°F to 120°F (-5°C to 50°C)
 - iii. Environmental Operating Range: -40°F to 158°F (-40°C to 70°C), 0-100% RH, non-condensing
 - iv. Accuracy: ±0.36°F (0.5°C)
 - v. Enclosure: Polycarbonate with NEMA 4, IP66 rating and UL94V-0 flammability rating, closed cell foam shall be utilized to seal the insertion hole and absorb vibration
 - vi. Probe: Stainless steel of sufficient length (8', 12' or 24') for size of duct.
 - vii. Provide Automated Logic ZSA-B-X-6-B or approved equal
- 3. Pipe Sensors
 - a. Immersion Temperature Sensors
 - i. Sensor: Thermistor type, double encapsulated to be watertight
 - ii. Range: -40°F to 212°F (-40°C to 100°C)
 - iii. Accuracy: ±1.3°F (0.5°C)
 - iv. Enclosure: Polycarbonate with NEMA 4, IP66 rating and UL94V-0 flammability rating, closed cell foam shall be utilized to seal the insertion hole and absorb vibration
 - v. Probe: Stainless steel of sufficient length (2" or 4") for size of pipe. Install in stainless steel or brass thermowell to accommodate pipe material.
 - vi. Provide Automated Logic ZSI-B-X-6-B with thermowell ZSI-T-2-X-B or approved equal.
 - b. Pipe Clamp-On Temperature Sensors
 - i. Sensor: Thermistor type with bendable copper sensing plate that forms to the curvature of the pipe along with an adjustable hose clamp that holds the unit in place around the pipe
 - ii. Range: -40°F to 212°F (-40°C to 100°C)
 - iii. Accuracy: ±1.3°F (0.5°C)
 - iv. Enclosure: Polycarbonate with NEMA 4, IP66 rating and UL94V-0 flammability rating, closed cell foam shall be utilized to seal the insertion hole and absorb vibration
 - v. For pipe sizes from 2" to 4 ½"
 - vi. Provide Automated Logic ZSS-B-2-6-B or approved equal.

2.9 Local Control Panels

- A. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
- B. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
- C. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.10 Wiring and Raceways

- A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.
- B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3: EXECUTION

- 3.1 Section Includes
- 3.2 Examination
- 3.3 Protection
- 3.4 Coordination
- 3.5 General Workmanship

- 3.6 Field Quality Control
- 3.7 Wiring
- 3.8 Communication Wiring
- 3.9 Fiber Optic Cable
- 3.10 Installation of Sensors
- 3.11 Flow Switch Installation
- 3.12 Actuators
- 3.13 Warning Labels
- 3.14 Identification of Hardware and Wiring
- 3.15 Controllers
- 3.16 Programming
- 3.17 Control System Checkout and Testing
- 3.18 Control System Demonstration and Acceptance
- 3.19 Cleaning
- 3.20 Training
- 3.21 Sequences of Operation
- 3.22 Control Valve Installation
- 3.23 Control Damper Installation
- 3.24 Smoke Damper Installation
- 3.25 Duct Smoke Detection

3.1 Start-Up and Checkout Procedures Examination

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and at the expense of—this contractor.

3.2 Protection

- A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.
- B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 Coordination

- A. Site
 - 1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
 - 2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.
- B. Test and Balance.
 - 1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
 - 2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
 - 3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.

4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.
- C. Life Safety.
 1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in sequences of operation.
 2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as specified in sequences of operation.
 3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.
- D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
 1. All communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.2 (Communication).
 2. Each supplier of a controls product is responsible for the configuration, programming, start up, and testing of that product to meet the sequences of operation described in Section 23 09 93.
 3. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
 4. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
 5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.4 General Workmanship

- A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 Field Quality Control

- A. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.8 (Codes and Standards).
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.
- C. Contractor shall have work inspection by local and/or state authorities having jurisdiction over the work.

3.6 Wiring

- A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification, Where the requirements of this section differ from Division 26, the requirements of this section shall take precedence.
- B. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.
- C. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.
- D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.
- E. All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway at levels below 3 m (10ft).

- F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
- G. Do not install wiring in raceway containing tubing.
- H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.
- I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
- J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
- K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
- M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- O. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.
- P. Include one pull string in each raceway 2.5 cm (1 in.) or larger.
- Q. Use color-coded conductors throughout with conductors of different colors.
- R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
- S. Conceal all raceways except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g. steam pipes or flues).
- T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- U. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.
- V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.
- W. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- X. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.
- Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.7 Communication Wiring

- A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.
- B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling
- C. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.
- D. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- E. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
- F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to manufacturer's instructions.
- G. All runs of communication wiring shall be unspliced length when that length is commercially available.
- H. All communication wiring shall be labeled to indicate origination and destination data.
- I. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
- J. BACnet IP, Arcnet, or MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:

1. IP
 - a. The network shall use Cat5e or greater cabling for connections.
 - b. Custom made patch cables must use either the T568A or T568 wiring standard and must use the same standard on both ends of the cable.
2. Arcnet
 - a. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 nominal. Distributed capacitance between conductors shall be less than 12.5 pF per foot (41 pF per meter.)
 - b. The maximum length of an Arcnet segment is 610 meters (2000 ft) with AWG 22 cable.
 - c. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.
 - d. An Arcnet network shall have no T connections
3. MS/TP
 - a. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot.)
 - b. The maximum length of an MS/TP segment is 1200 meters (4000 ft) with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485.
 - c. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.
 - d. An MS/TP EIA-485 network shall have no T connections.

3.8 Fiber Optic Cable

- A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
- B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

3.9 Installation of Sensors

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by wall framing.
- D. All wires attached to sensors shall be sealed in their raceways or in the wall to stop air transmitted from other areas from affecting sensor readings.
- E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.
- F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (10 ft) of sensing element for each 1 m² (1 ft²) of coil area.
- G. Do not install temperature sensors within the vapor plume of a humidifier. If installing a sensor downstream of a humidifier, install it at least 3 m (10 ft) downstream.
- H. All pipe-mounted temperature sensors shall be installed in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.
- I. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.
- J. Differential Air Static Pressure.
 1. Supply Duct Static Pressure. Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
 2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.
 3. Building Static Pressure. Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.
 4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.

5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
6. All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shut-off valves installed before the tee.
- K. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.
- L. Install humidity sensors for duct mounted humidifiers at least 3 m (10 ft) downstream of the humidifier. Do not install filters between the humidifier and the sensor.

3.10 Flow Switch Installation

- A. Use correct paddle for pipe diameter.
- B. Adjust flow switch according to manufacturer's instructions.

3.11 Actuators

- A. General. Mount and link control damper actuators according to manufacturer's instructions.
 1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
 2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 3. Provide all mounting hardware and linkages for actuator installation.
- B. Electric/Electronic
 1. Dampers: Actuators shall be direct mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° travel available for tightening the damper seal. Actuators shall be mounted following manufacturer's recommendations.
 2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.12 Warning Labels

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the control system.
 1. Labels shall use white lettering (12-point type or larger) on a red background.
 2. Warning labels shall read as follows.
 - a. **C A U T I O N**: This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.
- B. Permanent warning labels shall be affixed to all motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
 1. Labels shall use white lettering (12-point type or larger) on a red background.
 2. Warning labels shall read as follows.
 - a. **C A U T I O N**: This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.13 Identification of Hardware and Wiring

- A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with control system address or termination number.
- B. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.
- C. Permanently label or code each point of field terminal strips to show the instrument or item served.
- D. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- E. Identify all other control components with permanent labels. All plug-in components shall be labeled such that label removal of the component does not remove the label.
- F. Identify room sensors related to terminal boxes or valves with nameplates.
- G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
- H. Identifiers shall match record documents.

3.14 Controllers

- A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
- B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in sequences of operation.

3.15 Programming

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging.
- B. Point Naming. Coordinate with owner for point naming conventions. Name points as shown on the equipment points list provided with each sequence of operation or as directed by owner. If character limitations or space restrictions make it advisable to shorten the name, abbreviations as coordinated with owner may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.
- C. Software Programming.
 - 1. Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Embed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
 - a. Text-based:
 - i. Must provide actions for all possible situations
 - ii. Must be modular and structured
 - iii. Must be commented
 - b. Graphic-based:
 - i. Must provide actions for all possible situations
 - ii. Must be documented
 - c. Parameter-based:
 - i. Must provide actions for all possible situations
 - ii. Must be documented.
- D. Operator Interface.
 - 1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points List or sequence of operation.
 - 2. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

3.16 Control System Checkout and Testing

- A. Startup Testing. All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.
 - 1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
 - 2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
 - 3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.
 - 4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
6. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.
7. Alarms and Interlocks:
 - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
 - b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
 - c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

3.17 Control System Demonstration and Acceptance

A. Demonstration.

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
3. The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.
5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
6. Demonstrate compliance with Part 1, "System Performance."
7. Demonstrate compliance with sequences of operation through all modes of operation.
8. Demonstrate complete operation of operator interface.
9. Additionally, the following items shall be demonstrated:
 - a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
 - b. Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.
 - c. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
 - d. Interface to the building fire alarm system.
 - e. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall

cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.
- B. Acceptance.
1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.
 2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, "Submittals."

3.18 Cleaning

- A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
- B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
- C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.19 Training

- A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.
- B. Training shall enable students to accomplish the following objectives.
 1. Day-to-day Operators:
 - a. Proficiently operate the system
 - b. Understand control system architecture and configuration
 - c. Understand DDC system components
 - d. Understand system operation, including DDC system control and optimizing routines (algorithms)
 - e. Operate the workstation and peripherals
 - f. Log on and off the system
 - g. Access graphics, point reports, and logs
 - h. Adjust and change system set points, time schedules, and holiday schedules
 - i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
 - j. Understand system drawings and Operation and Maintenance manual
 - k. Understand the job layout and location of control components
 - l. Access data from DDC controllers and ASCs
 - m. Operate portable operator's terminals
 2. Advanced Operators:
 - a. Make and change graphics on the workstation
 - b. Create, delete, and modify alarms, including annunciation and routing of these
 - c. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals
 - d. Create, delete, and modify reports
 - e. Add, remove, and modify system's physical points
 - f. Create, modify, and delete programming
 - g. Add panels when required
 - h. Add operator interface stations
 - i. Create, delete, and modify system displays, both graphical and others
 - j. Perform DDC system field checkout procedures

- k. Perform DDC controller unit operation and maintenance procedures
 - l. Perform workstation and peripheral operation and maintenance procedures
 - m. Perform DDC system diagnostic procedures
 - n. Configure hardware including PC boards, switches, communication, and I/O points
 - o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
 - p. Adjust, calibrate, and replace system components
3. System Managers/Administrators:
- a. Maintain software and prepare backups
 - b. Interface with job-specific, third-party operator software
 - c. Add new users and understand password security procedures
- C. Organize the training into sessions or modules for the three levels of operators listed above. (Day-to-Day Operators, Advanced Operators, System Managers and Administrators). Students will receive one or more of the training packages, depending on knowledge level required.
- D. Provide course outline and materials according to the "Submittals" article in Part 1 of this specification. Provide one copy of training material per student.
- E. The instructor(s) shall be factory-trained and experienced in presenting this material.
- F. Classroom training shall be done using a network of working controllers representative of installed hardware.

3.20 Sequences of Operation

- A. See Section 23 Sequences of Operation

3.21 Control Valve Installation

- A. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.
- B. Slip-stem control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position. Ball type control valves shall be installed with the stem in the horizontal position.
- C. Valves shall be installed in accordance with the manufacturer's recommendations.
- D. Control valves shall be installed so that they are accessible and serviceable and so that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.
- E. Isolation valves shall be installed so that the control valve body may be serviced without draining the supply/return side piping system. Unions shall be installed at all connections to screw-type control valves.
- F. Provide tags for all control valves indicating service and number. Tags shall be brass, 1.5 inch in diameter, with ¼ inch high letters. Securely fasten with chain and hook. Match identification numbers as shown on approved controls shop drawings.

3.22 Control Damper Installation

- A. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
- B. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure ¼ in. larger than damper dimensions and shall be square, straight, and level.
- C. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8 in.) of each other.
- D. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
- E. Install extended shaft or jackshaft according to manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)
- F. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.
- G. Provide a visible and accessible indication of damper position on the drive shaft end.
- H. Support ductwork in area of damper when required to prevent sagging due to damper weight.
- I. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

3.23 Smoke Damper Installation

- A. The contractor shall coordinate all smoke and smoke/fire damper installation, wiring, and checkout to ensure that these dampers function properly and that they respond to the proper fire alarm system general, zone, and/or detector trips. The contractor shall immediately report any discrepancies to the engineer no less than two weeks prior to inspection by the code authority having jurisdiction.
- B. Provide complete submittal data to controls system subcontractor for coordination of duct smoke detector interface to HVAC systems.

3.24 Duct Smoke Detection

- A. Submit data for coordination of duct smoke detector interface to HVAC systems as required in Part 1, "Submittals."
- B. This Contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

3.25 Start-Up and Checkout Procedures

- A. Start up, check out, and test all hardware and software and verify communication between all components.
 1. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
 2. Verify that all analog and binary input/output points read properly.
 3. Verify alarms and interlocks.
 4. Verify operation of the integrated system.^{23 09 93} Sequence of Operations for HVAC Controls

PART 4: SEQUENCE OF OPERATIONS

1.1 Roof Top Unit (typical of 5)

Run Conditions - Scheduled:

The unit shall run according to a user definable time schedule in the following modes:

- Occupied Mode: The unit shall maintain
 - A 72°F (adj.) cooling setpoint
 - A 68°F (adj.) heating setpoint.
- Unoccupied Mode (night setback): The unit shall maintain
 - A 85°F (adj.) cooling setpoint.
 - A 55°F (adj.) heating setpoint.

Alarms shall be provided as follows:

- High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
- Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Zone Setpoint Adjust:

The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Optimal Start:

The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

Zone Unoccupied Override:

A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Smoke Detection:

The unit shall shut down and generate an alarm upon receiving a smoke detector status.

Fan:

The fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

Cooling Stage:

The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, the stage shall have a user definable (adj.) minimum runtime.

The cooling shall be enabled whenever:

- Outside air temperature is greater than 60°F (adj.).
- AND the zone temperature is above cooling setpoint.
- AND the fan is on.

Gas Heating Stage:

The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, the stage shall have a user definable (adj.) minimum runtime.

The heating shall be enabled whenever:

- Outside air temperature is less than 65°F (adj.).
- AND the zone temperature is below heating setpoint.
- AND the fan is on.

Economizer:

The controller shall measure the zone temperature and modulate the mixed air dampers in sequence to maintain the zone cooling setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open whenever occupied.

The economizer shall be enabled whenever:

- Outside air temperature is at least 3°F (adj.) less than the Zone Temperature.
- AND the outside air temperature is less than 75°F (adj.)

The economizer shall close whenever the freezestat (if present) is on.

The outside air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.

Filter Differential Pressure Monitor:

The controller shall monitor the differential pressure across the filter.

Filter Hours:

The controller shall monitor the fan runtime.

Alarms shall be provided as follows:

- Filter Change Required: Filter has been in use for more than 2200 hrs (adj.).

Discharge Air Temperature:

The controller shall monitor the discharge air temperature.

Alarms shall be provided as follows:

- High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
- Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

Fan Status:

The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.
- Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

Environmental Index:

When the zone is occupied, the controller will monitor the deviation of the zone temperature from the heating or cooling setpoint and calculate a 0 - 100% Environmental Index which gives an indication of how well the zone is maintaining comfort. The controller will also calculate the percentage of time since occupancy began that the Environmental Index is 70% or higher. Optionally, a weighting factor can be configured to adjust the contribution of the zone to the rollup average index based upon the floor area of the zone, importance of the zone, or other static criteria.

Point Name	Hardware Points				Software Points							Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Discharge Air Temp	x									x		x
Zone Setpoint Adjust	x											x
Zone Temp	x									x		x
Fan Status			x									x
Smoke Detector			x							x	x	x
Zone Override			x							x		x
Cooling Stage 1				x						x		x
Cooling Stage 2				x						x		x
Fan Start/Stop				x						x		x
Heating Stage 1				x						x		x
Cooling Setpoint					x					x		x
Environmental Index					x					x		
Heating Setpoint					x					x		x
Percent of Time Satisfied					x					x		
Schedule									x			
Compressor Runtime Exceeded											x	
Fan Failure											x	
Fan in Hand											x	
Fan Runtime Exceeded											x	
Filter Change Required											x	
High Discharge Air Temp											x	
High Zone Temp											x	
Low Discharge Air Temp											x	
Low Zone Temp											x	
Totals	3	0	3	4	4	0	0	1	12	10	12	

Total Hardware (10)

Total Software (27)

1.2 Exhaust Fan - 1, 2 & 3 (typical of 2)

Run Conditions - Scheduled:

The fan shall run according to a user definable schedule.

Fan:

The fan shall have a user definable (adj.) minimum runtime.

Fan Status:

The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.
- Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

Point Name	Hardware Points				Software Points						Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	
Fan Status			x						x		x
Fan Start/Stop				x					x		x
Schedule								x			
Fan Failure										x	
Fan in Hand										x	
Fan Runtime Exceeded										x	
Totals	0	0	1	1	0	0	0	1	2	3	2

Total Hardware (2)

Total Software (6)

1.3 Unit Heater (typical of 1)

Run Conditions - Scheduled:

The unit shall run according to a user definable time schedule in the following modes:

- Occupied Mode: The unit shall maintain a heating setpoint of 70°F (adj.).
- Unoccupied Mode (night setback): The unit shall maintain a heating setpoint of 65°F (adj.).

Alarms shall be provided as follows:

- Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Zone Setpoint Adjust:

The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Optimal Start:

The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

Zone Unoccupied Override:

A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Fan:

The fan shall run anytime the zone temperature drops below heating setpoint, unless shutdown on safeties.

Heating Coil Valve:

The controller shall measure the zone temperature and modulate the heating coil valve to maintain its heating setpoint.

The heating shall be enabled whenever:

- Outside air temperature is less than 65°F (adj.).
- AND the zone temperature is below heating setpoint.
- AND the fan is on.

Discharge Air Temperature:

The controller shall monitor the discharge air temperature.

Alarms shall be provided as follows:

- High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
- Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

Fan Status:

The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.
- Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

Environmental Index:

When the zone is occupied, the controller will monitor the deviation of the zone temperature from the heating or cooling setpoint and calculate a 0 - 100% Environmental Index which gives an indication of how well the zone is maintaining comfort. The controller will also calculate the percentage of time since occupancy began that the Environmental Index is 70% or higher. Optionally, a weighting factor can be configured to adjust the contribution of the zone to the rollup average index based upon the floor area of the zone, importance of the zone, or other static criteria.

Point Name	Hardware Points				Software Points							Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Discharge Air Temp	x								x		x	
Zone Setpoint Adjust	x										x	
Zone Temp	x								x		x	
Heating Valve		x							x		x	
Fan Status			x						x		x	
Zone Override			x						x		x	
Fan Start/Stop				x					x		x	
Environmental Index					x				x			
Heating Setpoint					x				x		x	
Percent of Time Satisfied					x				x			
Schedule								x				
Fan Failure										x		
Fan in Hand										x		
Fan Runtime Exceeded										x		
High Discharge Air Temp										x		
Low Discharge Air Temp										x		
Low Zone Temp										x		
Totals	3	1	2	1	3	0	0	1	9	6	8	

Total Hardware (7)

Total Software (19)

1.4 Radiant Tube Heater RH-1 & 2 (typical of 2)

Run Conditions - Continuous:

The unit shall run continuously and shall maintain a heating setpoint of 68°F (adj.).

Alarms shall be provided as follows:

- Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Electric Heating Stage:

The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, the stage shall have a user definable (adj.) minimum runtime.

The heating shall be enabled whenever:

- Outside air temperature is less than 65°F (adj.).
- AND the zone temperature is below heating setpoint.

Environmental Index:

When the zone is occupied, the controller will monitor the deviation of the zone temperature from the heating or cooling setpoint and calculate a 0 - 100% Environmental Index which gives an indication of how well the zone is maintaining comfort. The controller will also calculate the percentage of time since occupancy began that the Environmental Index is 70% or higher. Optionally, a weighting factor can be configured to adjust the contribution of the zone to the rollup average index based upon the floor area of the zone, importance of the zone, or other static criteria.

Point Name	Hardware Points				Software Points						Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	
Zone Temp	x								x		x
Heating Stage 1				x					x		x
Environmental Index					x				x		
Heating Setpoint					x				x		x
Percent of Time Satisfied					x				x		
Low Zone Temp										x	
Totals	1	0	0	1	3	0	0	0	5	1	3

Total Hardware (2)

Total Software (9)

1.6 Drive Through Gas Detection (typical of 1)

Drive Through Gas Detection:

The gas detection system shall be provided with relays for pre-alarm, high alarm and full alarm thresholds. The BAS shall monitor available relays for alarm logging and annunciation at the BAS front end.

Point Name	Hardware Points				Software Points						Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	
Totals	0	0	0	0	0	0	0	0	0	0	0
Total Hardware (0)					Total Software (0)						

1.8 Mini Split Heat Pump (typical of 1)

Run Conditions - Scheduled:

The unit shall run according to a user definable time schedule in the following modes:

- Occupied Mode: The unit shall maintain
 - A 70°F (adj.) cooling setpoint
 - A 68°F (adj.) heating setpoint
- Unoccupied Mode (night setback): The unit shall maintain
 - A 85°F (adj.) cooling setpoint.
 - A 55°F (adj.) heating setpoint.

Alarms shall be provided as follows:

- High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
- Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Zone Setpoint Adjust:

The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Optimal Start:

The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

Zone Unoccupied Override:

A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Fan:

The fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

Heating and Cooling - 1 Compressor Stage:

The controller shall measure the zone temperature and cycle the compressor to maintain its setpoint. To prevent short cycling, the stage shall have a user definable (adj.) minimum runtime. The compressor shall run subject to its own internal safeties and controls.

The heating shall be enabled whenever:

- Outside air temperature is less than 65°F (adj.).

- AND the fan is on.
- AND the reversing valve is in heat mode.

The cooling shall be enabled whenever:

- Outside air temperature is greater than 60°F (adj.).
- AND the fan is on.
- AND the reversing valve is in cool mode.

On mode change, the compressor shall be disabled and remain off until after the reversing valve has changed position..

Alarms shall be provided as follows:

- Compressor Runtime Exceeded: The compressor runtime exceeds a user definable limit (adj.).

Discharge Air Temperature:

The controller shall monitor the discharge air temperature.

Alarms shall be provided as follows:

- High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
- Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

Fan Status:

The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.
- Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

Environmental Index:

When the zone is occupied, the controller will monitor the deviation of the zone temperature from the heating or cooling setpoint and calculate a 0 - 100% Environmental Index which gives an indication of how well the zone is maintaining comfort. The controller will also calculate the percentage of time since occupancy began that the Environmental Index is 70% or higher. Optionally, a weighting factor can be configured to adjust the contribution of the zone to the rollup average index based upon the floor area of the zone, importance of the zone, or other static criteria.

Point Name	Hardware Points				Software Points							Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Zone Setpoint Adjust	x											x
Zone Temp	x									x		x
Fan Status			x							x		x
Zone Override			x							x		x
Compressor Stage 1				x						x		x
Fan Start/Stop				x						x		x
Reversing Valve				x						x		x
Cooling Setpoint					x					x		x
Environmental Index					x					x		
Heating Setpoint					x					x		x
Percent of Time Satisfied					x					x		
Schedule									x			
Compressor Runtime Exceeded											x	
Fan Failure											x	
Fan in Hand											x	
Fan Runtime Exceeded											x	
High Zone Temp											x	
Low Zone Temp											x	
Totals	2	0	2	3	4	0	0	1	10	6	9	

Total Hardware (7)

Total Software (21)

1.9 Domestic Hot Water System (typical of 1)

The digital mixing valve has a BACNet controller for connection to the mixing valve. Map over all available points from digital mixing valve including all temperatures.

Hot Water Pump Run Conditions:

The hot water pumps shall be enabled whenever:

- The building is occupied.

Hot Water Temperature Monitoring:

The following temperatures shall be monitored:

- Hot water return.
- Water Heater inlet temp
- Water heater discharge temp.

Alarms shall be provided as follows:

- Hot Water Pump Failure: Commanded on, but the status is off.
- Hot Water Pump Running in Hand: Commanded off, but the status is on.
- Hot Water Pump Runtime Exceeded: Status runtime exceeds a user definable limit
- Return water temp
- Supply water temp

END OF SECTION [230590](#)

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

(FOR REFERENCE ONLY – PROVIDED BY OWNER)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

- A. Qualification Data: Submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Submit the Contract Documents review report as specified in Part 3.
- C. Certified TAB reports.
- D. Sample report forms.
- E. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.

3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.
- B. TAB Conference: Meet with Architect on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including 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.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. 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.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- 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 properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical 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 the 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.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
 2. Air Outlets and Inlets: Plus or minus 5 percent.

3.7 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, 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.
- B. Status Reports: Prepare monthly progress 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. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.8 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.

- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- F. Apparatus-Coil Test Reports:
1. Coil Data:

- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig.
 - n. Refrigerant suction temperature in deg F.
 - o. Inlet steam pressure in psig.
- G. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.

