Specifications

BRULE PUBLIC WORKS GARAGE

Brule, Wisconsin

Project #

025170.00

March 10th, 2026

2 West 1st Street, Suite 201, Duluth, Minnesota 55802
tel (218) 727-2626 fax (218) 722-7467

dsgw.com

Recognized as JUST organization by the International Living Future Institute
DSGW is an Equal Opportunity Employer

SECTION 00 01 01

PROJECT MANUAL TITLE AND REGISTRATION SHEET

BRULE PUBLIC WORKS GARAGE
BRULE, WISCONSIN
DSGW PROJECT NO.: 025170.00

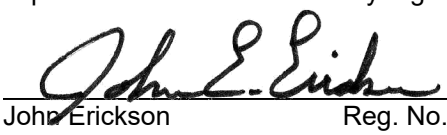
DATE: MARCH 10th, 2026

ARCHITECT
DSGW ARCHITECTS
2 West 1st Street, Suite 201
Duluth, MN 55802
Phone: 218-727-2626

MECHANCIAL/ELECTRICAL ENGINEER
WINDSOR ENGINEERS
4802 Oneota St – Suite 2
Duluth, MN 55807
Phone: 612-389-1658

STRUCTURAL/CIVIL ENGINEER
NORTHLAND CONSULTING ENGINEERS
102 South 21st Avenue West, Suite 1
Duluth, MN 55806
Phone: 218-727-5995

I hereby certify that these plans, specifications, or report were prepared by me or under my direct supervision and that I am a duly registered Architect under the laws of the state of Wisconsin.



John Erickson Reg. No. 9676-055

© DSGW. All rights reserved.

The architectural works depicted herein are the sole property of DSGW and may not be constructed or used without its express written permission. No permission to modify or reproduce any of these architectural works, including without limitation the construction of any building, is expressed or should be implied from delivery of preliminary drawings or unsealed construction drawings. Permission to construct the building depicted in sealed construction drawings is expressly conditioned on the full and timely payment of all fees otherwise due DSGW and, in the absence of any written agreement to the contrary, is limited to a one-time use on the site indicated on these plans.

END OF SECTION

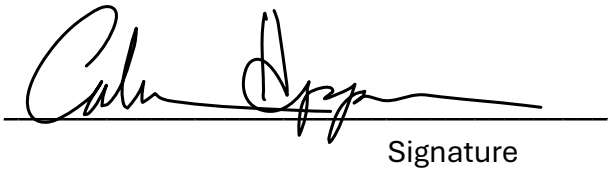
DOCUMENT 000105 – CERTIFICATIONS PAGE

PART 1 – GENERAL

1.1 DESIGN PROFESSIONALS OF RECORD

Mechanical Engineer, HVAC & Plumbing: I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.
DIVISION 22 & 23 TECHNICAL SPECIFICATIONS.

Calenn Heppner, PE
Windsor Engineers
License Number: 48270



Signature

03/09/2026
Date

Electrical Engineer: I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.
DIVISION 26 & 27 TECHNICAL SPECIFICATIONS.

Louis Meyette, PE
Windsor Engineers
License Number: 100172



Signature

03/09/2026
Date

SECTION 00 01 10
TABLE OF CONTENTS

BRULE PUBLIC WORKS GARAGE
BRULE, WISCONSIN

DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 01 – Project Manual and Registration Sheet
00 01 05 – Certifications Page
00 01 10 – Table of Contents
00 01 15 – Schedule of Drawings
00 11 13 – Advertisement for Bids
00 21 13 – Instructions to Bidders
00 22 13 – Supplementary Instructions to Bidders
00 31 00 – Available Project Information
---------- – Report of Geotechnical Exploration
00 40 00 – Bid Form Instructions
00 41 00 – Bid Form
00 43 25 – Request for Approval of Substitutions
00 72 00 - General Conditions
00 73 00 - Supplementary Conditions

DIVISION 01 -- GENERAL REQUIREMENTS

01 10 00 - Summary
01 20 00 - Price and Payment Procedures
01 30 00 - Administrative Requirements
01 40 00 - Quality Requirements
01 50 00 - Temporary Facilities and Controls
01 60 00 - Product Requirements
01 70 00 - Execution and Closeout Requirements
01 78 00 - Closeout Submittals

DIVISION 03 -- CONCRETE

03 10 00 - Concrete Forming and Accessories
03 20 00 - Concrete Reinforcing
03 30 00 - Cast-in-Place Concrete

DIVISION 05 -- METALS

05 40 00 – Cold Formed Metal Framing
05 50 00 – Metal Fabrications

DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES

06 10 00 – Rough Carpentry
06 20 00 – Finish Carpentry
06 41 00 - Architectural Wood Casework
06 82 13 – Fiberglass Reinforced Wall Panels

DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

07 11 13 – Bituminous Dampproofing

07 21 00 – Thermal Insulation

07 21 17 – Pre-Engineered Building Insulation

07 21 19 – Foamed in Place Insulation

07 25 00 – Weather Barriers

07 42 14 – Insulated Metal Wall Panels

07 62 00 – Sheet Metal Flashing and Trim

07 84 00 – Firestopping

07 90 05 - Joint Sealers

DIVISION 08 -- OPENINGS

08 11 13 - Hollow Metal Doors & Frames

08 14 16 - Flush Wood Doors

08 31 00 – Access Doors

08 36 13 – Sectional Doors

08 43 13 - Aluminum-Framed Storefronts

08 71 00 - Door Hardware

08 80 00 – Glazing

DIVISION 09 -- FINISHES

09 21 16 - Gypsum Board Assemblies

09 51 00 - Acoustical Ceilings

09 65 00 - Resilient Flooring

09 67 00 – Fluid Applied Flooring

09 90 00 - Painting and Coating

DIVISION 10 -- SPECIALTIES

10 14 19 – Cast Letters

10 14 23 - Interior Signage

10 28 00 – Toilet, Bath, And Laundry Accessories

10 44 00 - Fire Protection Specialties

DIVISION 12 -- FURNISHINGS

12 24 13 – Window Shade Systems

DIVISION 13 – SPECIAL CONSTRUCTION

13 34 19 – Metal Building Systems

DIVISION 22 -- PLUMBING

22 05 00 – Common Work Results for Plumbing

22 05 16 – Expansion Fittings and Loops for Plumbing Piping

22 05 17 – Sleeves and Sleeve Seals for Plumbing Piping

22 05 19 – Meters and Gauges for Plumbing Piping

22 05 23 – General-Duty Valves for Plumbing Piping

22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment

22 05 53 – Identification for Plumbing Piping and Equipment

22 07 16 – Plumbing Equipment Insulation
22 07 19 – Plumbing Piping Insulation
22 10 05 – Plumbing Piping
22 10 06 – Plumbing Piping Specialties
22 11 23 – Dometic Water Pumps
22 13 19 – Sanitary Waste Piping Specialties
22 15 00 – General-Service Compressed-Air Systems
22 30 00 – Plumbing Equipment
22 40 00 – Plumbing Fixtures
22 45 00 – Emergency Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 05 17 – Sleeves and Sleeve Seals for HVAC Piping
23 05 29 – Hangers and Supports for HVAC Piping and Equipment
23 05 48 – Vibration and Seismic Controls for HVAC
23 05 53 – Identification for HVAC Piping and Equipment
23 05 93 – Testing Adjusting, and Balancing for HVAC
23 07 13 – Duct Insulation
23 07 19 – HVAC Piping Insulation
23 08 00 – Commissioning of HVAC
23 11 23 – Facility Natural-Gas Piping
23 21 13 – Hydronic Piping
23 21 14 – Hydronic Specialties
23 21 23 – Hydronic Pumps
23 23 00 – Refrigerant Piping
23 31 00 – HVAC Ducts and Casing
23 33 00 – Air Duct Accessories
23 34 23 – HVAC Power Ventilators
23 35 16 – Engine Exhaust Systems
23 37 00 – Air Outlets and Inlets
23 52 16 – Condensing Boilers
23 55 33 – Fuel-Fire Unit Heaters
23 72 23 – Packaged Air-to-Air Energy Recovery Units
23 81 26.13 – Small-Capacity Split-System Air Conditioners
23 84 10 – Electric Heating Equipment

DIVISION 26 -- ELECTRICAL

26 05 19 – Low-Voltage Electrical Power Conductors and Cables
26 05 26 – Grounding and Bonding for Electrical Systems
26 05 29 – Hangers and Supports for Electrical Systems
26 05 33.13 – Conduit for Electrical Systems
26 05 33.16 – Boxes for Electrical Systems
26 05 53 – Identification for Electrical Systems
26 05 73 – Power System Studies

26 09 23 – Lighting Control Devices
26 24 16 – Panelboards
26 27 13 – Electricity Metering
26 28 16.16 – Enclosed Switches
26 32 13 – Engine Generators
26 36 00 – Transfer Switches
26 43 00 – Surge Protective Devices
26 51 00 – Interior Lighting
26 56 00 – Exterior Lighting

DIVISION 27 -- COMMUNICATIONS

27 05 33.13 – Conduit for Communications Systems
27 10 00 – Structured Cabling

END OF SECTION

SECTION 00 01 15

SCHEDULE OF DRAWINGS

BRULE PUBLIC WORKS GARAGE
BRULE, WISCONSIN

SHEET	TITLE
G1.1	Life Safety Plan & Energy Code Summary
G1.2	Mounting Heights
CIVIL	
G001	Sheet Index and Notes
G002	Civil Legends and Abbreviations
G003	Topographic Survey
C050	Existing Conditions and Demolition
C100	Composite Site and Utility Plan
C110	Erosion Control and Grading
C111	Grading Enlargement
C300	Stormwater Facility
C600	Erosion Control Details
C610	Site Details
C620	Sewer Details
STRUCTURAL	
S0.1	General Notes/Sheet Index
S1.0	Typical Details – Concrete
S1.1	Typical Details – Light Gauge Steel
S2.0	Foundation Plan/Mezzanine Framing Plan
S3.0	Sections and Details
ARCHITECTURAL	
A2.0	Floor Plan
A2.1	Enlarged Plans & Interior Elevations
A2.2	Roof Plan / RCP Plan
A4.1	Schedules and Types
A5.1	Exterior Elevations
A5.2	Exterior Elevations 3D
A6.1	Building Sections & Wall Sections
A6.2	Wall Sections
MECHANICAL - PLUMBING	
M0.1	Cover Sheet – Mechanical
M0.2	Schedules – Mechanical
M2.1	Floor Plan – Mechanical
M2.2	ME – Mechanical
M5.1	Cover Sheet – Mechanical
P0.1	Cover Sheet
P0.2	Schedules
P0.3	Schedules
P2.1	Underfloor Plan
P2.2	Floor Plan
P3.1	Enlarged Floor Plan
P5.1	Details
P5.2	Details
P6.1	Diagrams

ELECTRICAL

E0.1	Cover Sheet – Electrical
E0.2	Schedules – Electrical
E1.0	Site Plan – Electrical
E2.1	Floor Plan – Electrical
E3.1	Lighting RCP – Electrical
E5.1	Details – Electrical
E6.1	One-Line Diagram – Electrical

END OF SECTION

SECTION 00 11 13

ADVERTISEMENT FOR BIDS

BRULE PUBLIC WORKS GARAGE
BRULE, WISCONSIN

The City of Brule, Wisconsin will receive sealed bids for the “BRULE PUBLIC WORKS GARAGE”, until **Tuesday, March 31st, 2026, by 2:00 p.m.**, at the Town of Brule, ATTN: Diane Nelson, Town Clerk, 5231 South County Line Road, Brule, WI 54820, at which time all Bids will be publicly opened, read aloud and tabled. City of Brule to act on this item at a future meeting.

All bids must be sealed and clearly marked, "BID FOR: BRULE PUBLIC WORKS GARAGE", along with bidder's name, and must be accompanied by a certified check or bidder's bond in the amount of five percent (5%) of the net base bid amount, payable to the order of City of Brule, Wisconsin as warranty that the successful bidder will enter into a contract and furnish the usual Bonds (Performance Bond and Labor and Material Payment Bond) as required within ten (10) days after Notice of Award of Contract.

Bid Documents (plans and specifications) will be available electronically beginning Tuesday, March 10th, 2026. Free access to the plans & specifications may be obtained by contacting DSGW Architecture, (218) 727-2626. Bid Documents may also be examined at the builder’s exchanges of: Minnesota Builders Exchange, Construct Connect, and Dodge Data & Analytics. Pre-printed plans and specifications will not be provided.

No Bidder shall modify, withdraw or cancel their Bid or any part thereof for sixty (60) days after the date designated for the receipt of bids. The Owner reserves the right to reject any and all bids and to waive any irregularities and informalities therein and to award the Contract to other than the lowest bidder, if in their discretion the interest of the project will be best served thereby.

**Project is tax-exempt. City of Brule will provide tax exemption forms to awarded contractor.*

A Pre-Bid Meeting is scheduled for Tuesday, March 17th, 2026 at 2:00 p.m. at the Brule Town Hall, 5820 Maple Street, Brule, WI 54820.

Milestone Dates:

1. Bids due Tuesday, March 31st, 2026, by 2:00 p.m.
2. Plans will be issued for bid on Tuesday, March 10th, 2026.
3. Pre-Bid Meeting will be Tuesday, March 17th, 2026, at 2:00 p.m.

END OF SECTION

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

PART I GENERAL

1.01 INSTRUCTIONS TO BIDDERS

A. The "Instructions to Bidders", AIA Document No. A701, copyright 2018, as published by the American Institute of Architects, Article 1 thru 8, inclusive, are hereby made a part of the Contract Documents to the same extent as if bound herein and as supplemented hereinafter. A copy of A701 is on file in the Architect's office.

B. The "Supplementary Instructions to Bidders", Section 00 22 13, shall modify, replace or define portions of AIA A701, Instructions to Bidders, 2018 Edition.