- b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
- 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- I. Air-Terminal-Device Reports:
- 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft..
 - 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary air flow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final air flow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
- 1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.

2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.9 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.10 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB 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 TAB during near-peak summer and winter conditions.

END OF SECTION [230593](#)

SECTION 230595 – MECHANICAL, FACILITY STARTUP-COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The purpose of this section is to specify Division 23 responsibilities and participation in the commissioning process. Note that point-to-point commissioning of all control functions and complete documentation is the responsibility of the temperature control contractor under Division 23, and shall be included in the Division 23 contract.
- B. Commissioning is the responsibility of the commissioning agent (CA) under separate contract with University Medical Center. The CA is responsible to provide a Test Engineer to commission the facilities. The construction manager (CM) and his subcontractors shall provide all support required for start-up, testing, and commissioning. This section is intended to provide an indication of the tests, which must be performed by the Contractor prior to verification by the Owner's Representative and the Commissioning Agent. The commissioning process requires Division 23 participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner.
- C. Work of Division 23 includes:
 - 1. Start-up and testing of the equipment.
 - 2. Assistance in testing, adjusting and balancing, including furnishing additional sheaves and dampers as required.
 - 3. Operating equipment and systems as required for commissioning tests.
 - 4. Providing qualified personnel for participation in commissioning test, including seasonal testing required after the initial commissioning.
 - 5. Provide equipment, materials, and labor necessary to correct deficiencies found during the commissioning process, which fulfill contract and warranty requirements.
 - 6. Providing operation and maintenance information and as-built drawings to the Test Engineer for verification, organization, and distribution.
 - 7. Providing assistance to the Test Engineer to develop and edit system operation descriptions.
 - 8. Providing training for the systems specified in this Division with coordination by the Test Engineer, Owner's Representative and Commissioning Agent.

1.3 RELATED WORK

- A. All start-up and testing procedures and documentation requirements specified within Division 23.
- B. Cooperate with the test, adjust and balance (TAB) firm in the following manner:
 - 1. Allow sufficient time before final commissioning dates so that testing, adjusting and balancing can be accomplished.

2. Put all heating, ventilating, and air conditioning equipment and systems into full operation and continue the operation during each working day of testing, adjusting and balancing and commissioning.
3. Provide labor and material to make corrections when required, without undue delay.
4. Include the cost of exchange sheaves and belts as may be required by the TAB firm.
5. Provide test holes in ducts and plenums where directed or necessary for pitot tubes to take air measurements and to balance the air systems. Test holes shall be provided with an approved removable plug or seal. At each location where ducts and plenums are insulated, test holes shall be provided with an approved extension and plug fitting.
6. Provide pressure and temperature taps as indicated on construction documents in locations as required by the TAB firm to adequately test and/or balance the hydronic systems.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide test equipment as necessary for start-up and commissioning of the mechanical equipment and systems. The TAB firm will provide the test equipment required to perform their services.

2.2 TEST EQUIPMENT – PROPRIETARY

- A. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Test Engineer in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
- B. Identify the proprietary test equipment required in the test procedure submittals and in a separate list of equipment to be included in the operations and maintenance manuals.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

- A. Complete all phases of work so the system can be started, tested, adjusted, balanced, and otherwise commissioned. Division 23 has primary start-up responsibilities with obligations to complete systems, including all sub-systems so they are fully functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
- B. A commissioning plan will be developed by the Test Engineer and approved by the Commissioning Agent. Division 23 is obligated to assist the Test Engineer in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation. If the system modifications/clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner. If the Contractor initiated system changes have been made that alter the commissioning process; the Test Engineer will notify the Commissioning Agent and Owner's Representative for approval.
- C. Specific pre-commissioning responsibilities of Division 23 are as follows:
 1. Factory start-up services for the following items of equipment:

- a. Air-handling equipment and exhaust fans.
 - b. Heating equipment.
 - c. Cooling equipment.
 - d. Plumbing equipment.
 - e. Pumps.
2. Normal start-up services required bringing each system into a fully operational state. This includes cleaning, purging, leak testing, motor rotation check, control sequences of operation, full and part load performance, etc. The TAB firm will not begin TAB work until each system is complete, including normal contractor start-up. The Test Engineer will not begin commissioning process until each system is complete, including normal contractor start-up and the TAB work has been completed.
- D. Commissioning is intended to begin upon completion of a system. Commissioning may proceed prior to the completion of systems, or sub-systems, and will be coordinated with the Test Engineer. Start of commissioning before system completion will not relieve Division 23 from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start up all systems within Division 23. These same technicians shall be made available to assist the Test Engineer and Commissioning Agent in completing the commissioning program as it relates to each system and their technical specialty. Work schedules; time required for testing, etc., will be requested and coordinated by the Test Engineer. Division 23 will ensure that the qualified technician(s) are available and present during the agreed upon schedule and for sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. System problems and discrepancies may require additional technician time, Test Engineer time, Commissioning Agent time, redesign and or reconstruction of systems and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.
- C. The Owner's Representative and Commissioning Agent reserve the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Test Engineer to get the job done.

3.3 WORK TO RESOLVE DEFICIENCIES

- A. In some systems, misadjustments, misapplied equipment and/or deficient performance under the varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Architect and Owner's Representative, with input from the Contractor, equipment supplier, Test Engineer, and Commissioning Agent. Whereas all members will have input and the opportunity to discuss the work and resolve the problems, the Architect will have final jurisdiction on the necessary work to be done to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Agent will notify the Owner indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the

problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract may be undertaken at any time thereafter to ascertain adequate performance during the different areas.
- B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. Each Contractor and supplier shall be responsible to participate in the initial and the alternate peak seasons test of the systems required to demonstrate performance; as scheduled by the Test Engineer, with three day (minimum) advance notification.
- C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.5 RECOMMISSIONING

- A. After the initial and peak season commissioning is completed, there may be additional work required to serve new or revised loads. This work is not part of the contract.

3.6 TRAINING

- A. Participate in the training of the Owner's engineering and maintenance staff on each system and related components. Training, in part, will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids. Note that all training shall be videotaped in DVD format.
- B. Training will be conducted jointly by the Test Engineer, Commissioning Agent, Owner's Representative, the design engineers, the Contractor, and the equipment vendors. The Test Engineer will be responsible for highlighted system peculiarities specific to this project.

3.7 SYSTEMS DOCUMENTATION

- A. In addition to the requirements of Division 1, update contract documents to incorporate field changes and revisions to system designs to account for actual constructed configurations. All drawings shall be redlined on two sets. Division 23 as-built drawings shall include architectural floor plans, elevations and details, and the individual mechanical or electrical systems in relation to actual building layout.
- B. Maintain as-built redlines as required by Division 1. Given the size and complexity of this project, red-line drawings at completion of construction, based on memory of key personnel, is not satisfactory. Continuous and regular red-lining of drawings is considered essential and mandatory.

3.8 MISCELLANEOUS SUPPORT

- A. Division 23 shall remove and replace covers of mechanical equipment, open access panels, etc., to permit Contractor, Architect, and Owner's Representative to observe equipment and controllers provided. Furnish ladders and flashlights as necessary.

END OF SECTION 230595

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the duct services.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.3 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.4 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.

- f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed ducts.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply-air, return-air, and energy recovery exhaust duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 – HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the all HVAC piping systems.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

Flexible Elastomeric Foam: EPDM - Closed cell expanded rubber. Comply with ASTM C 534, Type I for tubular materials for refrigeration pipe sizes 1/4" and greater.

1. Outdoor Use, Basis of Design Product: Provide Reftekk AC-SSPT (EPDM pre-split with lap seal and field applied Aeroflex Aerocoat) or comparable product by one of the following.
 - a. Aeroflex, EPDM SSPT with field applied Aerocel Aerocoat
 - b. Armacell, LLC, EPDM UT Solaflex, Pre-split with lap seal and with field applied Black PVC jacket
 2. Indoor Use, Basis of Design Product: Provide Reftekk AC-SSPT (EPDM pre-split with lap seal) or comparable product by one of the following.
 - a. Aeroflex, EPDM SSPT
 - b. Armacell, LLC, EPDM UT Solaflex, Pre-split with lap seal
 3. Applied to Annealed Coiled Tubing (Line Sets), Basis of Design Product: EPDM continuous tube.
- B. Elastomeric insulation shall not use CFC's or HFC's in the manufacturing process.
 - C. Elastomeric insulation shall have a flame spread-index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 for all products through 2" thickness.
 - D. Elastomeric insulation and elastomeric joining system shall be suitable of use from -70°F to 257°F continuous service temperature, per ASTM C 411.
 - E. Elastomeric insulation shall have a maximum thermal conductivity of 0.235 Btu-in/h-ft²-°F at a mean temperature of 75°F when tested in accordance with ASTM C 177 or ASTM C 518.
 - F. Elastomeric insulation shall have a maximum water vapor transmission of ≤0.03 perm-inch when tested in accordance with ASTM E 96, Procedure A, latest revision.
 - G. Elastomeric insulation must exhibit long-term UV resistance in outdoor installation per ASTM G 7 and ASTM G 90.
 - H. Elastomeric insulation must not contribute to external stress corrosion cracking when tested per ASTM C 692.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.3 INSULATING PIPE HANGER SUPPORTS

- A. Support the piping system using high density rigid foam insulating pipe hanger supports with an inner lining of EPDM rubber insulating tape and 15-mil exterior EPDM rubber jacket. Insulation density to be a minimum of 10 lb. / cu. ft. with a compressive strength of 284 PSI or greater, and a k-value of 0.312 or lower. Continuous use temperature range to be -70°F to 257°F with water absorption of 5% or less.
- B. Basis of Design Product: Provide Reftekk "Cush-A-Therm", model UX insulated pipe support complete with steel channel insulation OD clamp or comparable product by one of the following:
 - 1. Aeroflex USA, Aerofix-U with matching steel channel insulation OD clamp.
 - 2. Armaflex LLC, Armafix IPH with matching steel channel insulation OD clamp

2.4 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: [White] [Color-code jackets based on system. Color as selected by Architect].
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
 - c. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.5 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Insulating Pipe Hanger Supports are to be installed at all pipe support and clamp locations. Insulating Pipe Hanger Supports are to be installed at the time of piping installation such that the pipe insulation system is installed in a continuous manner through the pipe support system.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- J. Install insulation with least number of joints practical.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
- B. Refrigerant Suction Piping:

1. Flexible Elastomeric Insulation per the following sizes. All exterior and roof mounted piping shall also have aluminum jacket with stainless steel bands.
 - a. Liquid pipes: 1" wall thickness.
 - b. Suction gas pipes: 1" wall thickness.

END OF SECTION

SECTION 232113 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
 - 1. Condensate-drain piping.

1.3 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe and fittings with solvent cement.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. DWV Copper Tubing: ASTM B 306, Type DWV.

2.2 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- D. Install piping at indicated slopes.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Install piping to allow application of insulation.
- H. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- I. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- J. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

3.3 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Spring hangers to support vertical runs.
 - 4. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.

3.4 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

END OF SECTION

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction (low pressure gas) Lines: 550 psig, or per equipment manufacturers recommendation.
 - 2. Hot-Gas (high pressure gas) and Liquid Lines: 550 psig, or per equipment manufacturers recommendation.

1.4 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated.

1.5 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."
- C. Installer Qualification: Only trained installers skilled in refrigeration pipe installation and brazing of copper tubing should be used.

1.6 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER PIPE AND FITTINGS

- A. Copper Tube Straight Lengths: ASTM B 75, UNS C12200, H55 Temper (Light Drawn), ACR Bending Quality; Cleaned, Eddy Current Tested, and Plugged per ASTM B 280.

- B. Coiled Copper Tube: ASTM B 280, UNS C12200, O60 Temper (Soft Annealed), ACR, cleaned and capped.
- C. Wrought-Copper Fittings: ASME B16.22.
- D. Wrought-Copper Unions: ASME B16.22.
- E. Brazing Filler Metals: AWS A5.8.
- F. Field Swaged Brazing Cups: MSS-SP-73, ASME B 16.50.
- G. Field Bends (all angles): ASME B31.5.
- H. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

- A. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Socket ends.
 - 5. Working Pressure Rating: 700 psig.
 - 6. Maximum Operating Temperature 250 deg. F
 - 7. Valves must be specifically rated for R-410A.

2.3 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction and Liquid Lines for pipe runs from condensing units to branch selector boxes: Straight Lengths, Copper, Type ACR Type L, H55 (light drawn)-temper tubing and field bent fittings with brazed joints.
- B. Suction and Liquid Lines for pipe runs from branch selector boxes to indoor units: Copper, Type ACR, O60 (soft annealed)-temper tubing and field bent fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install service valves as shown on plans or as required to isolate system components.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- Q. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors.

- S. Install sleeve seals for piping penetrations of concrete walls and slabs.
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- U. Provide proper compensation for pipe/tube expansion and contraction per equipment manufacturers recommendations.

3.4 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP-5 (15% Ag, 80% Cu, 5% P), copper-phosphorus alloy pre-formed brazing rings for joining copper swage fittings and copper socket fittings with copper pipe. Do NOT use flux.
 - 2. Use Type Bag-5 (45% Ag), cadmium-free silver alloy for joining copper with bronze or steel. Use manufacturers recommended flux.
- B. Field Swaged Brazing Cups: Fabricate brazing cup on one tubing end for each coupling. Only O60 (soft annealed) and H55 (light drawn) may be swaged. Do NOT swage H58 (drawn general purpose). Use swaging tool designed to provide a minimum of 0.0015" brazing gap and a maximum of 0.005" brazing gap. Brazing cup depth for each tube size shall be as follows.

1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1-3/8"	1-5/8"	2-1/8"
0.250"	0.280"	0.310"	0.390"	0.420"	0.460"	0.510"	0.560"	0.600"	0.700"

- C. Field Bends: Fabricate field bends with a center-line bend radius greater than or equal to 4 times the nominal OD of the pipe or tube. Tube shall be bent with a tubing bender sized for ACR OD tube sizes and shall not cause cracks or wrinkles in the tube or pipe. Do NOT use a conduit bender for bending ACR copper. The difference between maximum and minimum diameters for pipe bends should not exceed 8% of the nominal outside diameter of the pipe. Only O60 soft annealed-temper and H55 light drawn-temper shall be field bent. Do NOT field bend H58 drawn general purpose-temper copper tube.

D. BRAZING AND JOINING PROCEDURE

- 1. Tube ends shall be cut with a clean sharp tubing cutter.
- 2. Deburr the I.D. of the cut tube end with a clean deburring tool.
- 3. Visually inspect the interior of each tube for obstructions and debris before assembly. Protect the joint from contamination before brazing.
- 4. Method of pre-cleaning: Non-shedding abrasive pads (Scotch Bright) to remove all oxides in the brazing area followed by wiping with a clean lint-free white cloth. Do not groove the surfaces while cleaning.
- 5. Purge all tubing with oil free nitrogen while brazing and until cool to the touch. Use an oxygen analyzer to verify the absence of oxygen prior to brazing. The oxygen content shall be less than 1% before start of brazing.
- 6. Use a neutral to slightly reducing flame using oxy/acetylene or oxy/propane.
- 7. Use the proper torch tip based on tube size as recommended by the torch manufacturer. Use of Turbo-Torch or Rosebud is permitted.
- 8. Post Brazing Cleaning: Exterior of all completed joints shall be washed with a water soaked rag or sponge, followed by brushing with a stainless-steel hand wire brush to remove any residue for inspection.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Rigid high compressive strength foam insulating pipe support at all support points. Comply with Section 230719 "DX Piping System Insulation".
 - 3. Do NOT attach hangers directly to pipe or tube.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. Up to 3/4" OD: Maximum span, 60 inches; minimum rod size, 3/8 inch.
 - 2. Greater than 3/4" thru 1" OD: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. Greater than 1" thru 2-1/8" OD: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Evacuate (triple evacuation procedure) entire refrigerant system with a vacuum pump to obtain a steady state vacuum of less than 500 micrometers. If vacuum holds for 12 hours, system is ready for charging. Do NOT evacuate the system through a charging manifold. Use only suction rated hoses and core removal tools.
 - 2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 3. Charge system as recommended by equipment manufacturer.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION [232300](#)

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Rectangular ducts and fittings.
 - 2. Sheet metal materials.
 - 3. Sealants and gaskets.
 - 4. Hangers and supports.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.
 - 1. Static-Pressure Classes:
 - a. Supply Ducts: 1.5-inch wg.
 - b. Return Ducts (Negative Pressure): 1.5-inch wg.
 - c. Exhaust Ducts (Negative Pressure): 1.5-inch wg.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.4 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Formed-On Flanges: Ducts with transverse duct joints 28" and larger shall be constructed according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Lockformer.
 2. The installation of flanged system shall be in accordance with the manufacturers printed instruction and installation manuals.
 3. Construction of the duct, such as gauge, reinforcing, etc., shall be as indicated in the addendum to the SMACNA manuals as provided by the manufacturer and as tested by Pittsburgh Testing Laboratory.
- F. 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 sq. ft. of nonbraced panel area unless ducts are lined.

2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. 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.

2.3 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- C. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.4 HANGERS AND SUPPORTS

- A. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 15 Section "Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.

6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 15 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.6 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
- C. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - 3) The use of radius elbow with square inner throat is NOT acceptable for any duct velocities.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - 4) The use of radius elbow with square inner throat is NOT acceptable for any duct velocities.
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - 4) The use of radius elbow with square inner throat is NOT acceptable for any duct velocities.
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Manual volume dampers.
 - 2. Turning vanes.
 - 3. Duct-mounted access doors.
 - 4. Flexible connectors.
 - 5. Flexible ducts.
 - 6. Duct accessory hardware.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 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. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.

- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, 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.

2.2 MANUAL VOLUME DAMPERS

- A. Manufacturers:
 - 1. Air Balance, Inc.
 - 2. METALAIRE, Inc.
 - 3. Nailor Industries Inc.
 - 4. Ruskin Company.
 - 5. Pottorff.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
 - 1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
 - 2. Wherever the ducts are rendered inaccessible behind non-removable ceilings or furrings, or other construction that is not easily removable to permit access to the ducts, the devices shall be equal to Young Regulator Co. No. 1200 right angle worm gear regulator with 301 concealed damper regulator. On exposed or easily accessible ducts the adjusting devices shall be equal to Young No. 1 or No. 900 and shall be fastened to the duct.
 - 3. Manual dampers installed in stainless steel ducts shall be constructed of stainless steel.
- C. Single-blade Volume Dampers: For dampers where neither dimension exceeds 24", standard leakage rating, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 22 gage, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 - 2. Roll-Formed Steel Blades: 22 gage, galvanized sheet steel.
 - 3. Blade Axles: Galvanized steel.
 - 4. Bearings: Molded synthetic.
- D. Multiple-blade Volume Dampers: For dampers where either dimension exceeds 24", opposed-blade, standard leakage rating, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 16 gage, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 - 2. Roll-Formed Steel Blades: 16 gage, galvanized sheet steel, maximum 12" wide.
 - 3. Blade Axles: Galvanized steel.
 - 4. Bearings: Molded synthetic.

- E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.3 TURNING VANES

- A. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vaness and Vane Runners," and 2-4, "Vane Support in Elbows."
- C. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.4 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - d. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.
 - 4. Provide stainless steel access doors in stainless steel ducts.

2.5 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.

- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.6 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Thermaflex.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Low Pressure, Insulated, Flexible Duct: UL 181, Class 1, made and composed of a CPE liner duct permanently bonded to a coated spring steel wire helix and supporting a fiber glass insulating blanket. Low permeability outer vapor barrier of fiber glass reinforced film laminate shall complete the composite.
 - 1. Pressure Rating: 8-inch wg positive and 1-inch negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. R-Value: 4.2
 - 4. Temperature Range: Minus 20 to plus 250 deg F.
 - 5. Example: Thermaflex M-KE
- C. High Pressure, Insulated, Flexible Duct (Inlet to VAV boxes and Lab Supply Valves): UL 181, Class 1, factory made and composed of an inner duct of woven and coated fiber glass providing an air seal and permanently bonded to coated steel wire helix, a fiber glass insulating blanket and low permeability outer vapor barrier of fiber glass reinforced metalized film laminate.
 - 1. Pressure Rating: 16-inch (4"-10" ducts) or 8-inch (12"-16") wg positive and 2-inch negative.
 - 2. Maximum Air Velocity: 6000 fpm.
 - 3. R-Value: 4.2
 - 4. Temperature Range: Minus 20 to plus 250 deg F.
 - 5. Example: Thermaflex M-KC
- D. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.7 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Connect ducts to duct silencers with flexible duct connectors.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Downstream from manual volume dampers, control dampers,[turning vanes,] and equipment.
 - 3. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 4. At each change in direction and at maximum 50-foot spacing.
 - 5. Upstream of turning vanes.
 - 6. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.

5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.
 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 GRILLES AND REGISTERS

- A. Grilles and registers shall be furnished and installed as scheduled on the drawings.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kreuger.
 - b. METALAIRE, Inc.
 - c. Nailor Industries Inc.
 - d. Price Industries.
 - e. Titus.

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 237413 - PACKAGED ROOFTOP UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged rooftop air-conditioning units.

1.2 DEFINITIONS

- A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - b. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
 - c. Include unit dimensions and weight.
 - d. Include cabinet material, metal thickness, finishes, insulation, and accessories.
 - e. Fans:
 - 1) Include certified fan-performance curves with system operating conditions indicated.
 - 2) Include certified fan-sound power ratings.
 - 3) Include fan construction and accessories.
 - 4) Include motor ratings, electrical characteristics, and motor accessories.
 - f. Include certified coil-performance ratings with system operating conditions indicated.
 - g. Include filters with performance characteristics.
 - h. Include gas furnaces with performance characteristics.
 - i. Include dampers, including housings, linkages, and operators.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set(s) of filters for each unit.
 - 2. Gaskets: One set(s) for each access door.
 - 3. Fan Belts: One set(s) for each belt-driven fan.

1.6 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of packaged rooftop air-conditioning unit that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods as listed below from date of Substantial Completion,
 - a. All parts, materials, and labor for entire unit: 1 Year.
 - b. Aluminized Heat Exchangers: 10 years.
 - c. Stainless Steel Heat Exchangers: 15 years.
 - d. Compressors: 5 years.
 - e. Unit Controller: 3 Years

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE 15 Compliance: For refrigeration system safety.
- E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

- F. UL Compliance: Comply with UL 1995.

2.2 PACKAGED ROOFTOP AIR-CONDITIONING UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. AAON
2. Carrier Global Corporation
3. Lennox
4. Trane

- B. Unit Casings:

1. General Fabrication Requirements for Casings: Formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
2. Construction:

- a. Exterior Panels:

- 1) Heavy gauge
- 2) G60 pre-painted, galvanized steel
- 3) Textured pre-paint with Polyurethane finish
- 4) Corrosion resistant paint
- 5) Cyclic fog and UV exposure up to 1680 hours
- 6) Adhesion: ASTM D3359
- 7) Impact resistance: ASTM D2794
- 8) Humidity resistance: ASTM D2247
- 9) Abrasion resistance: ASTM 4060
- 10) Heat resistance: ASTM D3454
- 11) Flexibility: ASTM D4145 (NCCAI-19)

- b. Interior Panels:

- 1) G90-coated galvanized steel
- 2) 18- or 20-gauge thickness.

- c. Casing Insulation:

- 1) All panels adjacent to conditioned air are fully insulated with non-hygroscopic fiberglass insulation
- 2) Unit base is fully insulated
- 3) Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.

3. Airstream Surfaces: Surfaces in contact with airstream to comply with requirements in ASHRAE 62.1.
4. Full perimeter, heavy gauge galvanized steel base rail
5. Rigging holes on all four corners
6. Forklift slots (on three sides, not directly below condenser coil) on base rail

7. Raised or flanged edges around duct and power entry opening
8. Electrical lines and gas lines can be brought through the base of the unit or through horizontal knockouts
9. Panels and Doors:
 - a. Panels:
 - 1) Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - 2) Fasteners: Two or more camlock type for panel lift-out operation. Arrangement to allow panels to be opened against air-pressure differential.
 - 3) Gasket: Neoprene, applied around entire perimeters of panel frames.
 - 4) Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 - b. Access Doors:
 - 1) Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - 2) Gasket: Neoprene, applied around entire perimeters of panel frames.
 - 3) Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 - c. Locations and Applications:
 - 1) Fan Section: Doors.
 - 2) Access Section: Doors.
 - 3) Coil Section: Inspection and access panels.
 - 4) Damper Section: Doors.
 - 5) Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - 6) Mixing Section: Doors.
10. Condensate Drain Pans:
 - a. Location: Each type of cooling coil.
 - b. Construction:
 - 1) Anti-microbial, corrosion-resistant, composite.
 - c. Drain Connection:
 - 1) Located at lowest point of pan and sized to prevent overflow.
 - 2) Side or bottom drain connections.
 - 3) Reversible to allow connection to back of unit.
 - d. Slope: Minimum slope, to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.

- e. Length: Extend drain pan downstream from leaving face for distance to comply with ASHRAE 62.1.
- f. Width: Entire width of water producing device.
- g. Depth: A minimum of 2 inches deep.
- h. Pan-Top Surface Coating for Galvanized-Steel Drain Pans: Asphaltic waterproofing compound.
- i. Units with stacked coils must have an intermediate drain pan to collect condensate from top coil.

C. Fans, Drives, and Motors:

1. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
2. Direct Drive ECM or Belt drive as indicated in RTU schedule on drawings.
3. Permanently lubricated ball bearings (for belt drive motors)
4. Thermal overload protected motors with automatic reset
5. Adjustable sheaves on belt drive motors for blower speed adjustment
6. Optional low and high static motor/drive combinations and optional drive kits
7. Multi-Stage Air Volume (MSAV): Factory w/ Direct Drive ECM on 2-12.5 ton
8. Condenser-Coil Fan and Motor:
 - a. Direct drive with permanently lubricated ball bearings.
 - b. Watertight with thermal overload protection and automatic reset
 - c. Motor mount isolated from fan safety guard
 - d. Corrosion resistant propeller type.

D. Coils:

1. General Requirements for Coils:
 - a. Comply with AHRI 410.
 - b. Fabricate coils section to allow for removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
 - c. Coils to not act as structural component of unit.
 - d. Tube and fin condensing/evaporator coil general construction:
 - 1) Aluminum rippled and lanced fins
 - 2) Copper tube construction
 - 3) Flared shoulder tubing connections
 - 4) Aluminum fins mechanically bonded to copper tubes
 - 5) All coils are high pressure leak tested at manufacturing facility
 - 6) Aluminum lanced fins
 - 7) Aluminum fins thermally bonded to aluminum flat tube
 - 8) All coils are high pressure leak tested at manufacturing facility
2. Supply-Air Refrigerant Coil:
 - 1) With balanced port thermal expansion valves, freeze protection on each compressor circuit, pressure and leak tested to 500 psi
 - 2) 2-6 Tons - Each compressor circuit on coil divided across face of coil and active through full depth of coil.
 - 3) 6.5-25 Tons - Each compressor circuit on coil divided by rows that are active across

the entire surface area of the supply air.

E. Refrigerant Circuit Components:

1. Refrigerant type: R-454B or R-32
2. Capable of operating from 0 to 125° F without installation of additional controls
3. Compressors:
4. Scroll type
5. Resiliently mounted on rubber mounts for vibration isolation
6. Overload protected
7. Internal excessive current and temperature protection
8. Isolated from condenser and evaporator fan air streams
9. Refrigerant cooled
10. Thermal expansion valve
11. Crankcase heaters
12. High-capacity filter/driers
13. High pressure switches
14. Low pressure switches
15. Indoor coil freeze protection
16. Defrost Control
17. Low GWP Refrigerant Detection system (RDS)
 - a. Complies with UL 60335-2-40 approved standard
 - b. Required for all systems using R-454B refrigerant.
 - c. Factory installed on all units
 - d. Consists of a refrigerant detection sensor(s) and a mitigation control
 - e. Ensures safe operation for systems equipped with R-454B refrigerant
 - f. Sensor(s) monitors indoor coil area for R-454B refrigerant
 - g. If R-454B refrigerant is detected the refrigerant detection system will prevent compressor and heating operation until R-454B refrigerant is no longer detected
 - h. Refrigeration detection system energizes blower if any R-454B refrigerant is detected to mitigate any concentrations of refrigerant from the unit and the system.

F. Air Filtration: Disposable 2 inch thick pleated filters having minimum MERV 8 efficiency according to ASHRAE 52.2.

G. Gas Furnaces:

1. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
 - a. CSA Approval: Designed and certified by and bearing label of CSA.
 - b. Induced draft
 - c. Natural gas fired system with direct spark ignition
 - d. Electronic flame sensors
 - e. Flame rollout switches
 - f. High heat limit switches
 - g. Induced draft failure switch and capable of operating to altitude of 2000 feet with no derate to manifold pressure
 - h. Service access for controls, burners, and heat exchanger
 - i. Heat Exchanger:

- 1) Tubular Design
 - 2) Aluminized steel or Stainless steel as indicated in RTU schedule
- j. Gas piping system tight and free of leaks when pressurized to maximum supply pressure
- k. Gas Valve: redundant type gas heat valve with manual shutoff
- 1) Two-stage gas heating on 3 to 12 ton models
 - 2) Four-stage gas heating on 13-25 ton models
- l. Gas Burners: Aluminized steel inshot-type gas burners
- m. Direct spark pilot ignition
- n. Fan and Limit Control
- o. Safety Switches
- p. Gas piping system tight and free of leaks
- q. Low NOx 3-6 ton
- r. Field Installed Accessories:
- 1) Combustion Air Intake Extensions
 - 2) Vertical Vent Extension Kit
 - 3) LPG/Propane Kit (on projects utilizing propane)

H. Dampers:

1. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate must not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg rated in accordance with AMCA 500D.
2. Barometric relief dampers.
3. Electronic Damper Operators:
 - a. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 - b. Electronic damper position indicator to have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
 - c. Operator Motors:
 - 1) Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."
 - 2) Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - 3) Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

I. Electrical Power Connections:

1. RTU to have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

J. Controls:

1. Control equipment and sequence of operation are specified in Division 23 Section "Temperature Regulation"
2. Unit shall be provided with terminal strip for control through the building temperature controls system. Coordinate all requirements with Controls Contractor prior to bid.

K. Roof Curbs:

1. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - a. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 1) Materials: ASTM C1071, Type I or II.
 - b. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - 1) Liner Adhesive: Comply with ASTM C916, Type I.
 - 2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - 3) Liner materials applied in this location to have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
2. Curb Dimensions: Height of 14 inches.

L. Accessories:

1. Factory installed unpowered, duplex, 115-V, ground-fault-interrupter outlet.
2. Factory installed disconnect switch.
3. Phase/Voltage Detection
4. Low-ambient kit for operation down to 0 deg F.
5. Hinged access doors as specified above.
6. Each rooftop shall be provided with a factory installed and wired phase monitor with LED for on or fault indication. Protection shall be provided against phase imbalance, phase loss, and phase reversal.
7. Demand-controlled ventilation (when indicated on drawings)
8. Safeties:
 - a. Smoke detector.
 - b. Condensate overflow switch.
 - c. Phase-loss protection.
 - d. High and low pressure control.
 - e. Heating airflow-proving switch.
9. Hail guards of galvanized steel, painted to match casing.
10. Outdoor-air and relief air weather hoods.

11. Dual Enthalpy Economizer:
 - a. Hoods provided
 - b. Economizer fault detection and diagnostics
 - c. CO2 sensor error
 - d. Outside Air Temperature sensor error
 - e. Discharge Air sensor error
 - f. Actuator over voltage
 - g. Actuator under voltage
 - h. Economizer control: Differential Dual Enthalpy:
 - i. Barometric relief damper is included with economizer.
 - j. Power exhaust fan when indicated in RTU Schedule

2.3 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
3. Comply with AHRI 270 for testing and rating sound performance for RTUs.
4. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested according to AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PACKAGED ROOFTOP AIR-CONDITIONING UNITS

- A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Or AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.
- B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
- C. Equipment Mounting:
 - 1. Install RTUs on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section "Cast-in-Place Concrete."

3.3 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to RTU, allow space for service and maintenance.
- C. Connect piping to unit mounted on vibration isolators with flexible connectors.
- D. Connect condensate drain pans using, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Gas Piping: Comply with applicable requirements in Section "Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

3.4 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb unless noted otherwise by Structural Engineer.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure and curb.

3.5 ELECTRICAL CONNECTIONS

- A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate is to be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate is to be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
 - 3. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.7 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Inspect for visible damage to unit casing.
 - 3. Inspect for visible damage to furnace combustion chamber.
 - 4. Inspect for visible damage to compressor, coils, and fans.
 - 5. Inspect internal insulation.
 - 6. Verify that labels are clearly visible.
 - 7. Verify that clearances have been provided for servicing.
 - 8. Verify that controls are connected and operable.
 - 9. Verify that filters are installed.
 - 10. Clean condenser coil and inspect for construction debris.
 - 11. Clean furnace flue and inspect for construction debris.
 - 12. Connect and purge gas line.
 - 13. Remove packing from vibration isolators.
 - 14. Inspect operation of barometric relief dampers.
 - 15. Verify lubrication on fan and motor bearings.
 - 16. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 17. Adjust fan belts to proper alignment and tension.
 - 18. Start unit according to manufacturer's written instructions.

- a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
19. Inspect and record performance of interlocks and protective devices; verify sequences.
 20. Operate unit for an initial period as recommended or required by manufacturer.
 21. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency:
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 22. Calibrate thermostats.
 23. Adjust and inspect high-temperature limits.
 24. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
 25. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
 26. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 27. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
 28. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
 29. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.

- e. Relief-air fan operation.
- f. Smoke and firestat alarms.

30. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.8 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.
- C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.9 CLEANING

- A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. RTU will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237413

Division	Section Title	Pages
DIVISION 26 - ELECTRICAL		
260510	COMMON WORK RESULTS FOR ELECTRICAL	13
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	4
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	5
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	5
260533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS	7
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS	7
260923	LIGHTING CONTROL DEVICES	4
262200	LOW-VOLTAGE TRANSFORMERS	4
262416	PANELBOARDS	7
262726	WIRING DEVICES	6
262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS	5
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DIVISION 27 - COMMUNICATIONS		
271500	TELEPHONE AND DATA COMMUNICATIONS CABLING	6
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SECTION 260510 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. General requirements.
 - 2. Electrical equipment coordination and installation.
 - 3. Sleeves for raceways and cables.
 - 4. Sleeve seals.
 - 5. Grout.
 - 6. Common electrical installation requirements.

1.3 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. Connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

1.4 GENERAL REQUIREMENTS

- A. In general, the electrical lines to be installed under these Specifications shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards as to complete the work in a neat and satisfactorily workable manner. The following is a general outline concerning the running of electrical lines and is to be excepted where the drawings or conditions at the building necessitate deviating from these standards.

- B. The Contractor shall thoroughly acquaint himself with the details of the construction and finishes before submitting his bid as no allowances will be made because of the Contractor's unfamiliarity with these details. Place all inserts in masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.
- C. The electrical Drawings do not give exact details as to elevations of electrical lines, exact locations, etc., and do not show all the offsets, and other installation details. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to avoid all obstruction, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.
- D. The electrical Drawings show diagrammatically the locations of the various electrical outlets and apparatus and the method of circuiting and controlling them. Exact locations of these outlets and apparatus shall be determined by reference to the general Drawings and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with other sections, and in all cases shall be subject to the approval of the Architect. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation (within 10 feet of location shown on drawings) or after installation if an obvious conflict exists, without additional cost to the Owner.
- E. The Contractor shall be responsible for the proper fitting of his material and apparatus into the space. Should the particular equipment that any bidder proposes to install require other space conditions than those indicated on the drawings, he shall arrange for such space with the Architect before submitting his bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such necessary changes at his (the Contractor's) own expense.
- F. The contractor for the work under each section of these specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- G. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.
- H. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans. The drawings shall be checked by the Architect before the work is started. Any conflict with the building conditions shall be corrected by the Contractor before the work proceeds.
- I. Order of precedence shall be observed in laying out the pipe, ductwork, material, and conduit in order to fit the material into the space above the ceiling and in the chases and walls. The following order shall govern:
 - 1. Items affecting the visual appearance of the inside of the building such as lighting fixtures, diffusers, grilles, outlets, panelboards, etc. Coordinate all items to avoid conflicts at the site.
 - 2. Lines requiring grade to function such as sewers, roof drains and condensate drains.
 - 3. Large ducts and pipes with critical clearances.
 - 4. Conduit, water lines, and other lines whose routing is not critical and whose function would not be impaired by bends and offsets.
- J. Conduits serving outlets on items of equipment shall be run in the most appropriate manner. Where the equipment has built-in chases, the lines shall be contained therein. Where the equipment is of the open

type, the lines shall be run as close as possible to the underside of the top and in a neat and inconspicuous manner.

- K. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through windows, doorways or shafts, shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed.
- L. Exceptions and inconsistencies in Drawings and Specifications shall be brought to the Architect's attention before the contract is signed. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus, material, or equipment.
- M. The Contractor shall distinctly understand that the work described herein and shown on the accompanying drawings shall result in a finished and working job, and any item required to accomplish this intent shall be included whether specifically mentioned or not.
- N. Each bidder shall examine the Drawings and Specifications for the General Construction. If these documents show any item requiring work under Division 26 and that work is not indicated on the respective Electrical drawings, he shall notify the Architect in sufficient time to clarify before bidding. If no notification is received, the Contractor is assumed to require no clarification, and shall install the work as indicated on the General Drawings in accordance with the Specifications.
- O. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings. Any difference which may be found shall be submitted to the Architect for consideration before proceeding with the work.
- P. The accompanying plans do not indicate completely the existing electrical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.
- Q. There are portions of the existing electrical System that shall remain in use to serve the finished building in conjunction with the indicated new installations. By actual examination at the site, each bidder shall determine those portions of the remaining present installations, which must be relocated to avoid interference with the installations of new work of his particular trade and that of all other trades. All such existing installations that interfere with new installations shall be relocated by the Contractor under the Division in which the existing material normally belongs, and in a manner as directed by the Architect. For example where existing conduit and electrical equipment interferes with the installation of new work; it shall be relocated under Division 16. Failure to become familiar with the extent of the relocation work involved shall not relieve the Contractor of responsibility and shall not be used as a basis for additional compensation.
- R. All electric wiring of every character, both for power supply, for pilot and control, for temperature control, for communications, etc. will be done under Division 16 of these Specifications. Every electrical current consuming device furnished as a part of this project, or furnished by the Owner and installed in this project, shall be completely wired up under Division 26. Verification of exact location, method of connection, number and size of wires required, voltage requirements, and phase requirements is the responsibility of the Contractor under Division 26. If conflicts occur between the drawings and the actual requirements, actual requirements shall govern.

- S. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer.
- T. The workmanship shall in all respects be of the highest grade and all construction shall be done according to the best practice of the trade.
- U. The shop drawings for all equipment are hereby made a part of these Specifications. The Contractor under each section of the Specifications shall rough-in for the exact item to be furnished on the job, whether in another section of the Specifications or by the Owner. The Contractor shall refer to all drawings and other sections of the Specifications for the scope of work involved for the new equipment, and by actual site examination determine the scope of the required equipment connections for the Owner furnished equipment.
- V. Should any of the equipment furnished require connections of a nature different from that shown on the drawings, report the matter to the Architect and finally connect as directed by the Architect. Minor differences in the equipment furnished and that indicated on the drawings will not constitute ground for additional payment to the Contractor.

1.5 MATERIALS

- A. All materials shall be new unless otherwise specified and of the quality specified. Materials shall be free from defects and undamaged. All materials of a type for which the Underwriters Laboratories, Inc. have established a standard shall be listed by the Underwriters Laboratories, Inc. and shall bear their label.
- B. The Architect reserves the right to call for samples of any item of material offered in substitution, together with a sample of the specified material, when, in the Architect's opinion, the quality of the material and/or the appearance is involved and it is deemed that an evaluation of the two materials may be better made by visual inspection. This shall be limited to lighting fixtures, wiring devices, and similar items and shall not be applicable to major manufacturers' items of equipment.
- C. The Contractor shall be responsible for transportation of his materials to and on the job, and shall be responsible for the storage and protection of these materials and work until the final acceptance of the job.
- D. The Contractor shall furnish all necessary scaffolding, tackle, tools and appurtenances of all kinds, and all labor required for the safe and expeditious execution of his contract.

1.6 SUBMITTALS

- A. Wherever shop drawings/submittals are called for in these specifications, they shall be furnished by the Contractor for the work involved after review by the Architect as to the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary details. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary and should there be any charges in connection with this, they shall be borne by the Contractor.
- B. Shop drawings will be reviewed by the Architect for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Review by the Architect and any action by the Architect in marking shop drawings is subject to the requirements of the entire contract documents. Contractor will be held responsible for quantities, dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of all trades and the satisfactory performance of his work.

- C. Shop drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission of individual items shall designate the exact item offered and shall clearly identify the item with the project.
- D. All shop drawings shall be submitted at one time and shall consist of a bound catalogue of all shop drawings under each section, properly indexed and certified that they have been checked by the Contractor.
- E. The omissions of any material from the shop drawings which has been shown on the contract drawings or specified, even though reviewed by the Architect, shall not relieve the Contractor from furnishing and erecting same.

1.7 PERMITS, FEES, ETC.

- A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall arrange for all utility services, including sewer, water and gas services as applicable. If any charges are made by any of the utility companies due to the work on this project, the Contractor shall pay these charges, including charges for metering, connection, street cutting, etc. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.8 LAWS, CODES, AND ORDINANCES

- A. All work shall be executed in strict accordance with all local, state and national codes, ordinances and regulations governing the particular class of work involved, as interpreted by the inspecting authority. The Contractor shall be responsible for the final execution of the work under this heading to suit those requirements. Where these specifications and the accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect, shall prepare any supplemental drawings required illustrating how the work may be installed so as to comply and, on approval, make the changes at no cost to the Owner. On completion of the various portions of the work the installation shall be tested by the constituted authorities, approved and, on completion of the work, the Contractor shall obtain and deliver to the Owner a final certificate of acceptance.

1.9 TESTING

- A. The Contractor under each division shall at his own expense perform the various tests as specified and required by the Architect and as required by the State and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests. Notify the Architect a minimum of 24 hours in advance of all tests.

1.10 COORDINATION OF TRADES

- A. The Contractor shall be responsible for resolving all coordination required between trades. For example, items furnished under Division 23 which require electrical connections shall be coordinated with Division 26 for:
 - 1. Voltage
 - 2. Phase
 - 3. Ampacity
 - 4. No. and size of wires
 - 5. Wiring diagrams
 - 6. Starter size, details and location

7. Control devices and details

- B. Items furnished under various sections which require electrical connections shall be coordinated for services, voltage, size and location of connections.
- C. Items requiring insulation shall be fully insulated and that insulation shall be checked against manufacturer's directions and job requirements for suitability, coverage, thickness and finish.
- D. Items installed in/on finished ceilings shall be coordinated with the ceiling construction. The Contractor under each section shall conform to the reflected ceiling plan and shall secure details and/or samples of the ceiling materials as necessary to insure compatibility. Any device not conforming to this requirement shall be replaced by the Contractor at his expense.
- E. All items specified under Division 26 shall be installed tight, plumb, level, square and symmetrically placed in relation to the work of other trades.

1.11 CUTTING AND PATCHING

- A. All cutting and patching for work under Division 23 shall be done by the Contractor under the section for which the trade is specified.

1.12 CUTTING AND PATCHING

- A. The Contractor for work specified under each section shall perform all structural and general construction modifications and cut all openings through either roof, walls, floors or ceilings required to install all work specified under that section or to repair any defects that appear up to the expiration of the guarantee. The Contractor shall exercise due diligence to avoid cutting openings larger than required or in wrong locations. Verify the scope of this work at the site and in cooperation with all other trades before bidding.
- B. No cutting shall be done to any of the structural members that would tend to lessen their strength, unless specific permission is granted by the Architect to do such cutting.
- C. The Contractor for work under each section shall be responsible for the patching of all openings cut to install the work covered by that section and to repair the damage resulting from the failure of any part of the work installed hereunder.
- D. Before bidding, the Contractor shall review and coordinate the cutting and patching required under the respective section with all trades.
- E. In all spaces where new work under Division 23 is installed and no other alteration or refinishing work is shown or called for, existing floors, walls and ceilings shall be restored to match existing conditions. All cutting and patching shall be done by workmen skilled in the affected trade.
- F. Where openings are cut through masonry walls, the Contractor under each respective section shall provide and install lintels or other structural supports to protect the remaining masonry and adequate support shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation.

1.13 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.14 SUBSTITUTIONS

- A. Where a definite material or only one manufacturer's name is mentioned in these specifications, it has been done in order to establish a standard. The product of the particular manufacturer mentioned is of satisfactory construction and any substitution must be of quality as good as or better than the named article. No substitution shall be made without review by the Architect, who will be the sole judge of equality.
- B. The Contractor shall submit for approval a complete list of the materials he proposes to use. This list shall give manufacturers' names and designations corresponding to each and every item and the submission shall be accompanied by complete descriptive literature and/or any supplementary data, drawings, etc., necessary to give full and complete details.
- C. Should a substitution be accepted under the provisions of the conditions of these specifications, and should this substitute prove to be defective or otherwise unsatisfactory for the service for which it is intended within the guarantee period, the Contractor who originally requested the substitution shall replace the substitute material with the specified material.

1.15 TEMPORARY POWER AND LIGHTING

- A. Engage the appropriate local utility company to install temporary service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
- B. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
- C. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
- D. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
- E. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.
- F. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear. All temporary power for construction will be provided by Contractor. Owner will pay bills when submitted for payment.

- G. Install electric power service underground, except where overhead service must be used.
- H. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, power wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance. All circuits must be ground-fault circuit interrupter protected.
- I. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment. Provide four gang outlets, spaced so 100 foot cords can reach any areas. Provide separate 120 VAC, 20 amp GFCI circuit for each four gang outlet.
- J. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- K. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching:
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- L. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- M. Provide three 100-W incandescent lamps per 500 sq. ft. (45 sq. m), uniformly distributed, for general lighting, or equivalent illumination.
- N. Provide two 100-W incandescent lamps every 50 feet (15 m) in traffic areas.
- O. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the work is being performed.

1.16 USE OF SYSTEMS

- A. It is considered that it will be necessary to operate the mechanical systems to provide heating and ventilation in portions of the building that are enclosed. As systems or portions of systems become operable, they shall be operated as required to maintain habitable conditions in enclosed portions of the building that are still under construction and portions that are fully complete as may be required to properly protect installed piping, equipment and finishes.
- B. In order to provide protection to ducts, plenums, etc. install temporary filters over or in return air openings until all finished painting is completed. Protect supply outlets, coils, etc. as necessary in each case.
- C. Except for operation of cooling equipment to prove its performance and to adjust and balance the systems, that equipment will not be operated for comfort of construction workers.

- D. During warm weather the Contractor shall arrange for the operation of systems to supply 100 percent outside air. The systems controls shall be reset to their normal cycle of operation in each case during the times that heating is required and when the cooling equipment is operated.
- E. Immediately prior to the time that the systems are to be accepted by the Owner, each system shall be carefully examined and if ductwork is dirty, it shall be carefully cleaned by men skilled in that type of work. All filters shall be put in first class condition by replacement of filters and/or other procedures as directed.
- F. The use of the equipment for maintaining environmental and/or protective temperature conditions shall in no way constitute acceptance of that equipment and the connected piping, ducts, insulation, finishes, etc. by the Owner. Furthermore, it shall in no way shorten the guarantee period hereinafter specified. The Contractor shall either secure extended warranties from the vendors of equipment or shall purchase insurance to provide proper coverage on the equipment through the guarantee period and shall file with the Architect substantiating affidavits from equipment manufacturers or a copy of the insurance policy covering the equipment through the guarantee period. The personal underwriting of the Contractor for equipment manufacturers' warranties is not acceptable, but his personal underwriting of piping, ductwork, insulation and associated materials is acceptable subject to the provisions of the contract.
- G. The Contractor shall provide such labor as may be required in the operation of the systems and shall pay all costs.

1.17 INSTALLATION DRAWINGS

- A. It shall be incumbent upon the Contractor to prepare special drawings as called for elsewhere herein or as directed by the Architect to coordinate the work under each section, to illustrate changes in his work, to facilitate its concealment in finished spaces to avoid obstructions or to illustrate the adaptability of any item of equipment which he proposes to use.
- B. These drawings shall be used in the field for the actual installation of the work. Unless otherwise directed, they shall not be submitted for approval but three copies shall be provided to the Architect for his information.

1.18 OPERATING INSTRUCTIONS

- A. The Contractor for each section of the work hereunder shall, in cooperation with the representatives of the manufacturers of the various equipment items, carefully instruct the Owner's representatives in the proper operation of each item of equipment and of each system. During the balancing and adjusting of systems, the Owner's representative shall be made familiar with all procedures.

1.19 OPERATING MANUALS

- A. Prepare and submit 3 copies of the operating manuals bound in hard covers. Three weeks prior to completion of the work, the Architect will check the manuals and any additional material necessary to complete the manuals shall be furnished and inserted by the Contractor.
- B. Manuals shall contain the following data:
 - 1. Catalogue data of all equipment.
 - 2. Shop drawings of all equipment.
 - 3. Panel schedules.
 - 4. Start-up instructions for major equipment.

5. Trouble shooting procedures for major equipment.
6. Wiring diagrams.
7. Recommended maintenance schedule for equipment.
8. Parts list for all items.
9. Name and address of each vendor.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 3. Pressure Plates: Plastic. Include two for each sealing element.
 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 LOCATION AND DETECTION

A. Below ground:

- 1. Non-Metallic: Non-metallic pipe installed below ground shall have installed in the same trench a detectable plastic tape that conforms in to the APWA color coding as follows:
 - a. Orange – Telecommunications
 - b. Blue – Water
 - c. Green – Sanitary and Sewer Systems
 - d. Yellow – Gas
- 2. Such tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be approved 2 1/8" wide and shall be imprinted with a continuous traceable for a minimum of eight years after direct burial. Product shall be Terra Tape Detectable or approved equal. Tape shall be installed per manufacturer's instructions, but no less than 12" above the buried line.
- 3. Provide 16 gauge direct burial tracer wire with all non-metallic underground pipe. Wire shall be single strand, 14 gauge minimum with 4/64" vinyl insulation which is UL approved for direct underground burial when used in a National Electric Code Class II circuit.

B. Metallic:

- 1. Below ground metallic piping shall have identifying tape similar to that specified for below ground non-metallic except that the aluminum foil for location is not required.

3.4 PAINTING

- A. If the factory finish on any apparatus or equipment is marred, it shall be touched up and then given one coat of half-flat-half-enamel, followed by a coat of machinery enamel of a color to match the original. Paint factory primed surfaces.
- B. Paint all exposed conduit, boxes, cabinets, hangers and supports, and miscellaneous metal.
- C. Generally, painting is required on all surfaces such that no exposed bare metal is visible.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION [260510](#)

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.

- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire for light fixtures only.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

- I. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- K. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- L. Class 2 Control Circuits: Type THHN-THWN, in raceway.
- M. All fire alarm wiring shall be in raceway, minimum size $\frac{3}{4}$ ". Voice/Data, thermostat, lighting control wiring: Extend conduit to an accessible point above ceiling. In areas with exposed ceilings/structure route low-voltage/control wiring in conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. 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.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
 - 2. Grounding arrangements and connections for separately derived systems.
 - 3. Grounding for sensitive electronic equipment.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4" by 4" inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 1. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
- E. Conductor Terminations and Connections:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4" – by – 4" – by – 12"-inch grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. Thomas & Betts Corporation.
 - e. Unistrut; Tyco International, Ltd.
 - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.
8. Roof Mounted conduit use MAPA products conduit support systems.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
 - 9. Roof Mounted conduit use MAPA products conduit support systems.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: 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-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. LFMC: Liquid-tight flexible metal conduit.
- C. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 2. Electri-Flex Co.
 - 3. Wheatland Tube Company.

- C. Rigid Steel Conduit: ANSI C80.1.
- D. EMT: ANSI C80.3.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: compression type.
- G. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CANTEX Inc.
 - 2. Electri-Flex Co.
 - 3. Carlon Electrical Products.
 - 4. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. Hoffman.
 - 3. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 4. RACO; a Hubbell Company.
 - 5. Thomas & Betts Corporation.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Multi-gang boxes are not acceptable in hospital and ASC facilities in patient care areas.**
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

2.5 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.6 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Plastic. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit.
 - 2. Concealed Conduit, Aboveground: Rigid steel conduit.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC (Sealtite).
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
 - 6. Application of Handholes and Boxes for Underground Wiring:

- a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
 - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
 - c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: Rigid steel conduit.
 7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
 8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
 9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway.
 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
- 3.2 INSTALLATION
- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
 - B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
 - C. Complete raceway installation before starting conductor installation.
 - D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
 - E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Change from Type EPC-40-PVC, or rigid steel conduit before rising above the floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
 - 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit conduit (minimum 36" deep). Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.
- D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 ELECTRICAL EQUIPMENT AND DEVICES IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch. Coordinate labeling requirements with UMC personnel.
- B. All panels, disconnects, light switches, and receptacles shall be labeled in meeting with hospital requirements. Label must indicate name of device and branch circuit feeding the electrical device or equipment.

2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- H. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl tape applied bands:
 - 1. Fire Alarm systems: Red.
 - 2. Security System: Blue and yellow.
 - 3. Telecommunications System: Green and yellow.
 - 4. Control wiring: Green and red.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 10 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchgear.
 - e. Switchboards.

- f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- g. Substations.
- h. Emergency system boxes and enclosures.
- i. Motor-control centers.
- j. Enclosed switches.
- k. Enclosed circuit breakers.
- l. Enclosed controllers.
- m. Variable-speed controllers.
- n. Push-button stations.
- o. Power transfer equipment.
- p. Contactors.
- q. Remote-controlled switches, dimmer modules, and control devices.
- r. Battery-inverter units.
- s. Battery racks.
- t. Power-generating units.
- u. Monitoring and control equipment.
- v. UPS equipment.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 1. Photoelectric switches.
 2. Standalone daylight-harvesting switching controls.
 3. Indoor occupancy sensors.
 4. Lighting contactors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 1. Interconnection diagrams showing field-installed wiring.
 2. Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Intermatic Inc.
 2. Novitas, Inc
 3. Square D; Schneider Electric.
 4. Watt Stopper (The).
- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
 3. Time Delay: Fifteen second minimum, to prevent false operation.
 4. Surge Protection: Metal-oxide varistor, comply with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.

5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Lutron Electronics Co., Inc. or approved equal
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor:
 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
 2. Sensing Technology: Dual technology - PIR and ultrasonic.
 3. Switch Type: SP
 4. Voltage: 120 or 277 V type.
 5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
 8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.3 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Square D; a brand of Schneider Electric.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
 3. Eaton Corporation.
- B. Description: Electrically operated and electrically held, combination-type lighting contactors complying with NEMA ICS 2 and UL 508.
 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.

2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Division 26 Section "Network Lighting Controls."

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.

1.3 SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- B. 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.
- C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 2. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Transformer Enclosure Finish: Comply with NEMA 250.
- D. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- F. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 2. Tested according to NEMA TP 2.
- G. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 2. Indicate value of K-factor on transformer nameplate.
- H. Brackets: Manufacturer's standard brackets.

- I. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Mount all transformers on vibration isolation pads.
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- D. Remove and replace units that do not pass tests or inspections and retest as specified above.
- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 16461

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Architect's and Owner's written permission.
 - 3. Comply with NFPA 70E.

1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor. Only provide for surface mounted panels in finished spaces not in electrical or mechanical rooms.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Same finish as panels and trim.
 - 7. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- H. Panel and circuit breakers shall be "Fully rated". Series rated equipment is not acceptable.
- I. Arc Flash calculations and labeling shall be provided by equipment manufacturer.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker or Lugs only.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- G. Circuit breaker coordination/settings shall be provided by manufacturer.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration. Provide AFCI circuit breakers in all areas required by NEC article 210.12.
 - 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
 - f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
 - g. Circuit breaker coordination/settings shall be provided by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- I. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

- B. Set field-adjustable circuit-breaker trip ranges as indicated in coordination study.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Snap switches and wall-box dimmers.
 - 3. Receptacles and switches shall be Decora style. "White Body"
 - 4. Pendant cord-connector devices.
 - 5. Cord and plug sets.
 - 6. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. 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.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 2. Leviton Mfg. Company Inc. (Leviton).
 - 3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
- B. Device body and coverplate colors shall match existing. Coordinate color requirements with architect and owner.

2.2 STRAIGHT BLADE RECEPTACLES

- A. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD. **All receptacles shall be hospital grade and tamper resistant. Provide Decora style receptacles.**
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL2182
Or Approved Equal

2.3 USB RECEPTACLES

- A. General Description: Straight blade, non-feed-through type with two(2) USB ports. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. **All receptacles shall be hospital grade. Provide Decora style receptacles. USB ports shall be (1) type A and (1) type C.**
- B. Duplex GFCI Convenience Receptacles with two(2) USB ports, 125 V, 20 A: Comply with UL 498 Supplement SD.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; USB8300AC
 - b. Or Approved Equal

2.4 TAMPER RESISTANT RECEPTACLES

- A. Duplex Convenience Receptacles, 125 V, 20 A with tamper resistant internal mechanisms to limit access to energized internal components. **All receptacles shall be hospital grade. Provide Decora style receptacles.**

B.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; 2182WLTRA
 - b. Or Approved Equal

2.5 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. **All receptacles shall be hospital grade and tamper resistant. Provide Decora style receptacles.**
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; GFR8300SG.
 - b. Or Approved Equal

2.6 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 LIGHT SWITCHES

- A. Comply with NEMA WD 1 and UL 20. **Provide Decora style switches.**
- B. Switches, 120/277 V, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; DS1220 (single pole), DS320W (three way), DS420W (four way).
 - b. Or approved equal.
- C. Pilot Light Switches, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HPL1221PL for 120 V and 277 V.
 - a. Or approved equal.
 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

- D. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221L.
 - a. Or approved equal.
 - 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.8 FLOOR BOX SERVICE FITTINGS

- A. Type: 4-Gand deep floor box, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates 120v power from voice and data communication cabling.
- C. Coordinate Cover Plate Color with architect and owner.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable. Extend two(2) 1" conduits from box to an accessible point above ceiling.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; CFB4G30 Series Floor Box. Or Approved Equal
- F. Provide Hubbell System One series fire rated poke-thru floor boxes for second floor applications. Provide receptacles and devices as required. Coordinate floor box type and conduit size with UMC's IT personnel.

2.9 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Coordinate device plates with architect and owner.
 - 2. Provide decora style plates for receptacles.
 - 3. Plate-Securing Screws: Metal with head color to match plate finish.
 - 4. Material for Finished Spaces: coordinate with architect and owner.
 - 5. Material for Unfinished Spaces: 0.035-inch-thick, satin-finished stainless steel.
 - 6. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.10 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Coordinate colors plates with architect and owner.

2. Wiring Devices Connected to Normal Power System: coordinate with architect and owner. unless otherwise indicated or required by NFPA 70 or device listing.
3. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pig-tailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 1. **All receptacles and switches shall be hospital grade.**
 2. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 3. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 4. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 5. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 6. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 7. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 8. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 9. Tighten unused terminal screws on the device.
 10. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. All receptacles and switches shall have labels on cover plates in accordance with NFPA and TDH.
 - 2. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 - 2. Test Instruments: Use instruments that comply with UL 1436.
 - 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.3 DEFINITIONS

- A. HD: Heavy duty.
- B. NC: Normally closed.
- C. NO: Normally open.
- D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Architect no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Architect's written permission.
 - 4. Comply with NFPA 70E.

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: Auxiliary contacts, arranged to activate before switch blades open.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary contacts, arranged to activate before switch blades open.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.

3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I^2t response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- J. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 6. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Kitchen Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Coordination Study.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes the following enclosed controllers rated 600 V and less:
 - 1. Full-voltage manual.
 - 2. Full-voltage magnetic.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
 - 1. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.
 - c. Nameplate legends.
 - d. Short-circuit current rating of integrated unit.
 - e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.

- f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
 - C. Field quality-control reports.
 - D. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Routine maintenance requirements for enclosed controllers and installed components.
 - 2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 - 3. Manufacturer's written instructions for setting field-adjustable overload relays.
 - 4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.
 - E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
 - F. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.
- 1.5 QUALITY ASSURANCE
- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 - B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - C. Comply with NFPA 70.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
 - B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers
- 1.7 PROJECT CONDITIONS
- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

- B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of electrical systems.
 - 2. Indicate method of providing temporary utilities.
 - 3. Do not proceed with interruption of electrical systems without Architect's and Owner's written permission.
 - 4. Comply with NFPA 70E.

1.8 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
 - 1. Manufacturers:
 - a. Square D; a brand of Schneider Electric.
 - b. Cutler-Hammer
- C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - 1. Overload Relays: NEMA ICS 2, melting alloy type.
 - 2. Mounting: Surface

2.3 Magnetic Controllers: Full voltage, across the line, electrically held.

- 1. Configuration: Non-reversing.
- 2. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 4. Control Circuits: Coordinate control voltage with system.
 5. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - d. Analog communication module.
 - e. Electronic type; with phase loss and unbalance protection.
 - f. External overload reset push button.
- D. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
1. Fusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in each fusible-switch enclosed controller.
- D. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."
- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices and facility's central control system. Comply with requirements in Division 26 Section "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- B. Tests and Inspections:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test continuity of each circuit.
 - 3. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages.
 - 4. Test each motor for proper phase rotation.
 - 5. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Enclosed controllers will be considered defective if they do not pass tests and inspections.

- D. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required)

END OF SECTION 262913

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and drivers.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting fixture, including driver housing if provided.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Energy-efficiency data.
 - 4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 - 5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type.
 - a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
 - b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

- B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.
- E. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of fixtures for mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty : Manufacturer's standard form in which light fixtures manufacturer agrees to repair or replace light fixtures that fail in materials or workmanship within specified warranty period.
- B. Warranty Period for LED Light Fixtures: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.2 LED LIGHT FIXTURES

- A. Recessed Fixtures: Comply with NEMA LE 4.
- B. Bulb shape complying with ANSI C79.1.
- C. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- D. CRI of minimum 65. CCT of 4000 K.
- E. Rated lamp life minimum of 35,000 hours.
- F. Lamps dimmable from 100 percent to 1 percent of maximum light output.
- G. Internal driver.
- H. Nominal Operating Voltage: Universal.
 - 1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.3 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
 - 4. Install at least two independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- D. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 271500 – TELEPHONE, DATA AND TV COMMUNICATIONS CABLING

PART 1 - GENERAL

RELATED DOCUMENTS

- A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions (if any) and Division 1 - General Requirements apply to Work of this Section.

REFERENCES

- B. Design, installation and testing of all passive components shall be in compliance with the following referenced documents using latest edition, including any errata or additions:
- C. TIA-568-2.1,.2,.3,.4, Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted Pair Cable Components.
- D. TIA-568-C.1, Commercial Building Telecommunications Cabling Standard.
- E. TIA-569-D, Telecommunications Pathways and Spaces.

SYSTEM DESCRIPTION AND DEFINITIONS

- A. The communication system shall include Category 6 patch panel, Category 6 telephone data, and television(TV) outlets, and connecting hardware. Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F.
- B. All work under this section shall be performed by and all equipment shall be furnished and installed by a qualified telecommunications contractor hereafter referred to as Contractor. Contractor shall have minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- C. The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.
- D. Cable Requirements and Definitions
- E. Horizontal Distribution Wiring - Category 6 UTP/U. All cabling shall be installed by Commscope Systemax certified contractor. Coordinate requirements with UMC's IT personnel.
- F. Intra-building cable that cross-connects the workstation data jack to the designated equipment closet. Horizontal wiring shall be four pair, grade Unshielded Twisted Pair (UTP) cable meeting, at a minimum, Category 6 standards(match existing). Panduit RJ-45 modular connectors will be wired to meet EIA/TIA-568B standards and color code tables. Each connection shall include all eight wires of the four pair cable. All termination patch panels will comply with category 6 standards. Additionally, all equipment selected will meet the manufacturer's end-to-end solution requirements for warranty. All horizontal wiring shall be secured and/or protected to safeguard against damage. All cables that drop below ceiling level will be concealed conduit. Contractor shall coordinate exact connection requirements with UMC's IT personnel prior to any installation.
- G. Patch Panels: Panduit RJ-45 patch panels shall support all of the RJ-45 connections for a designated LAN zone. Each port shall be labeled designating the port's destination outlet and port number. All conductors of all cables shall be terminated at both ends Contractor shall coordinate exact connection requirements with UMC's IT personnel prior to any installation.
- H. Data Outlets: Provide Panduit Category 6 RJ-45 Outlet as indicated on drawings. Contractor shall coordinate exact connection and outlet requirements with UMC's IT personnel prior to any installation.

SUBMITTALS

- A. Section 01330 – Submittal Procedures.
- B. Product Data: Submit for category 6 outlet, category 6 cable, category 6 patch panel.
- C. Test Reports: Reports shall show the field test performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing.

PART 2 - PRODUCTS

HORIZONTAL DISTRIBUTION WIRING SYSTEM REQUIREMENTS

- A. The data/telephone cable shall be Commscope Systimax # 2071E category 6 U/UTP 23AWG with biseccor. Color shall be yellow. Cable shall be rated CMP.
- B. All cabling shall be installed by Commscope Systimax certified contractor. Coordinate requirements with UMC's IT personnel.
- C. Cable protection will be of the highest concern. The cable sheath shall be protected from sharp edges. Where cables pass over a sharp edge, a bushing or grommet shall be inserted to protect the cable.
- D. To reduce EMI induced into the cabling from fluorescent lights, cable sheath shall be installed in a hanging pathway in the area above the drop ceilings to maintain proper clearance of 12 centimeters (five inches) from fluorescent lights.
- E. Testing after installation and termination will be required to ensure a rating to Category 6 performance. The cable's outer sheath shall be "blue" in color for data.
- F. Horizontal cabling shall be installed in a star topology. Each work area outlet must be cabled directly to a horizontal cross connect in the appropriate equipment closet.
- G. Splices shall not be permitted for twisted-pair horizontal cabling.
- H. Bridged taps (multiple appearances of the same cable pairs at several distribution points) shall not be permitted in the horizontal cable.
- I. In all cases where the overall cable length allows, an additional 1.5 meters or 5 feet of slack shall be allowed for in the equipment closet.
- J. In all cases where the overall cable length allows, an additional 30 centimeters or 12 inches of cable slack shall be allowed for at the outlet location.
- K. In no case shall the slack allowances cause the overall length of the cable to exceed the limits as described in this section.
- L. Horizontal Cable Lengths: The maximum horizontal cable length from the cross connect panel to the workstation outlet shall not exceed 90 meters or 295 feet meeting requirements of . An additional 10- meter or 33-foot allowance has been made for the combined length of patch cables and cables used to connect equipment in the work area and equipment rack.
- M. Category 6 High Speed LAN Data specifications
- N. Commscope Systimax # 2071E category 6 U/UTP 23AWG. See testing specification for Category 6 performance - Execution for Attenuation and NEXT requirements.
- O. All cabling shall be installed by Commscope Systimax certified contractor. Coordinate requirements with UMC's IT personnel.

FIBER OPTIC CABLE

- A. Provide in accordance with ICEA S-83-596, TIA/EI-568-C.3, UL and NFPA 70. Cable shall be imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 40 inches.
- B. EIA TIA/EIA-492AAAA-A, multimode, 50/125-um diameter, tight buffered fiber optic cable. Provide a 12-strand multimode fiber optic cable. Provide nonconductive optical fiber general purpose cable (OFN or OFNG), nonconductive optical fiber plenum cable (OFNP), and nonconductive optical fiber riser cable (OFNR) rated cable in accordance with NFPA 70 and UL 910. Type OFNP or OFNR may be substituted for type OFN or OFNG and type OFNP may be substituted for type OFNR in accordance with NFPA 70. The cable cordage jacket, fiber, unit, and group color shall be in accordance with EIA TIA/EIA-598.
- C. Provide fiber optic cable from MDF to second floor IDF/LAN room. Route cable through conduit system.

FIBER OPTIC PATCH PANEL

- A. Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of 16 gauge steel minimum and shall be cabinet mounted and compatible with a EIA-310-D 19 inch equipment rack. Each panel shall provide 12 multimode adapters as duplex SC in accordance with EIA TIA/EIA-604-3A with zirconia ceramic alignment sleeves. Provide dust cover for unused adapters. The rear of each panel shall have a cable management tray a minimum of 8 inches deep with removable cover, in-coming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter. Provide fiber optic patch panel in each LAN hub enclosure. Coordinate equipment and connection requirements with UMC IT personnel.

OPTICAL FIBER ADAPTERS

- A. Provide optical fiber adapters suitable for duplex SC in accordance with EIA TIA/EIA- 604-3A with zirconia ceramic alignment sleeves, as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with EIA TIA-455-21-A for 500 mating cycles. Coordinate equipment and connection requirements with UMC IT personnel.

JACKS AND PATCH PANELS

- A. FAX- Panduit Category 3 rated #CJ88EIY to all connecting hardware appropriate for use with UTP cables specified the EIA/TIA-568-C3. Color shall be ivory. Provide separate patch panels for telephone and data wiring (match existing). Contractor shall coordinate exact connection requirements with UMC's IT personnel prior to any installation.
- B. Data, Telephone, TV Panduit Category 6 rated #CJ688TPBL to all connecting hardware appropriate for use with UTP cables specified in the EIA/TIA-568-C3. Color shall be black. Components used shall be characterized up to a minimum 6 certifications and typically intended for emerging technologies and applications. Provide a minimum of 10% spare ports in patch panel. Contractor shall coordinate exact connection requirements with UMC's IT personnel prior to any installation.
- C. Modular patch panels shall be Panduit #CPPL48WBLY. Color shall be black. Modular patch panel with molded snap-in faceplates. Provide complete assembly as required.

TV/MONITOR CONNECTIONS

- A. TV outlet with RG-6 Coaxial Cable. Provide RG-6 female connector, RG-6 coaxial cable, white decora face plate, back box, j hooks, and conduit to an accessible point above ceiling. Extend RG-6 cable to corresponding floor TTB located in room IT. Provide 15' of slack for each cable. Coordinate requirements with UMC IT personnel.
- B. Monitor outlet Category 6 Data cable. Provide one category 6 data outlet, category 6 data cable, white decora face plate, back box, j hooks, and conduit to an accessible point above ceiling. Extend and connect corresponding floor patch panel located in room IT. Refer to specifications for additional information. Co-

ordinate requirements with UMC IT personnel.

EQUIPMENT RACKS

- A. Provide steel 19”w, 7’ tall, 2-post open frame style equipment/server rack frame NSI/EIARS-310-D. Coordinate equipment rack with UMC IT personnel.
- B. Provide number of racks to support equipment required, including spaces as indicated.
- C. Provide Cable Management System for each rack.
- D. Provide rack with all associated hardware.
- E. All equipment shall meet requirements of UMC IT personnel.

2.8 SUPPORT PRODUCTS

- A. All Data/Telephone cabling shall be in conduit or cable tray. Refer to Section 260533 – Conduit.

SUPPORT PRODUCTS

- A. All Data/Telephone cabling shall be in conduit or cable tray. Refer to Section 16130 - Conduit, and j-hook system. J-hook system shall match existing. J-hooks shall be sized and spaced to meeting cable manufacturer and cabling standards. J-Hook system shall be capable of carrying 25% additional cables.

PART 3 - EXECUTION

- A. All cabling shall be installed by Commscope Systimax certified contractor. Coordinate requirements with UMC’s IT personnel. Contractor
- B. shall provide Category 6 Cable, Category 6 Patch Panels, Category 6 Outlets, Equipment Rack and Mounting hardware for LAN HUB. All communication cables shall be terminated and tested. Contractor shall coordinate exact connection requirements with UMC’s IT personnel prior to any installation.
- C. CABLE DISTRIBUTION
- D. The contractor shall wire the building as indicated on the contract drawings in accordance with standards. The building shall be wired using a universal wire plan that must accommodate the cables described in this specification. The wiring plan is designed to provide adequate pairs to support the campus LAN system’s high-speed data connections.
- E. All cabling shall be installed by Commscope Systimax certified contractor. Coordinate requirements with UMC’s IT personnel. Cable shall be rated CMP.
- F. Panduit Category 6, RJ-45 modular connections shall be wired to meet Commscope Systimax Requirements.
- G. Contractor shall coordinate exact connection requirements with UMC’s IT personnel prior to any installation.
- H. Placement relative to nearby noise sources, such as electric power wiring, radio frequency (RF) sources, large motors and generators, induction heaters, fluorescent light ballast, etc. shall be avoided. If necessary, place exposed cables not closer than 1.2 meters (four feet) from large motors or transformers, 30 centimeters (one foot) from conduit and cables used for electrical power distribution and twelve centimeters (five inches) from fluorescent lighting.
- I. Unless otherwise instructed by this specification installation shall be in compliance with EIA/TIA-568-C1, TIA-568-2, TIA-569, NFPA 70, UL Standards, Telecommunications Cabling Standard, EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces, and ANSI/NFPA 70 National Electric Code. Installation shall also meet any additional manufacturer’s requirements to fulfill warranty specifications.

- J. Provide a minimum of 1.5 meters (five feet) of cable slack in the equipment cabinets and 30 centimeters (twelve inches) at the outlet for each cable run to accommodate for future cabling system changes.

USER WORK AREA

- A. Distribution of drop locations will be as indicated on the contract documents. Provide the following at each outlet location: Minimum Telephone/Data – one (1) Category 6 jack (RJ-45) Data. One (1) Category 3 jack for each fax machine. Coordinate location of fax machines with UMC personnel. A Contractor shall provide yellow cable color and ivory cover plate with UMC's IT personnel prior to any installation. All cabling shall be installed by Commscope Systemax certified contractor. Coordinate requirements with UMC's IT personnel. Cable shall be rated CMP.
- B. Coverplates/faceplate shall be Panduit #CFPL2EIY. Mini-com single gang 2-port and #CFPL4EIY. Mini-com single gang 4-port

Labeling

- A. All data outlets, patch panel ports, and both ends of each cable shall be clearly and neatly labeled. Two cable identification schemes will be used, one for the end of the cable in the work area, and one for the end of the cable at the patch panel. The labeling schemes shall be as existing. Coordinate labeling requirements with UMC's IT personnel.
- B. Patch Panel Scheme: The first portion of the I.D. number will correspond with the room number to which the cable runs.

EQUIPMENT CLOSETS

- A. Equipment racks shall be bolted to the floor slab. Cable guides shall be bolted or screwed to racks. Racks shall be installed level.
- B. Patch Panels: High density, low profile patch panels shall be used in all locations. Patch panels may vary in number of ports provided, but shall be of the same manufacturer and series, for all closets. All patch panels will be populated with port counts that equal or exceed total ports needed, plus 10%, for each closet.
- C. UTP Patch Panels
- D. All patch panels used to terminate UTP cables shall comply with selected vendors channel rating for Category 6.
- E. Patch cables connecting data work ports to the LAN switches shall be Category 6 compliant, both cordage and couplers. Patch cables shall be constructed of stranded cable. Although the switches and other active components will be provided by the owner, all patch cables shall be provided by the contractor to provide connection to these active components. The contractor shall also provide each site a quantity of spare patch cables equal to 10% of the total used at that site. Patch cables shall be appropriately sized to allow for a neat and maintainable system.
- F. All ports will be labeled in accordance with the labeling scheme described in this specification.

TESTING

- A. Horizontal Wiring Testing: Testing of all data horizontal UTP cables shall be performed in accordance with EIA/TIA TSB-1152 to ensure rating of Category 6 performance. Test parameters shall include wire mapping, attenuation, NEXT and noise measurements to verify a limit below 100mV.
- B. All distribution plant facilities associated with the new wiring system shall be tested and verified after installation activities and all major plant rearrangements have been completed. Tested copper pairs shall conform to the design guidelines as specified, as well as manufacturer's standards. Cable plant testing of the data jack will diagnose the presence of all open-loop conductors, noisy lines and distortion, low-loop current, high-loop loss, ringer failures, grounded, shorted or crossed conductors, dB loss, split connections, at-

tenuation range, and/or near-end cross-talk. The contractor will supply complete testing and correction reports/information and explanation to the government, or designated representative, for review prior to acceptance of the system(s). The contractor and the government or designated representative will develop a mutually acceptable format for recording and reporting of testing results prior to the start of testing activities. All errors are to be corrected at the contractor's expense prior to providing the completed records.

- C. Perform Category 6 link tests in accordance with EIA TIA/EIA-568-C.1 and EIA TIA/EIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay and delay skew.
- D. A wire map test will be performed as per TIA/EIA TSB-568-C.3. This test will be used to verify pair to pin termination at each end and check for installation connectivity errors.
- E. Contractor shall test coaxial cable to digital industry standards for transmission rates.
- F. Horizontal Wiring Testing (Test from both ends)
- G. The following parameters will be measured from both sides of the link:
- H. Attenuation - a measure of signal loss in the link.
- I. Near-end crosstalk loss (NEXT) - a measure of signal coupling from one pair to another within a UTP cabling link and is derived from swept/stepping frequency voltage measurements.

Noise Testing

- A. The noise level testing associated with the data circuit will only be required if problems occur with the previous test procedures, or if the manufacturer requests it for warranty purposes. If tested, it shall be measured over seven different frequencies.
- B. Noise will be measured by recording interference from all outside sources (for example, power cables). The noise is generally steady throughout the entire frequency range and permanently exists. Acceptable levels will be the lower of, the manufacturers' specifications, or less than 100mV.
- C. Noise peaks will be measured by adjusting a threshold. All peaks that exceed the threshold will be documented. Acceptable peaks will be determined by the manufacturer's specifications, or by IEEE 802.3 10BaseT Ethernet Standards.

Additional Testing

- A. Any additional testing and/or documentation required by the manufacturer to show full compliance with warranty requirements shall be provided to the government by the contractor. Final test results will meet manufacturer's guidelines for the cabling channel.
- B. Telecommunications Cabling Testing
- C. Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-C.1, EIA TIA/EIA-568-C.2, EIA TIA/EIA-568-C.3, and TIA-568-2. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure. All fiber optic, data, and telephone cables shall be terminated and tested.
- D. For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with EIA TIA/EIA-568-C.3 and EIA TIA/EIA-526-14 using Method A, Optical Power Meter and Light Source for multimode optical fiber.

END OF SECTION 271500

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Addressable fire alarm control panel.
 - 2. Addressable manual fire alarm boxes.
 - 3. Addressable system smoke detectors.
 - 4. Notification appliances.
 - 5. Remote fire alarm annunciator panel.
 - 6. Addressable interface device.
 - 7. Digital alarm communicator transmitter.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire alarm service only.
- B. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire alarm service only.

1.5 SUBMITTALS

- A. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 - 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. NICET-certified fire alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- B. Product Data: For each type of product indicated.

- C. Shop Drawings: For fire alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - 2. Include voltage drop calculations for notification appliance circuits.
 - 3. Include battery-size calculations.
 - 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 - 6. Include alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 - 7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

- D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 - 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

- E. Qualification Data: For qualified Installer.

- F. Seismic Qualification Certificates: For fire alarm control unit, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- G. Field quality-control reports.

- H. Operation and Maintenance Data: For fire alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - 3. Record copy of site-specific software.
 - 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

- a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire alarm control unit.
 7. Copy of NFPA 25.
- I. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire alarm Level III technician.
- C. Source Limitations for Fire Alarm System and Components: Obtain fire alarm system from single source from single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.
- F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.
- H. NFPA Certification: Obtain certification according to NFPA 72 by

1.7 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
 - 2. Detector Bases: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
 - 3. Keys and Tools: One extra set for access to locked and tamperproofed components.
 - 4. Audible and Visual Notification Appliances: One of each type installed.
 - 5. Fuses: two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. NOTIFIER; a Honeywell company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire alarm signal initiation shall be by one or more of the following devices and systems:
 - 1. Manual stations.
 - 2. Smoke detectors.
 - 3. Duct mounted smoke detectors.
 - 4. Heat detectors.
 - 5. Automatic sprinkler system water flow.
- B. Fire alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm at fire alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Release fire and smoke doors held open by magnetic door holders.
 - 6. Activate alarm communication system.
 - 7. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
 - 8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 9. Activate stairwell and elevator-shaft pressurization systems.
 - 10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 11. Recall elevators to primary or alternate recall floors.
 - 12. Activate emergency lighting control.
 - 13. Activate emergency shutoffs for gas and fuel supplies.
 - 14. Record events in the system memory.
 - 15. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.

- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire alarm control unit.
 4. Ground or a single break in fire alarm control unit internal circuits.
 5. Abnormal ac voltage at fire alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire alarm control unit or annunciator.
 9. Fire pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE ALARM CONTROL PANEL

- A. General Requirements for Fire Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands
- C. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style D.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 6.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
 2. Serial Interfaces: Two RS-232 ports for printers.

- D. Smoke Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire alarm control unit.
 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire alarm control unit and detector.
 3. Record events by the system printer.
 4. Sound general alarm if the alarm is verified.
 5. Cancel fire alarm control unit indication and system reset if the alarm is not verified.
- E. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- G. Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire alarm control unit.
1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire alarm control unit.
 2. Status Annunciator: Indicate the status of various alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- H. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
1. Alarm current draw of entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
- J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: Sealed lead calcium.

- K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- L. All fire alarm wiring shall be installed in conduit. All wiring methods and conduit runs shall comply with Section 16130 – Raceway and Boxes
- M. All fire alarm wiring shall be UL listed for use as a fire protective signaling system.

2.4 MANUAL FIRE ALARM BOXES

- A. General Requirements for Manual Fire Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.
 - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be four wire type.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire alarm control unit.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type indicating detector has operated.
 - 7. Retain subparagraph below for analog-addressable system where remotely adjustable detectors are to be used.
 - 8. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire alarm control unit.
- B. Photoelectric Smoke Detectors:
 - 1. Detector address shall be accessible from fire alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
3. Photoelectric Duct-Mounted Smoke Detector: The detector housing shall be UL listed specifically for use in air handling system. Provide duct-mounted sample tube with detector. For each duct-mounted smoke detector provide a remote status/test switch mounted on the ceiling below the unit.

C. Intelligent Thermal Detectors:

1. Provide addressable, fixed temperature 135 degrees F detectors where indicated. Utilize 200 degree F detectors in kitchen area.

2.6 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.
- B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- E. Horn: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. The audible portion of the device shall have a sound output level of at least 90 dBA measured at 10 feet from the device. This visual portion of the devices shall meet the requirements of the American's with Disability's Act and the Texas Accessibility Standards. Minimum candela level for the strobe light intensity shall be 75 and the flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz. The maximum flash duration shall be two-tenths of one second. It is the Contractor's responsibility to provide additional amplifiers, speaker, wire and conduit to meet all requirements of NFPA.
- F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
 1. Rated Light Output:
 - a. 75 cd.
 - b. 15/30/75/110 cd, selectable in the field.
 2. Mounting: Wall mounted unless otherwise indicated.

3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.7 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire alarm control unit, including acknowledging, silencing, resetting, and testing.
 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LCD screen indicating shall match those of fire alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.8 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 1. Verification that both telephone lines are available.
 2. Programming device.
 3. LED display.
 4. Manual test report function and manual transmission clear indication.
 5. Communications failure with the central station or fire alarm control unit.
 - 6.
- D. Digital data transmission shall include the following:
 1. Address of the alarm-initiating device.
 2. Address of the supervisory signal.
 3. Address of the trouble-initiating device.
 4. Loss of ac supply or loss of power.
 5. Low battery.

6. Abnormal test signal.
 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire alarm equipment.
- B. Equipment Mounting: Install fire alarm control unit on concrete base with tops of cabinets not more than 72 inches above the finished floor. Retain first subparagraph below if Project requires seismic bracing. Coordinate with Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Equipment Mounting: Install fire alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.
1. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
 2. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Smoke- or Heat-Detector Spacing:
1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.
- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

- G. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- H. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm-Indicating Devices: Install 80 inches above finished floor or 6 inches below the ceiling as required by ADA/ADAAG. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- J. Visible Alarm-Indicating Devices: Install 80 inches above finished floor or 6 inches below the ceiling as required by ADA/ADAAG.
- K. Fire Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.
- L. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

- A. For fire protection systems related to doors in fire rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - 3. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 7. Supervisory connections at valve supervisory switches.
 - 8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 9. Supervisory connections at elevator shunt trip breaker.
 - 10. Supervisory connections at fire pump power failure including a dead-phase or phase-reversal condition.
 - 11. Supervisory connections at fire pump engine control panel.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire alarm control unit.

3.4 GROUNDING

- A. Ground fire alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.

END OF SECTION 283111

SECTION 311000
SITE CLEARING

PART 1 - SITE CLEARING

- 1.1 Description. This item of work includes the removal and disposal of all materials or objects not intended to remain intact. Removal and disposal shall include, but is not necessarily limited to, rubbish, debris, brush, paving, curb and gutter, foundations, or other structures or materials, known or unknown, which may interfere with the proper execution of the work under this contract.
- 1.2 Quality Assurance. All material excavated shall be classified as defined below:
- A. Provide adequate measures to protect all existing improvements above and below ground, on-site and on adjacent properties, intended to remain intact. Make all repairs necessary in the event of property damage to the satisfaction of the Owner of the damaged property at Contractor's expense.
 - B. Take precautions to avoid interruptions of access to and from adjoining properties. Do not obstruct public rights-of-way without specific permission from the local jurisdiction.
 - C. Take precautions to prevent excessive spread of dust during demolition and clearing work. Occasional sprinkling or moistening of exposed earth may be required to prevent dust being a nuisance to adjoining properties and the public.
 - D. Contractor shall implement Stormwater Pollution Prevention Plan (SWP3) measures including stabilization of ingress/egress areas and erection of runoff prevention measures prior to commencement of clearing operations.
- 1.3 Products.
- A. Protection of work. Barricading, flagmen, cones, temporary lighting, or any other items not specifically called for in these specifications but which may be necessary to assure adequate safety for the public and workmen during demolition and clearing operations shall be provided by the Contractor, and at no additional expense to the Owner.
 - B. Materials. Contractor shall take possession of all materials resulting from demolition, clearing, and grubbing operations that are not to be incorporated into the work. These materials shall be legally disposed of off-site by Contractor.
- 1.4 Construction Methods.
- A. Preparation. Prior to commencing work under this section, Contractor shall locate all utilities and other existing improvements, and elevation benchmarks. Objects, which are to remain, and which might suffer damage due to these operations shall be flagged or otherwise delineated. Contractor shall determine an orderly sequence of the work and coordinate sequence with Owner and material suppliers.
 - B. Utilities. Contractor shall disconnect or arrange to have disconnected and capped or plugged all utilities thus indicated per requirements of entity having jurisdiction. All existing utilities across the site, which are intended to remain intact, shall otherwise be preserved in good operating condition. Contractor shall provide protection as necessary to assure continuance of service.
 - C. Clearing and Grubbing. All stumps, trash, debris, and rubbish within contract work areas shall be removed to ground level, gathered, and removed off-site. All stumps, matted roots, and roots greater than or equal to 3 inches in diameter shall be removed to a minimum depth of 24 inches below finished grade in all paved areas and 12 inches below final grade in all other areas, unless directed otherwise by the Engineer.

- D. Foundations. Below-grade construction and slabs on grade shall be broken up, removed and disposed of by the Contractor. Voids resulting from demolition shall be completely filled with suitable materials and thoroughly compacted.
- E. Pavement. All lines separating pavement or curb and gutter to be removed from pavement or curb and gutter to remain in place shall be cut neatly and in a straight line.
 - 1. Curb and Gutter. The limits of curb and gutter to be removed are shown on the drawings. The method of breaking up and removing the curb and gutter shall be such that no damage results to the remaining curb and gutter or the adjoining pavement
 - 2. Pavement. The limits of bituminous surfaced and concrete paving to be removed are shown on the drawings. Pavement shall be broken up by approved methods and disposed of off-site. Flexible base course shall be retained for use in embankments.



SECTION 31 1100
CONSTRUCTION LAYOUT

PART 1 - GENERAL

1.1 DESCRIPTION

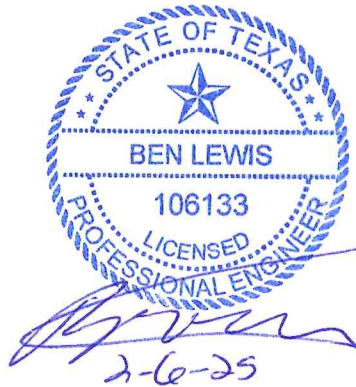
- A. Construction layout is the responsibility of the contractor.
- B. Construction layout control is the responsibility of the contractor.

1.2 WORK INCLUDED

- A. Layout for the construction of site demolition and clearing.
- B. Layout for the construction and placement of rough earthwork and subgrade.
- C. Layout for the construction and placement of site concrete.
- D. Layout for the construction and placement of caliche base course.
- E. Layout for the construction and placement of dense-graded hot-mix asphalt.
- F. Layout for the construction and placement of concrete pavement.
- G. Layout for the construction and placement of on-site & off-site utilities.
- H. Layout for the construction & layout of any buildings or structure related to the project.

1.3 RESPONSIBILITY OF CONTRACTOR

- A. Provide and pay for any construction layout required during the duration of the project.



SECTION 312000
EARTH MOVING

PART 1 - GENERAL

- 1.1 Description. This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct streets and parking areas as well as other areas for drainage, sidewalks or other purposes in accordance with these specifications and in conformity to the dimensions and typical section shown on the plans. Additionally, where plan sheets conflict with specifications, the more restrictive or stringent specification and/or detail shall be followed.
- 1.2 Classification. All material excavated shall be classified as defined below:
- A. Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature.
 - B. Unsuitable Excavation. Any material containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction.
- 1.3 Materials.
- A. Furnish approved material capable of forming a stable embankment from required excavation in the areas shown on the plans or from sources outside the project location. Granular material that is free from vegetation or other objectionable material and meets the requirements of Table 1

Table 1
Outside Building Pad Testing Requirements

Property	Test Method	Specification Limit
Liquid limit	Tex-104-E	Max. 35
Plasticity index (PI)	Tex-106-E	Min. 5; Max 15
Bar linear shrinkage	Tex-107-E	Min. 2; Max. 10

The Linear Shrinkage test only needs to be performed as indicated in Tex-104-E.

Materials such as rock, loam, clay, or other approved materials.

Material from required excavation areas shown on the plans.

Retaining wall backfill material must meet the requirements of the pertinent retaining wall Items.

PART 2 - EXECUTION

- 2.1 General. All unsuitable material shall be disposed of off-site.
- A. If necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. The Contractor shall, at his own expense, satisfactorily repair or pay the cost of all damage to such facilities or structures, which may result from any of the Contractor's operations during the period of the contract.
- 2.2 Excavation. No excavation shall be started until the Contractor has staked out the work.
- A. All suitable excavated material shall be used in the formation of embankment, subgrade, or for other purposes shown on the plans. All unsuitable material shall be disposed of off-site.
- B. When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or disposed of as directed. When the volume of excavation is not sufficient for constructing the fill to the grades indicated, the deficiency shall be obtained from approved sources.
- C. The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water, which may affect the work.
- D. Removal of Utilities.
1. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by someone other than the Contractor, e.g., the utility unless otherwise shown on the plans. All existing foundations shall be excavated for at least 2 feet below the top of subgrade or as indicated on the plans, and the material disposed of as directed. All foundations thus excavated shall be backfilled with suitable material and compacted as specified herein.
- E. Compaction Requirements.
1. The subgrade under areas to receive structural and nonstructural fill shall be compacted to a depth as shown on the plans. Compaction shall be to a density of not less than 95 percent for cohesive soils or 100 percent for noncohesive soils of the maximum density as determined by ASTM D 698. One dry density and moisture content test per building pad and every one thousand (1,000) square yards outside building pads.
 2. The in-place field density shall be determined in accordance with ASTM D1556, ASTM D 2167 or ASTM 2922. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in top 6 inches of the subgrade.
 3. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the plans or as directed by the Engineer.
- 2.3 Drainage Excavation.
- A. Drainage excavation shall consist of excavating for drainage ditches such as intercepting, inlet or outlet, for temporary levee construction; or for any other type as designed or as shown on the plans. The work shall be performed in the proper sequence with the other construction. All satisfactory material shall be placed in fills; unsuitable material shall be placed in waste areas or as directed. Intercepting ditches shall be constructed prior to starting adjacent excavation operations. All necessary work shall be performed to secure a finish true to line, elevation, and cross section.
- B. The Contractor shall maintain ditches constructed on the project to the required cross section and shall keep them free of debris or obstructions until the project is accepted.
- 2.4 Preparation of Embankment Area.
- A. Where an embankment is to be constructed to a height of 4 feet or less, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed, and the cleared surface shall be completely broken up by plowing or scarifying to a minimum depth of 6 inches. This area shall then be compacted as indicated in paragraph 2.5.

- 2.5 Formation of Embankments.
- A. Embankments shall be formed in successive horizontal layers of not more than 9 inches in loose depth, unless otherwise approved by the Engineer.
 - B. The grading operations shall be conducted, and the various soil strata shall be placed, to produce a soil structure as shown on the typical cross section or as directed. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.
 - C. Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage.
 - D. The material in the layer shall be within +/-2 percent of optimum moisture content before rolling to obtain the prescribed compaction. In order to achieve a uniform moisture content throughout the layer, wetting or drying of the material and manipulation shall be required when necessary. Should the material be too wet to permit proper compaction or rolling, all work on all of the affected portions of the embankment shall be delayed until the material has dried to the required moisture content. Sprinkling of dry material to obtain the proper moisture content shall be done with approved equipment that will sufficiently distribute the water. Sufficient equipment to furnish the required water shall be available at all times.
 - E. Rolling operations shall be continued until the embankment is compacted to not less than 95 percent of maximum density for noncohesive and cohesive soils as determined by ASTM D 698.
 1. Structural fill shall be compacted to a depth as shown on the plans. Compaction shall be to a density of not less than 95 percent for cohesive soils or 100 percent for noncohesive soils of the maximum density as determined by ASTM D 698. One dry density and moisture content test per building pad per lift.
 2. Non-structural fill (outside building pads) shall be compacted to a depth as shown on the plans. Compaction shall be to a density of not less than 95 percent for cohesive soils or 100 percent for noncohesive soils of the maximum density as determined by ASTM D 698. One dry density and moisture content test every one thousand (1,000) square yards.
 - F. The in-place field density shall be determined in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 2922.
 - G. Compaction areas shall be kept separate, and no layer shall be covered by another until the proper density is obtained.
 - H. During construction of the embankment, the Contractor shall route equipment at all times, both when loaded and when empty, over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.
 - I. In the construction of embankments, layer placement shall begin in the deepest portion of the fill; as placement progresses, layers shall be constructed approximately parallel to the finished pavement grade line.
 - J. When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the embankment and the other material shall be incorporated under the future paved areas. Stones or fragmentary rock larger than 4 inches in their greatest dimensions will be not be allowed in the top 6 inches of the subgrade. Rockfill shall be brought up in layers as specified or as directed and every effort shall be exerted to fill the voids with the finer material forming a dense, compact mass. Rock or boulders shall not be disposed of outside the excavation or embankment areas, except at places and in the manner designated.
 - K. When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in layers not exceeding 2 feet in thickness. Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments

of rock. These type lifts shall not be constructed above an elevation 4 feet below the finished subgrade. Density requirements will not apply to portions of embankments constructed of materials, which cannot be tested in accordance with specified methods.

- L. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material.

2.6 Finishing and Protection of Subgrade.

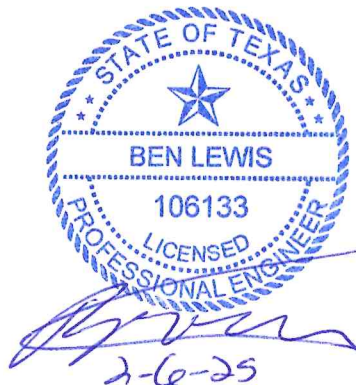
- A. After the subgrade has been substantially completed all areas shall be conditioned by removing any soft or other unstable material which will not compact properly. The resulting areas and all other low areas, holes or depressions shall be brought to grade with suitable select material. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans.
- B. Grading of the subgrade shall be performed so that it will drain readily. The Contractor shall take all precautions necessary to protect the subgrade from damage and shall limit hauling over the finished subgrade to that which is essential for construction purposes.
- C. All ruts or rough places that develop in a completed subgrade shall be smoothed and recompacted.

2.7 Haul.

- A. All hauling will be considered a necessary and incidental part of the work. Its cost shall be considered by the Contractor and included in the contract price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

2.8 Tolerances.

- A. In those areas upon which a base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 16-foot straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 1/2 inch, or shall not be more than 0.04 foot from true grade as established by grade hubs or pins. Any deviation in excess of these amounts shall be corrected by loosening, adding, or removing materials; reshaping; and recompacting by sprinkling and rolling.



SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Soil treatment with termiticide.
- B. Related Sections:
 - 1. Section 061000 "Rough Carpentry" for wood preservative treatment by pressure process.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For termite control products, from manufacturer.
- B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- C. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- B. Source Limitations: Obtain termite control products from single source from single manufacturer.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
 - 1. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - 3. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

SECTION 321313
CONCRETE PAVING

PART 1 - GENERAL

- 1.1 Description. These specifications shall govern Portland cement concrete used for curb and gutter, valley gutters and fillets, alley paving, sidewalks, street paving, site paving, curb ramps, medians, and drainage improvements. Where plan sheets conflict with specifications, the more restrictive or stringent specification and/or detail shall be followed.
- A. The concrete shall be produced at a Ready-Mix Concrete Batch Plant conforming to ASTM C94.
 - B. The concrete shall be transported to the project location in approved Revolving Drum Agitator Trucks, and shall be placed within one hour of mixing time. The concrete shall be continuously mixed during transit.
 - C. Concrete shall have a temperature of less than 90 degrees at time of placement. Concrete above this temperature will be rejected and shall be removed from the job site.
 - D. No more than eight yards of concrete shall be loaded in a Revolving Drum Agitator Truck and transported to the job site. Loads in excess of eight yards will be rejected and shall be removed from the job site.
 - E. No patching of any nature shall be allowed in repairing any damage to concrete improvements. Where damage occurs, the section shall be removed to the nearest joints and shall be replaced with new construction. Small cracks with no evidence of displacement may be repaired with epoxy, only where approved by the Engineer.
 - F. All concrete shall have 5 percent, minus 1.5 percent to plus 3 percent, air entrainment in conformance with ASTM C260.
 - G. When delivered to the jobsite, each truck shall provide the load ticket indicating weights of all concrete ingredients, including cement, aggregates, water, and admixtures.
 - H. Load tickets must be computer generated.
- 1.2 Classification

Class	Type
A	Curb and gutter, sidewalks, curb ramps, drainage channels, medians, inlet boxes, headwalls, junction boxes, residential driveways, and retaining walls
B	Alley returns, and alley paving
C	Concrete pavement, valley gutter, fillets, and commercial driveways
D	Utility encasements
E	Fast setting concrete pavement such as "Fast Track" Concrete Pavement or, other special design.

- A. Thickness of Concrete Surfaces:
 - 1. Concrete paving shall have a minimum thickness as shown on plans.
 - a. No tolerance on minimum thickness will be allowed.
 - b. All other proposed concrete paving thickness shall be approved in writing by the Engineer.

1.3 Mix Design

- A. Thirty (30) days prior to beginning any concrete construction the contractor shall submit the concrete mix design to the Engineer for approval.
- B. The following shall be submitted to the Engineer for review:
 - 1. Test certificates from an approved commercial testing laboratory on all proposed aggregate.
Certificates shall indicate material source, gradation, and loss from 5 cycle Magnesium Sulfate test not to exceed 25 percent.
- C. Mix design based on water-cement ratio.
 - 1. Results of compression tests in conformance with ASTM C 39 and/or flexural tests in conformance with ASTM C78, made by an approved commercial testing laboratory.
 - 2. Tests shall be made on 6 cylinders and/or 6 beams at curing times appropriate to the class of concrete.
- D. The Engineer will approve or reject the mix design and materials based on these submittals.
- E. Mix design approval shall be subject to additional testing during construction.
- F. Mix designs for various classes of concrete shall conform to the following:

Class	Min. Sacks Cement per cubic yard	Water/Cement Ratio	Max. Slump (Inches)
A	5	0.40 – 0.60	5
B	5	0.40 – 0.60	5
C	6	0.35 – 0.45	3
D	4	0.40 – 0.60	5
E	As Required for specific cure time and strength.		

- 1. New mix designs shall be submitted annually, or when material properties or sources change
- 2. New mix design submittal will be required for any deviation from the mix design during construction.

1.4 Strength Requirements

- A. The various classes of concrete shall conform to the following minimum strengths in pounds per square inch (psi) as determined by the average of two test cylinders or beams:

Class	Min. Compressive Strength			Min. Flexural Strength
	3 Day	7 Day	28 Day	28 Day
A	-	2100	3000	-
B	2500	3000	-	-
C	-	2500	4000	600
D	-	-	2500	-
E	3000 psi at 24 hours			

- B. ACI Testing will be followed
- C. When cores are subsequently used to prove compressive strength where test cylinders indicate failures or the quality of the installation is of concern, cores shall be tested in accordance with ACI C42. The cores shall meet minimum 28-day compressive strength in the table above and meet 85% of the mix design strength.
- D. To place concrete in service the strength must meet 75% of the 28-day minimum compressive strength in the table above.

1.5 Materials

A. Cement

1. Cement shall be Type I, Type II, or Type I-II cements, conforming to ASTM C150 "Standard Specification for Portland Cement".
2. The contractor shall notify the Engineer prior to any changes of the cement supplier or source during construction. The Engineer may require a new mix design if changes of supplier or source occur.
3. Supplementary Cementitious Materials may replace up to 30% of the Cement with the following limits.
 - a. Fly Ash conforming to ASTM C618, Class C or F no more than 30% by weight.

B. Aggregate

1. Concrete aggregate shall consist of natural, washed and screened sand, and washed and screened gravel or clean crushed stone conforming to ASTM C33.
2. All aggregate shall be free of injurious amounts of clay, soft or flaky materials, loam, organic impurities, or other deleterious materials.
3. Fine aggregate shall be graded from fine to coarse and shall conform to ASTM C136.
 - a. The gradation for fine aggregate shall meet the following requirements:

Fine Aggregate	Cumulative Percent Retained (by weight)
Retained on 3/8" Sieve	0
Retained on No. 4 Sieve	0-5
Retained on No. 8 Sieve	0-20
Retained on No. 16 Sieve	15-50
Retained on No. 30 Sieve	35-75
Retained on No. 50 Sieve	65-90
Retained on No. 100 Sieve	90-100
Retained on No. 200 Sieve	97-100

4. Coarse aggregates shall be well graded from coarse to fine with a maximum size of 1-1/2 inches, and shall conform to ASTM C136.
 - a. The gradation for coarse aggregate shall meet the following requirements:

Coarse Aggregate	Cumulative Percent Retained (by weight)
Retained on 1-3/4" Sieve	0
Retained on 1-1/2" Sieve	0-5
Retained on 3/4" Sieve	10-40
Retained on 1/2" Sieve	40-75
Retained on No. 4 Sieve	95-100

Material Property	Max. Allowable Limit
Deleterious Material	2.0%
Decantation	1.5%
Flakiness Index	17
Magnesium Sulfate Soundness	25%

5. Aggregate Quality Requirements shall comply with the following requirements:
6. Stockpiles shall be protected from dusty conditions by drift fences or other methods approved by the Engineer.
 - a. Stockpiling methods used shall not allow aggregate to roll down the slope as it is added to existing stockpiles.
 - b. Stockpiles shall be built in layers of uniform thickness.
 - c. Equipment shall not be permitted to operate over the same lift repeatedly.

1.6 Water

- A. Water shall be clean, clear, free from oil, acid or organic matter and free from injurious amounts of alkali, salts, or other chemicals and shall conform to AASHTO T26.

1.7 Admixtures

- A. Admixtures may be applied to the concrete mix design when approved by the Engineer to achieve any desired special properties. Chemical admixtures shall conform to ASTM C494. Chemical admixtures shall not be used as a substitute for Cement.
- B. Mineral admixtures such as Class C Ash and Natural Pozzolans in conformance with ASTM C618 may be used with Types I, II, and III Portland Cement.
- C. When fly ash is permitted to be used, "cement" in relation to mix design shall be defined as "cement plus fly ash".
 1. Fly ash may constitute a maximum of 30 percent by weight of the cement.

1.8 Reinforcing Material

- A. All concrete shall incorporate reinforcement as shown on the plans.
- B. Steel
 1. All steel reinforcing materials shall be securely held in proper position with devices appropriate to the type of reinforcement used, subject to approval by the Engineer.
 2. Wire mesh shall conform to ASTM A185, and shall be 6-inch x 6-inch – 6-gauge welded wire fabric as specified.
 3. Reinforcing bars shall be grade 60 (60 KSI), open-hearth, basic oxygen or electric furnace new billet steel manufactured in accordance with ASTM A615 and ASTM A305.
 4. Steel reinforcing materials shall be stored off the ground in a manner as to be protected from accumulations of grease, mud, other foreign matter and rust producing materials.
 5. When incorporated into construction, steel reinforcement shall be free from rust, scale, oil, mud, and structural defects.
 6. Dowels for slip joints shall be smooth plain round bars free from burrs, rough surfaces, and deformations. Caps, sleeves, or wrapping shall be as indicated on plan sheets.
 7. Chairs shall be used to support the reinforcing steel in the correct position while concrete is being placed. Chairs shall be made of plastic (preferred) or steel, and shall be of adequate size to positively hold the reinforcing materials in position.

1.9 Joints

- A. Curb and gutter (Class A concrete) shall be constructed with an expansion joint at the tangent point of each return at intersections and at intervals not more than 40 feet between the intersections.
 - 1. Construction joints formed by removable metal templates accurately shaped to the cross-section of the curb and gutter shall be located at the midpoint of each section between expansion joints, or as directed by the Engineer.
 - 2. Tooled contraction joints cut at least one quarter the concrete depth shall be placed at 10-foot intervals.
 - 3. Expansion joint material shall be placed full depth of the concrete curb.
- B. Parking lot, Street and Driveway Paving (Class C) shall be constructed with contraction and expansion joints as indicated on the plan and detail sheets.
 - 1. Unless otherwise noted, the joints shall be sawed $\frac{1}{2}$ inch wide and to a depth equal to $\frac{1}{4}$ of the pavement thickness plus one-half inch.
 - 2. Joints shall be sawed within 12 hours of placement of the concrete paving.
 - 3. Joints shall be sealed with elastomeric sealer.
 - 4. Joints shall be cleaned thoroughly with high press air prior to installation of any sealing materials.
- C. Valley gutters and fillets shall be constructed with tooled construction joints.
 - 1. Joints shall be sealed with an elastomeric sealer.
 - 2. Joints shall be cleaned thoroughly with high pressure air prior to installation of any sealing materials.
- D. Joint Sealing Materials
 - 1. Zip Strip Bituminous pre-molded expansion joint board material shall conform to ASTM D1751 and shall be placed as indicated on plan sheets or in these specifications.
 - 2. Expansion joint material shall be placed full depth of the concrete slab.
 - 3. Elastomeric sealant for contraction joints shall be, or shall be equivalent to, W.R.Meadows "SOF-SEAL", W.R. Meadows #158 cold applied, or "GARDOX" as required by plan sheets.
 - 4. Hot poured sealant for joints between Portland cement concrete and Bituminous concrete shall conform to ASTM D3405.
 - 5. Hot poured joint sealant for all other joints in Portland cement concrete pavement shall conform to ASTM D3406.
 - 6. Cold poured joint sealant shall conform to ASTM C920.
 - 7. Elastomeric joint sealant shall be mixed and applied in accordance with the manufacturer's recommendations.
 - 8. Prior to application, joints shall be cleaned by sandblasting and otherwise prepared so that the sealant adheres to the surfaces to form an effective seal against moisture and solid particles.
 - 9. The sealant shall be a soft, highly flexible, crack, or break when exposed to hot and cold temperature extremes typical of local conditions.
 - 10. Backer rod used with elastomeric sealant shall be 25 percent greater in diameter than the joint width. It shall be made of polyethylene foam or other material as recommended by the sealant manufacturer.
 - 11. Compression of the backer rod material shall be approximately 25 percent shrinkage at 8 psi applied stress.
 - 12. The material shall not melt, shrink, evaporate, or absorb water, and shall be compatible with the application of the sealant to be used.

1.10 Curing Compounds

- A. All fresh concrete surfaces shall be completely painted with a liquid membrane forming curing compound at a rate of one gallon per every 180 square feet. Its application shall conform to DMS - 4650 and TxDOT Item "Concrete Structures - Curing Materials".
 - 1. Fresh concrete is defined as less than 10 minutes after finishing
 - 2. No other methods of moisture retention on fresh concrete shall be used unless specifically approved by the Engineer.

1.11 Forms

- A. Forms for curb and gutter, paving, and flatwork may be of wood or metal, of a section satisfactory to the Engineer, straight, free of warp, and of a depth equal to the depth of the concrete section formed.
- B. Forms shall be constructed accurately to the line and grade as established in the field, shall be adequately braced so that they will not move during the placing of the concrete, and shall remain in place at least 12 hours after placing of the concrete.
- C. Forms shall be treated with a light oil or release agent before each use, and forms which are to be re-used shall be cleaned immediately after each use and maintained in good condition.
- D. Curb forms shall be such that the face of the curb can be formed by use of a face form held in place by steel templates.
- E. Forms used for curb radii shall meet all of the above specifications, except that face forms on curb radii may be omitted if a true section and an accurate flow line can be obtained by other methods approved by the Engineer.
- F. In no case will concrete placement be started without the approval of the Engineer.
- G. No forms shall be placed until the subgrade is within one inch of its finished grade.
- H. Forms for paving slabs may be used as a guide for screeding.
- I. Where longitudinal construction joints are required, the form shall be so constructed as to provide an approved load transfer mechanism in the face.

PART 2 - EXECUTION

2.1 Placing and Finishing Concrete

- A. Placing of concrete shall not start before sunrise, and shall stop one hour before sunset.
 - 1. Concrete shall be placed as close to its proper location as practical.
 - 2. Sufficient concrete shall be placed to allow for shrinkage and extra material for finishing.
 - 3. The concrete shall be floated and troweled to the approximate section.
 - 4. When water is needed for finishing purposes it must be dispensed by a pressurized canister with a misting nozzle.
- B. Removal of face forms and finishing of curb and gutter shall be started only after a partial set occurs.
 - 1. Only construction approved forms, templates, and tools shall be used to form the cross-sections indicated on plan or detail sheets.
- C. Concrete shall not be placed when the ambient temperature is below 40 degrees F or if sustained winds are 25 mph or higher as determined by the Texas Tech University Mesonet sites in Midland. If the sustained winds exceed the 25 miles per hour all placement operations will cease immediately.
- D. Concrete shall not be placed on frozen subgrade.
- E. The contractor shall have available sufficient covering material, approved by the Engineer, to immediately protect concrete should the air temperature fall below 33

degrees F. This protection and forms shall remain in place as long as the temperature continues below 32 degrees, to a maximum of 5 days.

- F. No salt or other chemical admixtures shall be added to the concrete to prevent freezing.
- G. All concrete placed for pavement shall be consolidated by use of mechanical vibrators approved by the Engineer and designed to vibrate the concrete internally.
- H. Vibrators shall be operated in a manner not to interfere with joints, and shall not come in contact with forms. Vibrators shall not be used to move concrete within the forms.
- I. All other concrete surfaces shall be completed with a light broom finish.
- J. When forms are used for concrete paving the forms must stay in place for a minimum of 12 hours.
- K. No equipment shall be placed on concrete until it has reached 75% of the specified 28-day compressive strength.
- L. Finished concrete surfaces shall not have irregularities in excess of 1/8 inch when tested with a 10-foot straightedge using the TxDOT Item 585 Surface Test Type A.
- M. Prior to acceptance, the Contractor shall apply sufficient water to all gutters and paving to determine locations of ponding.
- N. Ponded areas deeper than 1/8 inch shall be removed and replaced, or rectified as directed by the Engineer.
- O. Any concrete construction damaged by equipment, tools, vandals, or other influences shall be replaced at the contractor's own expense.

2.2 Tolerance in Elevation and Grade

- A. Curb and gutter or other concrete surfaces shall be constructed to the elevations and grades as indicated on plan sheets. Deviation from elevations indicated on plans resulting in a longitudinal slope of less than 0.15%, will be considered to be deficient, and shall be removed and replaced at the correct elevations as indicated on the plans.



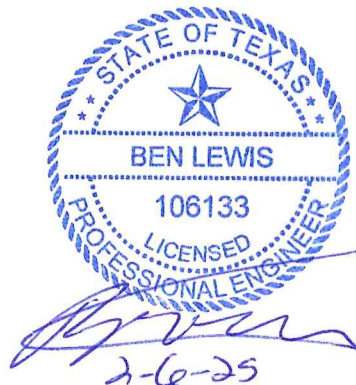
SECTION 321723
PAVEMENT MARKINGS

PART 1 - GENERAL

- 1.1 Description. This Section includes the following: Furnish and install all painted lines, directional arrows, handicapped symbols, or similar markings on paved surfaces, as shown on the drawings or specified herein, as required by jurisdiction having authority, and as required to complete the work. Where plan sheets conflict with specifications, the more restrictive or stringent specification and/or detail shall be followed.
- 1.2 Materials. Acrylic Waterborne Paint or Low Volatile Organic Compound (VOC) solvent base paint, lead and chromate free, ready-mixed, cold applied traffic marking paint, white or yellow color as designated on the plans for striping and lane markings, white and blue as international handicapped parking symbols. Acceptable products include Devoe Exterior "Safety Line" or approved equal.

PART 2 - EXECUTION

- 2.1 Verification of Conditions: Examine areas and conditions under which the work of this Section will be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.
- 2.2 Surface Preparation: Allow fresh pavement surfaces to weather at least 30 days prior to application of traffic marking paint.
- 2.3 Application: Traffic Marking Paint: Unless otherwise indicated, apply traffic marking paint in nominal 4" wide stripes at the rate of 100 to 110 sf/gal
 - A. Unless otherwise indicated, apply traffic markings in nominal 4" wide stripes with clear and sharp dimensions. See drawings for striping patterns, directional arrows and symbols.
 - B. Unless otherwise indicated, use yellow markings at lane striping and directional symbols, white markings at parking striping and white and blue markings at international handicapped symbols.
 - C. Comply with ANSI 117.1 and ADA requirements for graphic symbols, stall widths, and access aisles at handicapped parking spaces. Provide approved templates for symbols and directional arrows.



SECTION 330500
SITE UTILITIES

PART 1 - GENERAL – DOMESTIC WATER SERVICE CONNECTIONS

- 1.1 General
- A. This section of the specifications describes the materials required in the installation of service connections. All service connections shall be installed as shown in the plans, unless otherwise specified. Where plan sheets conflict with specifications, the more restrictive or stringent specification and/or detail shall be followed.
- 1.2 Service saddles
- A. All service taps will be made using Mueller bronze service double strap, malleable iron body pipe saddle, with an integral gasket seal around the tap opening. Saddles shall have 1, 1-1/2 or 2-inch AWWA standard corporation stop threads as specified.
- 1.3 Corporation stops
- A. All service taps will be fitted with a corporation stop having 1, 1-1/2 or 2-inch AWWA standard threads on the inlet side and pack joint outlet connections suitable for use with 1, 1-1/2 or 2-inch polyethylene service tubing with copper tubing outside diameter. All corporation stops shall be manufactured according to AWWA Standard C800.
- 1.4 Service tubing
- A. Service connections shall be made with 1, 1-1/2, 2 or 2-1/2 inch polyethylene tubing. The tubing shall have the same outside diameter as copper tubing of the same nominal O.D., shall have a standard dimension ratio of 9, pressure class 160. It shall be approved by the National Sanitation Foundation for use in potable water service, and shall be so marked.
- 1.5 Meter valve
- A. Each 1 or 1-1/2 inch meter connection shall be fitted with Mueller ball meter valve having a pack joint inlet for use with 1 or 1-1/2 inch polyethylene tubing, a ball or plug valve fitted with a lockout wing, 110 compression connection inlet and a threaded meter connection for connecting to a 1 or 1-1/2 inch meter.
- B. Each 2-inch meter connection shall be fitted with 2-inch gate valve as specified above.
- 1.6 Service meter
- A. Water meters furnished shall be produced from an ISO 9001 manufacturing facility and conform to the "Standard Specifications for Cold Water Meters" C700, latest revision issued by AWWA or as otherwise stated.
- B. Only magnetic-driven, positive displacement meters of the flat nutating disc type will be accepted because of enhanced low flow accuracy performance.
- C. The size, capacity, and meter lengths shall be as specified in AWWA Standard C700 (latest revision). The maximum number of disc nutations is not to exceed those specified in AWWA C700 latest revision.
- D. All meter maincases shall be made of a no-lead high copper alloy containing a minimum of 85% copper that meets the ANSI/NSF 61 standard. The serial number should be stamped between the outlet port of the maincase and the register. Maincase markings shall be cast raised and shall indicate size, model, direction of flow, and NSF 61 certification. Plastic maincases are not acceptable.
- E. Maincases 1 and 1-1/2 inch meters shall be of the removable bottom cap type with the bottom cap secured by six (6) bolts on the 1 and 1-1/2 inch size.
- F. All no-lead maincases shall be guaranteed free from manufacturing defects in workmanship and material for the life of the meter.
- G. All meters must be adaptable to a field programmable absolute encoder register without interruption of the customer's service.
- H. All maincase bolts shall be of 300 series non-magnetic stainless steel to prevent corrosion.

- I. The register shall be of the straight reading sealed magnetic drive type and shall contain six (6) numeral wheels. Registers must be roll sealed and dry. All direct reading register cups shall be copper to prevent corrosion and be covered with a high strength, impact resistant flat glass lens to prevent breakage. The lens shall be positioned above the register box to allow for run off of debris. The register lid shall overlap the register box to protect the lens. The register retaining ring shall be designed to absorb impact from the register. Register boxes and lids shall be of high-strength synthetic polymer or approved equivalent. All registers shall have the size, model and date of manufacture stamped on the dial face. The dial shall have a red center sweep hand and shall contain 100 equally divided graduations at its periphery.
- J. The register must contain a low flow indicator with a 1:1 ratio to disc nutations to provide leak detection.
- K. Registers shall be secured to the maincase by means of a plastic tamper-proof seal to allow for inline service replacement. Register seal screws are only accepted when supplied with attached sealing wire to at least one bottom cap bolt with seal wire holes of not less than 3/32" in diameter.
- L. Registers shall be guaranteed for at least 10 years. All meters will be guaranteed for one year on material and workmanship.
- M. Meters shall meet City specifications, verify model and size.

PART 2 - EXECUTION – DOMESTIC WATER SERVICE CONNECTIONS

- 2.1 The contractor shall install service connections at each location marked on the plans, according to the installation detail shown in the plans. All installations shall be hydrostatically tested prior to placing them in service, and all leaks shall be corrected.

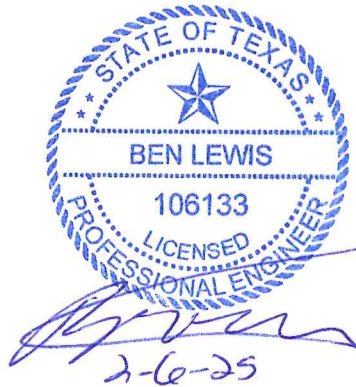
PART 3 - GRAVITY SEWER SERVICE CONNECTIONS

3.1 General

- A. Gravity sewer service lines in this project shall be constructed using PVC pipe, unless other materials are specified in the plans.
- B. Tees or wyes shall be provided in sewer main lines for service connections at each lot or building site.
- C. Service connections shall be schedule 40 pvc.
- D. Service lines shall not cross property boundaries into adjacent private property without coverage by a dedicated easement.
- E. Minimum size service connections shall be 4-inch diameter.
- F. Maximum size service connection shall be no larger than one standard size smaller than the main to be tapped.
- G. Size-on-size service connections are not allowed.
- H. Gravity sewer taps shall connect to sewer main lines at or above the spring line.

PART 4 - EXECUTION – GRAVITY SEWER SERVICE CONNECTIONS

- 4.1 The contractor shall install service connections at each location marked on the plans, according to the installation detail shown in the plans. All installations shall be hydrostatically tested prior to placing them in service, and all leaks shall be corrected.



Geotechnical Evaluation Report

UMC Wolfforth Clinic
Donald Preston Dr. & Preston Hollow Lane
Wolfforth, Texas

Prepared for

UMC Health System



SHANE NANCE, P.E.

Shane Nance, PE
Associate Director, Senior Engineer
License Number: 81519
February 5, 2025

Project B2500461

Braun Intertec Corporation
TBPELS Firm Registration No. F-12228

February 5, 2025

Project B2500461

UMC Health System
c/o Condray Design Group, Inc.
Mr. Grant Koertner
3708 Upland Avenue
Lubbock, TX 79407
806.748.6190
grant@condray.com

Re: Geotechnical Evaluation
UMC Wolfforth Clinic
Donald Preston Dr. & Preston Hollow Lane
Wolfforth, Texas

Dear Mr. Koertner:

We are pleased to present this Geotechnical Evaluation Report for the referenced site. The attached report contains a description of our review of available information, our field exploration program, our engineering evaluation and interpretation of the results with respect to the project characteristics, our geotechnical recommendations for site development and foundation design, as well as construction guidelines for the planned project.

Thank you for making Braun Intertec Corporation your geotechnical consultant for this project. If you have questions about this report or if there are other services that we can provide in support of our work to date, please contact Shane Nance at 806.677.0600 (snance@braunintertec.com).

Sincerely,

BRAUN INTERTEC CORPORATION
TBPELS Firm Registration No. F-12228



Joel Gonzalez, EIT
Staff Engineer



Shane Nance, PE
Associate Director, Senior Engineer

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Appendix

Soil Boring Location Sketch

Log of Boring Sheets ST-1 through ST-7

Fence Diagram

Descriptive Terminology of Soil

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the proposed design and construction of a new single-story clinic and its associated parking lot. The site is located at Donald Preston Dr. and Preston Hollow Lane in Wolfforth, TX. Figure 1 shows an illustration of the approximate proposed site location.

Figure 1. Site Location

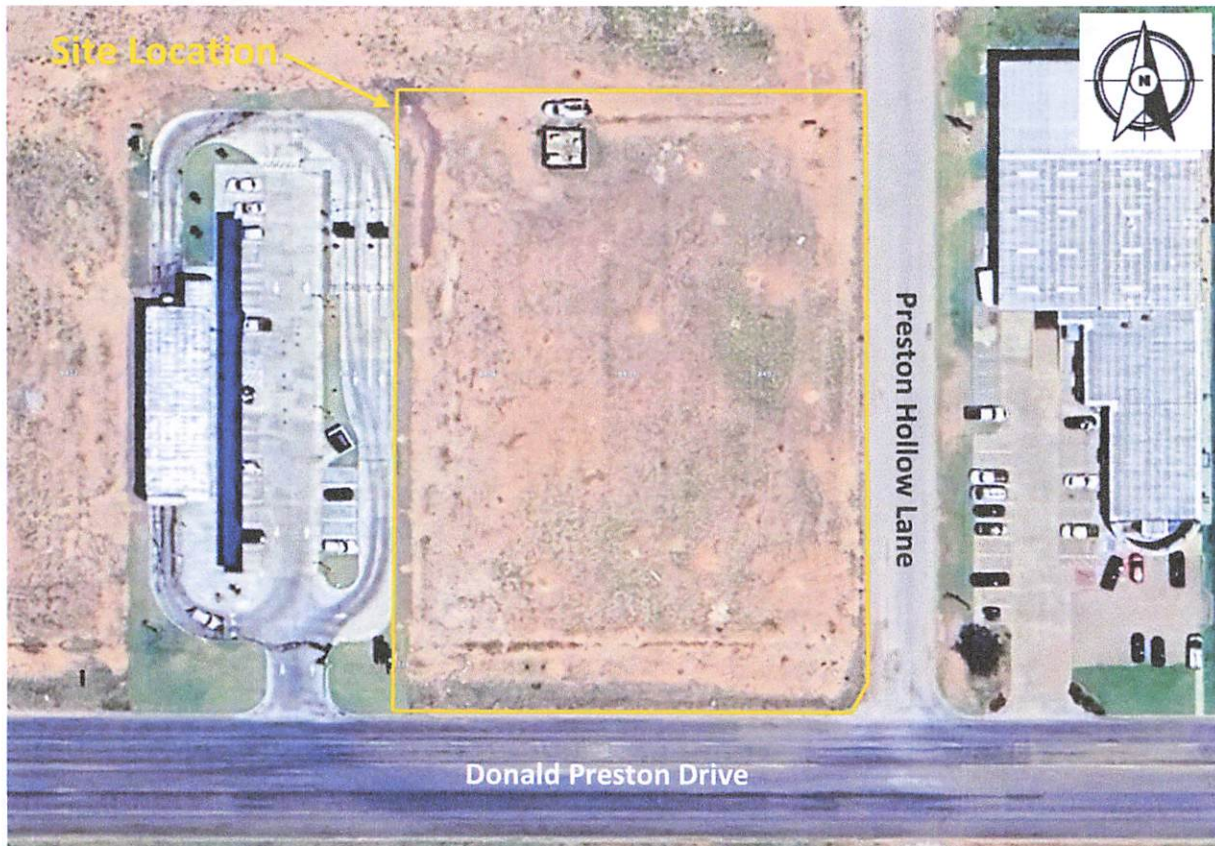


Figure provided by Google Earth.

A.2. Purpose

The purpose of our geotechnical evaluation was to provide recommendations for the design and construction of the proposed project. In order to provide our recommendations, we characterized subsurface geologic conditions at selected exploration locations and evaluated their impact on the design and construction of the planned project. Our site characterization included drilling soil borings and performing selected laboratory testing.

A.3. Background Information and Reference Documents

We reviewed the following information:

- Historical Aerial Imagery, Google Earth, accessed January 31, 2025
- Site Plan provided by Conrad Design Group, Inc.
- Communications with Grant Koertner of Condray Design Group, Inc. and the project team
- The National Geologic Map Database, published on the United States Geological Survey website, <https://ngmdb.usgs.gov>, accessed January 31, 2025

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses and/or recommendations.

A.4. Scope of Services

We performed our scope of services for the project in accordance with our Proposal QTB208771 to Grant Koertner of Condray Design Group, Inc. dated January 9, 2025; and authorized on January 13, 2025. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Coordinated the staking and clearing the exploration location of underground utilities. Condray Design Group, Inc. selected, and we staked the exploration locations. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.
- Performed 7 soil borings, denoted as ST-1 through ST-7, to nominal depths ranging from 5 to 20 feet below existing grade.
- Performed sampling at 1.5 to 2-foot intervals to a depth of 10 feet, and at 5-foot intervals at greater depths in general accordance with American Society for Testing and Materials (ASTM) D1586.
- Performed laboratory testing on select samples to aid in soil classification and engineering analysis.

- Performed engineering analysis including estimation of potential vertical rise, determination of recommended foundation design parameters, and pavement structure recommendations.
- Prepared this report containing the findings of our field exploration, laboratory testing, and engineering recommendations.

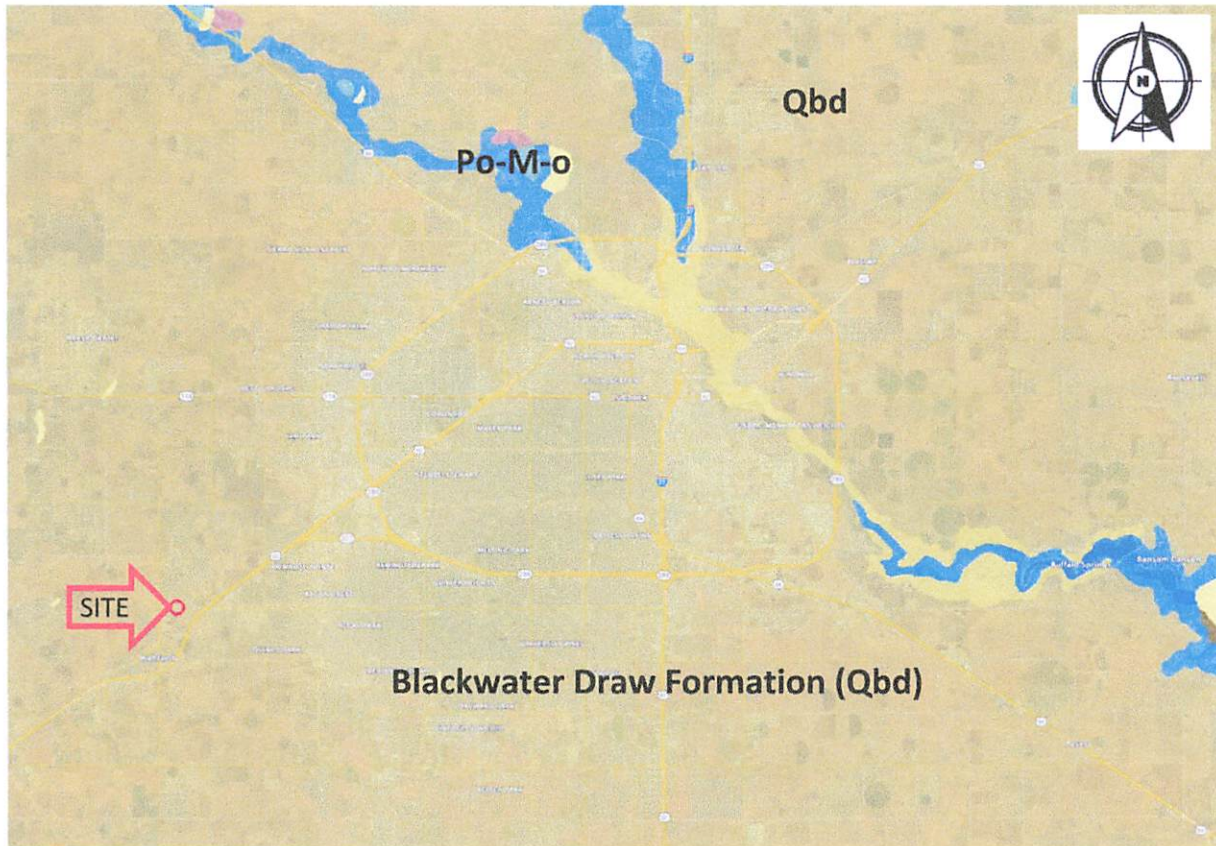
Our scope of work did not include any environmental assessment or investigation for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site.

B. Results

B.1. Geologic Overview

Based upon our review of available geologic resources, the site is underlain by the Blackwater Draw Formation (Qbd). The Blackwater Draw Formation consists mainly of sand, fine- to medium-grained quartz, silt, clay, and caliche nodules.

Figure 2. Geologic Map



(<https://ngmdb.usgs.gov>)

We based the geologic origins used in this report on the soil types and available common knowledge of the geological history of the site. We did not perform a detailed investigation of the geologic history for the site.

B.2. Boring Results

Table 1 provides a subsoil strata summary of the material encountered during drilling operations within the soil borings performed at the site. Please refer to the Log of Boring sheets in the Appendix for additional details. The Descriptive Terminology sheet in the Appendix includes definitions of abbreviations used in Table 1.

Table 1. Subsurface Profile Summary

Strata		Soil Type - ASTM Classification	Range of Penetration Resistances BPF	Commentary and Details
I	Sandy Lean Clay	CL	9 to 43	<ul style="list-style-type: none"> ▪ Light brown to brown ▪ Encountered from ground surface to 5-12 feet below ground surface ▪ Stiff to hard in relative consistency ▪ Generally dry
IA	Silty, Clayey Sand	SC-SM	11 to 26	<ul style="list-style-type: none"> ▪ Light Brown to reddish brown ▪ Encountered from ground surface to 20 feet below ground surface in Boring ST-6 ▪ Medium dense in relative consistency ▪ Generally dry
II	Clayey Sand	SC	13 to 68	<ul style="list-style-type: none"> ▪ Light brown to brown ▪ Encountered from 8-12 to 20 feet below ground surface ▪ Medium dense to very dense in relative consistency ▪ Generally dry

B.3. Groundwater

Groundwater was not observed while advancing the borings. It appears that groundwater is below the depths explored. Project planning should anticipate seasonal and annual fluctuations of groundwater.

B.4. Laboratory Test Results

The boring logs show the results of moisture content, Atterberg Limits and percent finer than No. 200 sieve tests we performed, next to the tested sample depth. We performed the tests in general accordance with ASTM procedures. The Appendix contains the results of these tests.

The moisture content of the tested samples varied from approximately 6 to 15 percent. Liquid limits determined for the soils ranged from 20 to 30; plasticity index values ranged from 5 to 14. The percent passing the No. 200 sieve test, which separates sand and gravel from silt and clay, was performed on selected samples and the results are on the order of 25 to 67 percent.

Atterberg limit testing is necessary to confirm the classification of the subsoils observed at various depths in the borings and provide an indication of the relative strength, the potential for volumetric expansion and contraction with respect to changes in moisture content, and compressibility of the subsoils.

C. Recommendations

C.1. Design and Construction Discussion

C.1.a. Foundation-Type Building Support

Based on the results of our subsurface exploration and evaluation, foundation systems consisting of shallow spread footings should provide adequate support for the structure. Our recommendations for site grading, subgrade preparation, and foundation design parameters are presented in the following sections.

C.1.b. Expansive Soil Conditions/Potential Vertical Rise (PVR)

The current site near surface stratigraphy was generally comprised of sandy lean clay. The Potential Vertical Rise (PVR) of the site was estimated using the Texas Department of Transportation Potential Vertical Rise method (Test Procedure TEX-124-E) and was found to be near 1 inch (dry to wet condition). Potential moisture fluctuations due to improper drainage or variations in subsurface moisture levels may allow actual site swell to exceed the estimated values. Proper drainage provisions should be provided during and after construction.

The estimated shrink/swell movements are based on the soil moisture variations from a dry to a wet condition. Actual soil movements will occur depending on various factors, and the soil movements could be less than the estimated PVR if the moisture remains constant. Extreme moisture fluctuations resulting from extended droughts, flooding, shallow groundwater, poor site drainage, and/or leaking irrigation/water lines may result in swelling values above those estimated using the PVR estimation technique.

C.1.c. Groundwater

Free water was not observed while drilling. Annual rainfall is about 19 inches, and we expect evaporation, and transpiration will exceed rainfall over time. The on-site soils will collect water from precipitation or if water drains to the site. We recommend the contractor remove any water that

collects in work areas before performing further work. Groundwater conditions may be different at the time of construction. Groundwater conditions may vary because of seasonal variations in rainfall, landscape irrigation, and runoff.

C.1.d. Construction Disturbance

The contractor should note the on-site soils are highly susceptible to disturbance from repeated construction traffic. Disturbance of these soils may cause areas that were previously prepared, or that were suitable for pavement or structure support, to become unstable and require moisture conditioning and compaction. Subcutting and replacing the disturbed material with crushed, coarse gravel, free of fines is also an alternative. The contractor should use appropriate means and methods to limit disturbance of the soils.

C.1.e. Weather

To account for potential rainfall during construction, we recommend maintaining construction grades to intercept surface water flow into the area and drain water from the area to an appropriate collection point. After grading, the contractor should compact the soil surface with a smooth drum roller to attempt to lower infiltration. After rain events, the contractor should limit construction traffic until the surface is dry enough that traffic will not mix accumulated surface water into lower portions of the soil.

C.2. Site Grading and Subgrade Preparation

C.2.a. Subgrade Preparation

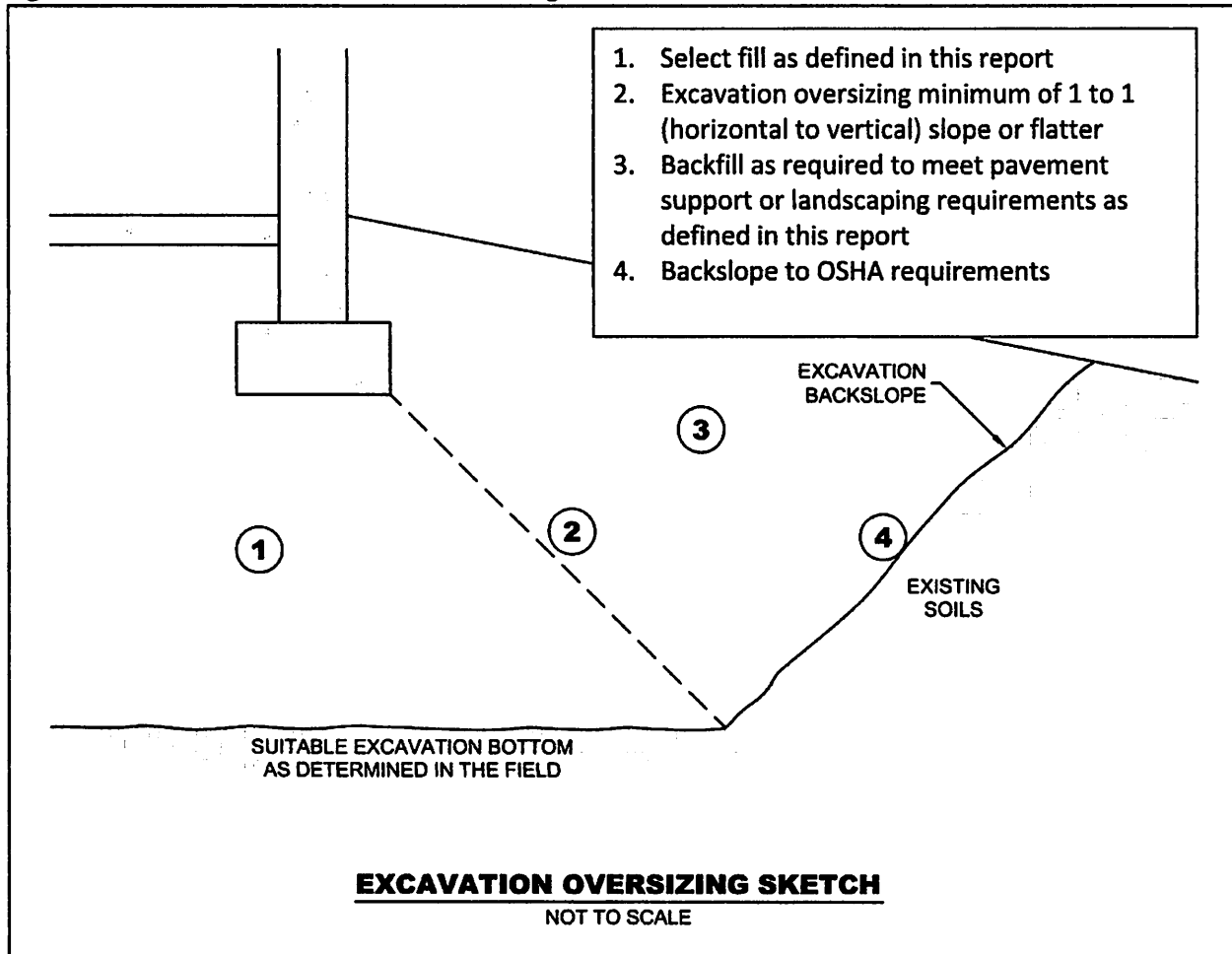
We recommend removing vegetation, construction debris, and other deleterious material from the building pad area. After the pad area has been cleared, we recommend proofrolling the subgrade soil as described in section C.2.d. Once the proofroll is complete, the subgrade soils should be scarified to a minimum depth of 8 inches and recompact to 95% Standard Proctor Density (ASTM D698), at -2% to +2% of optimum moisture. Select fill may be placed to achieve final grade as outlined in section C.2.e.

Finished grade was not provided at the time of writing this report; however, we assume finished grade will be within 2 feet of existing grade at the time of our field activities.

C.2.b. Excavation Oversizing

When removing materials below structures, we recommend the excavation extend outward and downward at a slope of 1H:1V (horizontal:vertical) or flatter. See Figure 3 for an illustration of excavation oversizing.

Figure 3. Generalized Illustration of Oversizing



C.2.c. Excavated Slopes

Based on the borings, we anticipate on-site soils in temporary excavations will consist mostly of sandy lean clays. These soils are typically considered Type B Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported temporary excavations in Type B soils should have a gradient no steeper than 1H:1V (45°). Slopes constructed in this manner may still exhibit surface sloughing. OSHA requires an engineer to evaluate all slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches". This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

C.2.d. Subgrade Proofroll

After preparing the subgrade as described above and prior to placement of fill material, we recommend proofrolling the subgrade soils in accordance with Texas Department of Transportation (TxDOT) Standard Specification Item 216. We also recommend having a geotechnical representative observe the proofroll. Areas that fail the proofroll likely indicate soft or weak areas that will require additional soil correction work to support the structures.

The contractor should correct areas that display yielding or rutting. Possible options for subgrade correction include moisture conditioning and recompaction, excavation and replacement with soil or crushed aggregate, and/or chemical stabilization. We recommend performing a second proofroll after the fill material is in place and prior to constructing the foundations or prior to placing asphalt or concrete pavement.

C.2.e. Fill Materials and Compaction

Table 2 below contains our recommendations for fill materials.

Table 2. Fill Materials

Locations To Be Used	Fill Classification	Possible Soil Type Descriptions	Gradation	Additional Requirements
Below Structures and Pavement	Select fill	SC, CL	1. 100% passing 3-inch sieve 2. 65% maximum passing No. 200 sieve	1. Liquid Limit <35 2. Plasticity Index between 5 and 15 3. < 2% Organic Content
Below landscaped surfaces, where subsidence is not a concern	Non-select fill	—	100% passing 6-inch sieve	< 10% OC

We recommend spreading select fill in loose lifts of approximately 8 inches thick and compacting the soils in accordance with the criteria presented in Table 3. The project documents should specify compaction specification of fill, based on the structure located above the fill, and vertical proximity to that structure.

Table 3. Compaction Recommendations Summary

Reference	Recommended Compaction, % (ASTM D698 – Standard Proctor)	Moisture Content Variance from Optimum, percentage points
Select fill soils below structures, pavement, and oversizing zones	95	-2 to +2
Existing soils below structures, pavement, and oversizing zones	95	-2 to +2
Existing soils below landscaped surfaces	90	-3 to +3

We recommend performing density tests in fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

C.2.f. Inspections of Soils

We recommend including the site grading and placement of soil within the structure pad under the direction of a licensed geotechnical engineer. Inspection requires observation of soil conditions below fill or footings, evaluations to determine if excavations extend to the anticipated soils, and if fill materials meet requirements for type of fill and compaction condition of fill. A licensed geotechnical engineer should direct the inspections of site grading and fill placement. The purpose of these inspections is to evaluate whether the work is in accordance with the approved geotechnical report for the project. Special inspections should include evaluation of the subgrade, observing preparation of the subgrade (surface compaction or dewatering, excavation oversizing, placement procedures, and materials used for fill, etc.), and compaction testing of the fill.

C.3. Spread Footings

Table 4 contains our recommended parameters for shallow foundation design.

Table 4. Recommended Shallow Footing Design Parameters

Item	Description
Maximum net allowable bearing pressure (psf) Spread footings (existing soils/select fill) Perimeter strip footings (existing soils/select fill)	2,500 1,900
Minimum factor of safety for bearing capacity failure	3
Minimum width (inches) Pad footings Perimeter strip footings	24 16
Minimum embedment below final exterior grade for structures (inches)	24
Total estimated settlement (inches)	Less than 1 inch
Differential settlement	Typically about 2/3 of total settlement*

* Actual differential settlement amounts will depend on final loads and foundation design

Spread footings should have a minimum embedment depth as recommended in Table 4 above. We recommend confirming the soil conditions prior to constructing the footings. Subgrade should be appropriately prepared in accordance with Section C.2.

For select fill, the recommended allowable passive resistance is 170 psf/ft (triangular earth pressure distribution) and an allowable coefficient of friction equal to 0.30 is recommended for evaluating sliding resistance.

For existing soil, the recommended allowable passive resistance is 140 psf/ft (triangular earth pressure distribution) and an allowable coefficient of friction equal to 0.27 is recommended for evaluating sliding resistance.

C.3.a. Construction Considerations

The base of all footing excavations should be free of all water and loose material prior to placing concrete. The surface should be relatively flat and smooth. In general, a smooth-mouth bucket should be used for the final foot of excavation, or excavation stopped two inches above the bucket teeth length and the remainder excavated by hand. Concrete should be placed as soon as possible after excavating so

that excessive drying or disturbance of bearing materials does not occur. If the bearing surface must be left overnight, it should be covered by three or four inches of lean concrete. Please note that the lean concrete cannot be included in the footing thickness. Should the materials at bearing elevation become excessively dry or saturated, we recommend that the affected material be removed prior to placing concrete.

C.4. Interior Slabs

C.4.a. Subgrade Preparation

The intent of recommendations in Section C.2 is to develop subgrades suitable for support of the building floor slab. Immediately prior to construction of the building floor slab, we recommend the exposed subgrade be evaluated to establish whether moisture contents are within the recommended range and to identify areas disturbed by construction operations. Unsuitable or disturbed areas should be reworked prior to placement of a leveling course and construction of the floor slab.

C.4.b. Construction Considerations

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking or curling of the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of the concrete. We recommend that all concrete placement and curing operations be performed in accordance with recommendations from the American Concrete Institute (ACI).

C.5. Moisture Protection

Foundation and slab performance may be strongly impacted by how well runoff water drains from the site. The design and construction of this project should maintain drainage both during construction and over the life of the proposed project. We recommend grading the ground surface around the structure such that water flows readily away from the structure without ponding. Positive drainage away from all structures and pavements must be maintained during the life of the improvements.

In general, the elevation of exterior grades should not be higher than the elevation of the subgrade beneath the slab to help prevent water intrusion beneath slabs. Should utility leaks/breaks or unusually high rainfall occur, saturated zones and “perched” groundwater may develop in the subgrade. These conditions may cause significant soil swelling resulting in damage of the slab and other structural elements. Consequently, we recommend grading the site, so water drains away readily without saturating the foundation. Building maintenance plans should require regular exams of potential water

sources (water pipes, drains, etc.) for signs of leakage or damage. We recommend promptly repairing leakage and/or damage.

The project team should also consider limiting landscaping and irrigation adjacent to the building areas. Trees and large bushes can develop intricate root systems that can draw moisture from the subgrade soils, causing them to shrink. This effect is particularly pronounced during dry periods of the year. Desiccation of soils below foundations and flatwork can result in damage to the improvements.

C.6. Flatwork

Flatwork elements, including sidewalk areas and paving, are subject to distress resulting from potential vertical soil movements. We recommend that flatwork not be rigidly connected to structures, and joints between flatwork and structures be completely filled with an elastomeric material.

Differential movements may occur between the planned slab and adjacent patios, porches, and entries. If differential movements are a concern, such as at emergency exits, the foundation pad should be extended beneath the adjacent flatwork such that the proper operation of the exits is not impeded.

Adequate drainage should be provided so that runoff is not allowed to collect in areas where intrusion into subgrade soils that are in the vicinity of, or upslope from, site improvements may occur.

C.7. Utilities

C.7.a. Subgrade Stabilization

Earthwork activities associated with utility installations located inside the building footprint should adhere to the recommendations in Section C.2.

For exterior utilities, we anticipate the soils at typical invert elevations will be suitable for utility support. However, if construction encounters unfavorable conditions, the unsuitable soils may require some additional subcutting and replacement with sand or crushed rock to prepare a proper subgrade for pipe support. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

C.8. Equipment Support

The recommendations included in the report may not be applicable to equipment used for the construction and maintenance of this project. We recommend evaluating subgrade conditions in areas

of shoring, scaffolding, cranes, pumps, lifts and other construction equipment prior to mobilization to determine if the exposed materials are suitable for equipment support or require some form of subgrade improvement. We also recommend project planning consider the effect that loads applied by such equipment may have on structures they bear on or surcharge – including pavements, buried utilities, below-grade walls, etc. We can assist you in this evaluation.

C.9. Seismic Site Classification

Due to project scope limitations, we did not perform a 100-foot-deep boring as recommended in the International Building Code (IBC) for seismic site classification. We conservatively assumed that the overburden soil consistency extends and continues below the bottom of the borings. Thus, if the soil stratigraphy is extrapolated, and considering pertinent reference materials, this site would meet the criteria for Site Class D as defined in Chapter 16 of the 2021 International Building Code.

C.10. Pavements

C.10.a. General

The satisfactory performance of pavements for the parking and drive areas depends upon several factors including:

- Characteristics of the supporting soil;
- Magnitude and frequency of wheel load applications;
- Quality of construction materials;
- Thickness of pavement section components;
- Contactor's placement and workmanship abilities; and
- Desired period of design life.

The general pavement design information presented in this report is based on subsurface conditions inferred by the test borings, information published by The Asphalt Institute, the Portland Cement Association, the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), and experience in the locale. The published information was utilized in conjunction with the available field and laboratory test data to develop a general pavement design based on the AASHTO structural numbering system.

C.10.b. Pavement Types

Pavements to be utilized by light or heavy vehicular traffic may be either flexible or rigid pavement sections supported on aggregate base material, processed existing soils or select fill. However, Portland

cement concrete pavements should be utilized where large loads (i.e., waste disposal containers, etc.) are located. Both flexible and rigid pavement sections have been recommended using general engineering design criteria referenced in this report.

C.10.c. Subgrade

Subgrade Pavement Support. Most pavement design methods predicate the section design on a subgrade support value. Thus, the selection of a realistic subgrade support value is paramount to the design, performance, and life-cycle costs of the pavement section. Subgrade support is quantified by the California Bearing Ratio (CBR) in most pavement design procedures. Based on previous experience with similar soils, we estimate the existing subgrade soil has a CBR value of 4. The modulus of subgrade reaction, k , and resilient modulus, MR , are 125 pci and 6,200 psi respectively.

Subgrade Stability. All pavement subgrade should meet density requirements and pass a proofrolling test and inspection (to confirm subgrade stability) in accordance with acceptable construction methods. A minimum 25-ton roller should be used for this application.

It is strongly recommended that the contract documents require verification of these subgrade characteristics prior to beginning placement of pavement section materials. Stable subgrade is especially critical to the successful performance of flexible pavement sections.

Subgrade may be or become wet and unstable under paving areas, depending on several factors, including construction season, groundwater fluctuations, contractor's maintenance of positive drainage, routing of equipment, weather, and scheduling constraints. Flexible base should not be placed below rigid pavements.

Subgrade or Subbase Compaction. The subgrade soils should be scarified to a minimum depth of 8 inches and recompacted to 95% Standard Proctor Density (ASTM D698), at -2% to +2% of optimum moisture.

C.10.d. Flexible Pavement Details

Asphaltic Surface Course. Surface course asphaltic concrete should consist of a dense graded Type "D" hot mix that meets the requirements as defined by *Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, 2014* (TxDOT Specifications) Item 340.

Aggregate Base Material. Only aggregate base materials that meet local specifications or TxDOT Specifications Item 247: Grade 1-2, including the durability requirements, should be used. Aggregate

base material should be compacted to 100% of the maximum dry density defined by the Standard Proctor.

C.10.e. Rigid Pavement Details

Concrete. Concrete compressive strength should be a minimum of 4,000 psi at 28 days. The concrete should be designed with 5% (\pm 1%) entrained air to improve workability and durability.

Reinforcement. Steel reinforcement should be in accordance with local or accepted codes.

Concrete Finishing. Proper finishing of concrete pavement requires appropriate construction joints to reduce the potential for cracking.

- Construction joints ("weakened planes") should be designed in accordance with current Portland Cement Association guidelines.
- Braun Intertec recommends that such "weakened plane" joints be spaced no more than 15 feet center-to-center.
- Depth of such joints should be at least $\frac{1}{4}$ ($\frac{1}{2}$ preferred) of the pavement thickness.
- These joints should be cut as soon as the concrete will support the saw cutting machinery. Joints should be sealed and maintained to reduce the potential for water infiltration into pavement joints and subsequent infiltration into the supporting soils. The saw cut pattern should be regular with special attention provided at the curved sections of the driveways.

C.10.f. Pavement Section Recommendations

Table 5 presents a summary of both rigid and flexible pavement sections. It should be noted that the pavement sections as presented below are minimums. If it is desired to reduce potential cracking, greater thickness of select fill or subbase (select fill or existing subgrade) and/or greater pavement section thickness could be utilized. In addition, long term pavement performance requires good drainage and performance of periodic maintenance activities. Refer to the text for qualification of the designs and further discussion and limitations.

Table 5. Recommended Pavement Sections – 20 Year Design (Light Duty – Vehicular and Panel Truck Parking and Drive Areas)

Pavement Type	Pavement Section
Portland Cement Concrete, 4000 psi, 20 Year Design Period	5.0" Portland Cement Concrete 6.0" Density-Controlled Native Soil or Select Fill
HMAC Over Crushed Aggregate Base, 20 Year Design Period	2.0" Dense HMAC with 1/2-inch nominal maximum size aggregate or equivalent – Surface Coarse (TxDOT Item 340 Type "D") 6.0" Aggregate Base Course (flexible) 6.0" Density Controlled Native Soil or Select Fill

NOTE: Materials shall meet general requirements of the local governing bodies, TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, & Bridges, and specific requirements listed herein.

For fire/bus lanes, loading docks, and dumpster aprons, we recommend placing at least 6 inches of concrete pavement over 6 inches of density-controlled native soil or select fill.

All paving recommendations are based on stable subgrade. Subgrade areas which are unstable should be over excavated and replaced or otherwise rendered stable prior to proceeding with base material placement.

C.10.g. Additional Pavement Considerations

Drainage. Effective drainage of the pavement area, including the migration of moisture below the pavement section, is a key component in the performance of the pavement structure. Grading should be such that runoff is channeled away from pavement areas. The pavement should be sloped to provide rapid surface drainage and positive surface drainage should be maintained away from the edge of the paved areas. Design alternatives which could reduce the risk of subgrade saturation and improve long-term pavement performance include crowning the pavement subgrade to drain toward the edges, rather than to the center of the pavement areas; and, installing surface drains next to any areas where surface water could pond. In areas where there will be irrigation adjacent to pavements, we recommend installing perimeter drains for the pavements.

Preventative Maintenance. Preventative maintenance should be planned because of the active nature of the soils at this site. Differential soil movements can occur that can cause pavement cracking and opening of joints. Water entering joints can reduce the service life of the pavement. Preventative maintenance should be provided for through an on-going pavement management program to enhance future pavement performance. Preventative maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Preventative maintenance consists

of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventative maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Also, thicker pavement sections could be used to reduce the required maintenance and extend the service life of the pavement. Signs should be placed at the entrances of the parking area to limit heavy trucks traveling on the automobile pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventative maintenance.

D. Procedures

D.1. Test Borings

We drilled the borings with a truck-mounted auger drill. We performed the borings in general accordance with ASTM D1586 taking samples semi-continuously to a depth of 10 feet and then 5-foot intervals thereafter. The boring logs show the actual sample intervals and corresponding depths.

D.2. Exploration Logs

The Appendix includes log of boring sheets for our test borings. The logs identify and describe the penetrated geologic materials and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of laboratory tests performed on test samples and groundwater measurements.

We inferred strata boundaries from changes in the test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations and the boundaries themselves may occur as gradual rather than abrupt transitions.

D.3. Material Classification and Testing

D.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials observed in accordance with ASTM D2488. The Appendix includes a chart explaining the classification system.

D.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. We performed the tests in general accordance with ASTM or AASHTO procedures.

D.4. Groundwater Measurements

The drillers checked for free water while advancing the test borings and again after auger withdrawal. We then filled the boreholes as noted on the boring logs.

E. Qualifications

E.1. Variations in Subsurface Conditions

E.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

E.1.b. Groundwater Levels

We made free water measurements under the conditions reported herein and shown on the exploration logs and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

E.2. Continuity of Professional Responsibility

E.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

E.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those observed by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

E.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

E.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix



 DENOTES APPROXIMATE LOCATION OF SOIL BORING



40' 0 80'



SCALE: 1"= 80'

**BRAUN
INTERTEC**
The Science You Build On.

215 S Fannin Street
Amarillo, TX 79105
806.677.0600
braunintertec.com

Project No:
B2500461

Drawing No:
B2500461

Drawn By: JAG
Date Drawn: 2/5/25
Checked By: JGG
Last Modified: 2/5/25

UMC Wolfforth Clinic

Donald Preston and Preston Hollow Lane

Wolfforth, Texas

**Soil Boring
Location Sketch**

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2500461				BORING: ST-1	
Geotechnical Evaluation				LOCATION: Estimated.	
UMC Wolfforth Clinic				DATUM: WGS 84	
Donald Preston Dr. & Preston Hollow Lane				LATITUDE: 33.52056	LONGITUDE: -102.00349
Wolfforth, Texas		DRILLER: Subcontractor		LOGGED BY: J. Gonzalez	START DATE: 01/27/25
SURFACE ELEVATION: 3311.0 ft		RIG: Subcontractor	METHOD: Air Rotary	SURFACING: Soil	WEATHER: Clear
END DATE: 01/27/25					

Elev./Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (Blows/ft) Recovery	q _p tsf	MC %	%Pass No. 200	Atterberg Limits			Dry Unit Wt. pcf	Un. Com. Str. tsf	Tests or Remarks
								LL	PL	PI			
		SANDY LEAN CLAY (CL), light brown, dry, stiff		7-6-7 (13)		8							
		<i>Very stiff below 3.5 feet</i>		8-12-12 (24)		8	67	28	14	14			
3306.0		END OF BORING											
5.0		Boring then backfilled with auger cuttings											

Water not observed while drilling.

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2500461				BORING: ST-2	
Geotechnical Evaluation				LOCATION: Estimated.	
UMC Wolfforth Clinic				DATUM: WGS 84	
Donald Preston Dr. & Preston Hollow Lane				LATITUDE: 33.52056	LONGITUDE: -102.00293
Wolfforth, Texas				START DATE: 01/27/25	END DATE: 01/27/25
DRILLER: Subcontractor	LOGGED BY: J. Gonzalez	SURFACE ELEVATION: 3311.0 ft		RIG: Subcontractor	METHOD: Air Rotary
SURFACING: Soil		WEATHER: Clear			

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (Blows/ft) Recovery	q _p tsf	MC %	%Pass No. 200	Atterberg Limits			Dry Unit Wt. pcf	Un. Com. Str. tsf	Tests or Remarks
								LL	PL	PI			
		SANDY LEAN CLAY (CL), brown, moist, stiff		3-4-5 (9)		15		29	15	14			
		<i>Dry, very stiff below 3.5 feet</i>		8-10-11 (21)		8							
3306.0		END OF BORING											
5.0		Boring then backfilled with auger cuttings											

Water not observed while drilling.

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2500461				BORING: ST-3	
Geotechnical Evaluation				LOCATION: Estimated.	
UMC Wolfforth Clinic				DATUM: WGS 84	
Donald Preston Dr. & Preston Hollow Lane				LATITUDE: 33.51998	LONGITUDE: -102.00342
Wolfforth, Texas				START DATE: 01/27/25	END DATE: 01/27/25
DRILLER: Subcontractor	LOGGED BY: J. Gonzalez	SURFACING: Soil		WEATHER: Clear	
SURFACE ELEVATION: 3311.0 ft	RIG: Subcontractor	METHOD: Air Rotary			

Elev./Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (Blows/ft) Recovery	q _p tsf	MC %	%Pass No. 200	Atterberg Limits			Dry Unit Wt. pcf	Un. Com. Str. tsf	Tests or Remarks
								LL	PL	PI			
		SANDY LEAN CLAY (CL), light brown, dry, stiff		5-3-7 (10)		8							
3306.0				5-7-8 (15)		10							
5.0		END OF BORING											
		Boring then backfilled with auger cuttings											

Water not observed while drilling.

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2500461				BORING: ST-4	
Geotechnical Evaluation				LOCATION: Estimated.	
UMC Wolfforth Clinic				DATUM: WGS 84	
Donald Preston Dr. & Preston Hollow Lane				LATITUDE: 33.51998	LONGITUDE: -102.00297
Wolfforth, Texas				START DATE: 01/27/25	END DATE: 01/27/25
DRILLER: Subcontractor	LOGGED BY: J. Gonzalez	SURFACING: Soil		WEATHER: Clear	
SURFACE ELEVATION: 3311.0 ft	RIG: Subcontractor	METHOD: Air Rotary			

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (Blows/ft) Recovery	q _p tsf	MC %	%Pass No. 200	Atterberg Limits			Dry Unit Wt. pcf	Un. Com. Str. tsf	Tests or Remarks
								LL	PL	PI			
		SANDY LEAN CLAY (CL), light brown, dry, very stiff		8-11-13 (24)		7							
3306.0				9-10-9 (19)		9	51	27	14	13			
5.0		END OF BORING											
		Boring then backfilled with auger cuttings											

Water not observed while drilling.

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2500461				BORING: ST-5	
Geotechnical Evaluation				LOCATION: Estimated.	
UMC Wolfforth Clinic				DATUM: WGS 84	
Donald Preston Dr. & Preston Hollow Lane				LATITUDE: 33.52036	LONGITUDE: -102.00319
Wolfforth, Texas				START DATE: 01/27/25	END DATE: 01/27/25
DRILLER: Subcontractor	LOGGED BY: J. Gonzalez	SURFACING: Soil		WEATHER: Clear	
SURFACE ELEVATION: 3311.0 ft	RIG: Subcontractor	METHOD: Air Rotary			

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (Blows/ft) Recovery	q _p tsf	MC %	%Pass No. 200	Atterberg Limits			Dry Unit Wt. pcf	Un. Com. Str. tsf	Tests or Remarks
								LL	PL	PI			
		SANDY LEAN CLAY (CL), brown, dry, stiff											
		<i>Very stiff below 3.5 feet</i>		6-6-5 (11)		8							
			5	8-9-7 (16)		7							
				6-8-11 (19)		8	55	27	16	11			
		<i>Light brown, hard below 8.5 feet</i>											
			10	14-21-22 (43)		8							
3299.0	12.0	CLAYEY SAND (SC), brown, dry, dense											
				17-19-19 (38)		11							
		<i>Light brown, very dense below 18.5 feet</i>											
			15										
3291.0	20.0	END OF BORING		13-20-48 (68)		9							

Water not observed while drilling.
Boring then backfilled with auger cuttings

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2500461				BORING: ST-6	
Geotechnical Evaluation				LOCATION: Estimated.	
UMC Wolfforth Clinic				DATUM: WGS 84	
Donald Preston Dr. & Preston Hollow Lane				LATITUDE: 33.52020	LONGITUDE: -102.00342
Wolfforth, Texas				START DATE: 01/27/25	END DATE: 01/27/25
DRILLER: Subcontractor	LOGGED BY: J. Gonzalez	SURFACING: Soil		WEATHER: Clear	
SURFACE ELEVATION: 3311.0 ft	RIG: Subcontractor	METHOD: Air Rotary			

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (Blows/ft) Recovery	q _p tsf	MC %	%Pass No. 200	Atterberg Limits			Dry Unit Wt. pcf	Un. Com. Str. tsf	Tests or Remarks
								LL	PL	PI			
		SILTY, CLAYEY SAND (SC-SM), light brown, dry, medium dense											
				5-9-10 (19)		8	46	24	17	7			
				8-7-4 (11)		8							
		<i>Brown below 5.5 feet</i>		9-13-13 (26)		8							
				9-11-13 (24)		8							
		<i>Reddish brown below 13.5 feet</i>		6-7-12 (19)		6							
				11-9-13 (22)		7	25	20	15	5			
		<i>Light brown below 18.5 feet</i>											
3291.0													
20.0		END OF BORING											

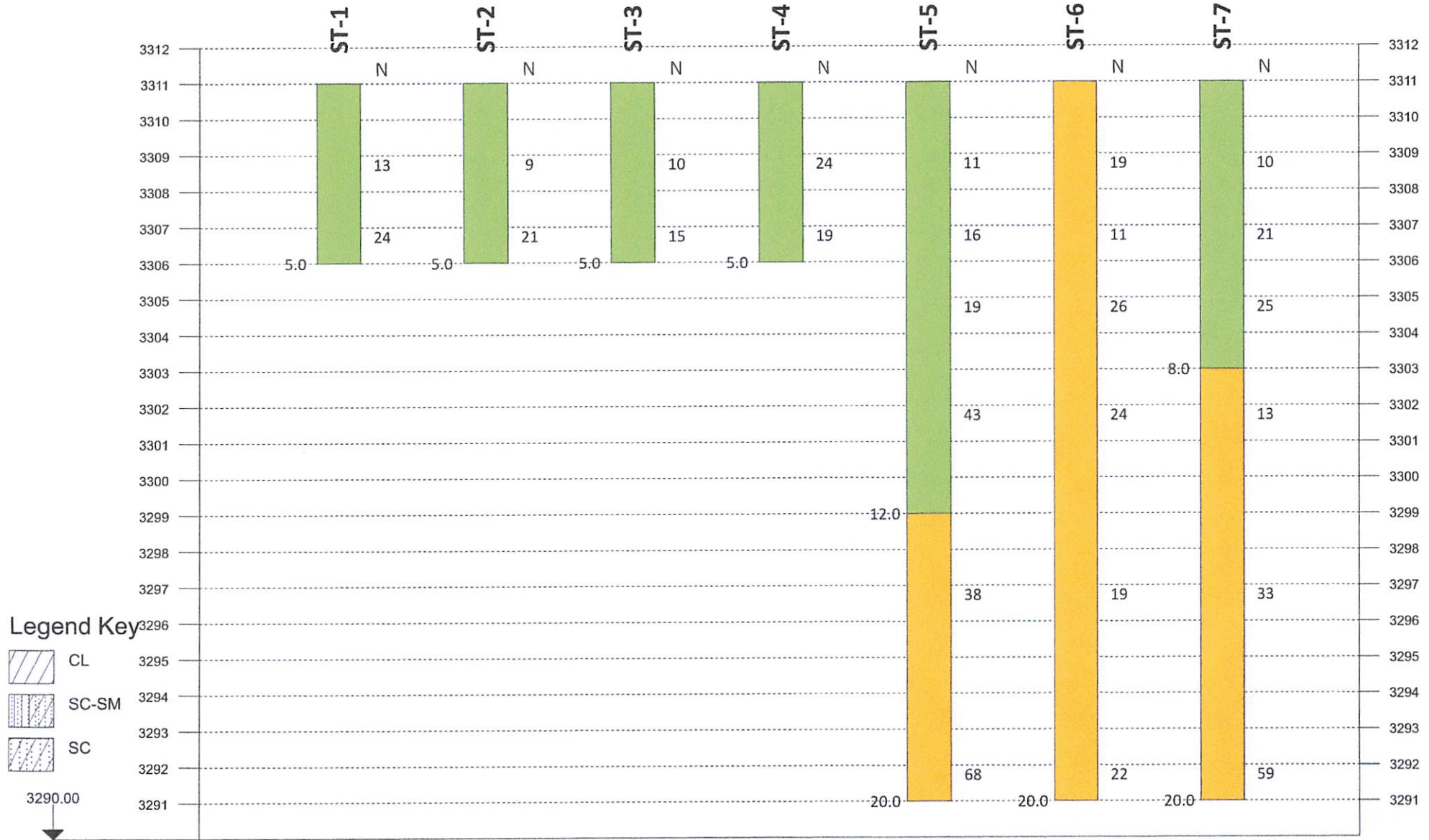
Water not observed while drilling.
Boring then backfilled with auger cuttings

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2500461				BORING: ST-7		
Geotechnical Evaluation				LOCATION: Estimated.		
UMC Wolfforth Clinic				DATUM: WGS 84		
Donald Preston Dr. & Preston Hollow Lane				LATITUDE: 33.52014	LONGITUDE: -102.00307	
Wolfforth, Texas		DRILLER: Subcontractor		LOGGED BY: J. Gonzalez	START DATE: 01/27/25	END DATE: 01/27/25
SURFACE ELEVATION: 3311.0 ft	RIG: Subcontractor	METHOD: Air Rotary	SURFACING: Soil		WEATHER: Clear	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (Blows/ft) Recovery	q _p tsf	MC %	%Pass No. 200	Atterberg Limits			Dry Unit Wt. pcf	Un. Com. Str. tsf	Tests or Remarks
								LL	PL	PI			
		SANDY LEAN CLAY (CL), light brown, dry, stiff											
		<i>Very stiff below 3.5 feet</i>		5-5-5 (10)		10							
			5	8-9-12 (21)		11	63	30	17	13			
				8-11-14 (25)		11							
3303.0	8.0	CLAYEY SAND (SC), reddish brown, dry, medium dense		7-7-6 (13)		10	41	25	13	12			
		<i>Light brown, dense below 13.5 feet</i>		14-15-18 (33)		14							
		<i>Very dense below 18.5 feet</i>		9-11-48 (59)		10							
3291.0	20.0	END OF BORING											

Water not observed while drilling.
Boring then backfilled with auger cuttings



SECTION LINE 1

Fence Diagram

Geotechnical Evaluation

UMC Wolfforth Clinic

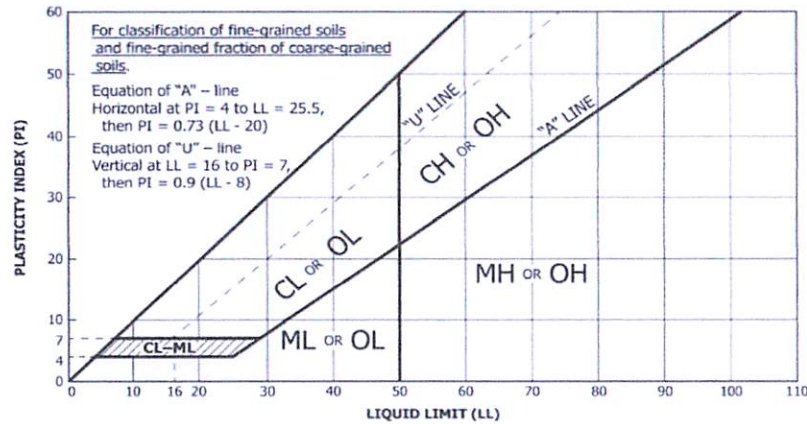
Donald Preston Dr. & Preston Hollow Lane

Wolfforth, Texas

Project ID: B2500461
 Vert. Scale: 1"= xxx'
 Hor. Scale: NTS
 Date: 02/03/2025

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A			Soil Classification			
			Group Symbol	Group Name ^B		
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5% fines ^C)	$C_u \geq 4$ and $1 \leq C_c \leq 3^D$	GW	Well-graded gravel ^E	
		Gravels with Fines (More than 12% fines ^C)	$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$) ^D	GP	Poorly graded gravel ^E	
			Fines classify as ML or MH	GM	Silty gravel ^{EFG}	
	Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines ^H)	$C_u \geq 6$ and $1 \leq C_c \leq 3^D$	SW	Well-graded sand ^I	
		Sands with Fines (More than 12% fines ^H)	$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$) ^D	SP	Poorly graded sand ^I	
			Fines classify as CL or CH	SM	Silty sand ^{GI}	
Fine-grained Soils (50% or more passes the No. 200 sieve)	Silt and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line ^I	CL	Lean clay ^{KLM}	
			PI < 4 or plots below "A" line ^I	ML	Silt ^{KLM}	
	Silt and Clays (Liquid limit 50 or more)	Organic	Liquid Limit - oven dried	< 0.75	OL	Organic clay ^{KLMN}
			Liquid Limit - not dried		OH	Organic silt ^{KLMO}
		Inorganic	PI plots on or above "A" line	CH	Fat clay ^{KLM}	
			PI plots below "A" line	MH	Elastic silt ^{KLM}	
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor		PT	Peat		

- A. Based on the material passing the 3-inch (75-mm) sieve.
- B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
- C. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
- D. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
- E. If soil contains $\geq 15\%$ sand, add "with sand" to group name.
- F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
- G. If fines are organic, add "with organic fines" to group name.
- H. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
- I. If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
- J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
- K. If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
- L. If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
- M. If soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.
- N. PI ≥ 4 and plots on or above "A" line.
- O. PI < 4 or plots below "A" line.
- P. PI plots on or above "A" line.
- Q. PI plots below "A" line.



Laboratory Tests			
DD	Dry density, pcf	q_p	Pocket penetrometer strength, tsf
WD	Wet density, pcf	q_u	Unconfined compression test, tsf
P200	% Passing #200 sieve	LL	Liquid limit
MC	Moisture content, %	PL	Plastic limit
OC	Organic content, %	PI	Plasticity index

Particle Size Identification

- Boulders..... over 12"
- Cobbles..... 3" to 12"
- Gravel
 - Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
 - Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
- Sand
 - Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
 - Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
 - Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
- Silt..... No. 200 (0.075 mm) to .005 mm
- Clay..... < .005 mm

Relative Proportions^{L, M}

- trace..... 0 to 5%
- little..... 6 to 14%
- with..... $\geq 15\%$

Inclusion Thicknesses

- lens..... 0 to 1/8"
- seam..... 1/8" to 1"
- layer..... over 1"

Apparent Relative Density of Cohesionless Soils

- Very loose 0 to 4 BPF
- Loose 5 to 10 BPF
- Medium dense..... 11 to 30 BPF
- Dense..... 31 to 50 BPF
- Very dense..... over 50 BPF

Consistency of Cohesive Soils Blows Per Foot Approximate Unconfined Compressive Strength

- Very soft..... 0 to 1 BPF..... < 0.25 tsf
- Soft..... 2 to 4 BPF..... 0.25 to 0.5 tsf
- Medium..... 5 to 8 BPF 0.5 to 1 tsf
- Stiff..... 9 to 15 BPF..... 1 to 2 tsf
- Very Stiff..... 16 to 30 BPF..... 2 to 4 tsf
- Hard..... over 30 BPF..... > 4 tsf

Moisture Content:

- Dry:** Absence of moisture, dusty, dry to the touch.
- Moist:** Damp but no visible water.
- Wet:** Visible free water, usually soil is below water table.

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (), at the end of drilling (), or at some time after drilling ().

Sample Symbols

	Standard Penetration Test		Rock Core
	Modified California (MC)		Thinwall (TW)/Shelby Tube (SH)
	Auger		Texas Cone Penetrometer
	Grab Sample		Dynamic Cone Penetrometer