END OF SECTION

SECTION 00 22 13

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

THE FOLLOWING SUPPLEMENTARY INSTRUCTIONS TO BIDDERS SHALL MODIFY, REPLACE, OR DEFINE PORTIONS OF THE A.I.A. INSTRUCTIONS TO BIDDERS, A701, 2018 EDITION. THOSE PORTIONS OF THE A.I.A. INSTRUCTIONS TO BIDDERS, A701, WHICH ARE NOT ALTERED BY THESE SUPPLEMENTARY GENERAL CONDITIONS SHALL REMAIN IN EFFECT AS PUBLISHED.

1. ARTICLE 1 - DEFINITIONS

ADD the following Paragraph:

1.10 The word "product" herein means any material, equipment, assembly, manufacturer, brand, trade name, element, item or similar description as applicable. Wherever a product is named on the Drawings or in the Specifications, the phrase "or acceptable substitute in the opinion of the Architect" shall be implied throughout the Specification, whether specifically noted or not.

2. ARTICLE 3 - BIDDING DOCUMENTS

ADD to and modify paragraph 3.1.1 as follows:

3.1.1 **Bidders** may access the documents electronically as noted in the Advertisement for Bids, Section 00 11 13.

ADD paragraph 3.2.4 as follows:

3.2.4 It is the Bidder's (and Contractor's) responsibility to bring all discrepancies, ambiguities, omissions, for matters in need of clarification to the attention of the Architects or interpretation and decision.

ADD the following Subparagraphs after paragraph 3.3.1:

3.3.1.1 Any product or manufacturer used as basis of the Specifications shall generally set the criteria. It shall be expressly understood that any other product or manufacturer listed in the Specification or any addenda as acceptable will be acceptable provided they fully comply with the requirements and match the basic and essential criteria of the product used for base Specification, including the level of workmanship quality, as determined by the Architect. For final acceptance for use in the work, the Architect shall have the right to accept or reject proposed deviations. Should a proposed product be unable to meet requirements, the product shall not be used.

3.3.1.2 Where two or more products are shown or specified, the Bidder and Contractor has his option of which to use, provided the product proposed will meet all requirements of the Specifications and the design criteria. The right is reserved by the Architect to accept or reject proposed deviations in design, function, construction or similar differences that will affect design intent or quality, or,

3.3.1.3 For any same or like product for this Project, only one brand, manufacturer, source or type shall be used, as approved by Architect.

3.3.1.4 For products specified or shown by describing proprietary items, model numbers, catalog numbers, manufacturers, trade names or similar reference, each Bidder obligates himself to submit bids and accept awards of a contract based upon the use of such products. The reference is intended to establish the measure for the quality, which has been determined as requisite and necessary for the Project.

REVISE paragraph 3.3.2 as follows:

3.3.2 No substitutions will be considered prior to receipt of bids unless written request for approval has been received by the Architect at least seven (7) days prior to the Date for receipt of Bids.

ADD the following at the end of paragraph 3.3.3:

...<u>If a written reply is required, the Contractor shall furnish two (2) copies of the request and a self-addressed, stamped envelope</u>. FAX REQUESTS WILL NOT BE ACCEPTED.

ADD paragraph 3.3.6 as follows:

3.3.6 The supplier or manufacturer providing any acceptable product shall bear the cost of any required modifications to spaces, services, utilities and other features as the result of the use of his product, including but not limited to, larger capacity mechanical or electrical service, devices or utilities resulting from acceptance of the product for bidding purposes, as well as to pipes, conduits, ducts, and controls for conveying, distributing, and controlling those services or utilities; as well as insulation, wrapping, coatings, or other integral features of the lines or items conveying those lines, and additional costs of the products installation.

3. ARTICLE 4 - BIDDING PROCEDURES

4.1 FORM AND STYLE OF BIDS

DELETE paragraphs 4.1.1 and ADD the following:

4.1.1 Bids shall be submitted on forms identical to the form included in the Bidding Documents, photo copies will be acceptable. The Bidder shall submit two (2) copies of the bid Form with his Bid. DO NOT REMOVE BID FORMS FROM BIDDING DOCUMENTS.

4. ARTICLE 6 - POST BID INFORMATION

ADD the following paragraph:

6.4 TIME AND COMPLETION

6.4.1 Each Bidder agrees to commence work on or before a date to be specified in a written "Notice to Proceed" signed by the Owner, and to substantially complete the work by the date stated on the Bid Form.

5. ARTICLE 7 - PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

7.1 BOND REQUIREMENTS

ADD the following paragraph:

7.1.4.1 Performance/Payment Bonds are required.

6. ADDITIONAL LAWS AND REGULATIONS

A. The Bidder's attention is directed to the fact that all applicable State laws, County and municipal ordinances and the Rules and Regulations of all authorities having jurisdiction over the construction of the project shall apply to the contract throughout and they will be deemed to be included in the Contract the same as though written.

B. The bidders shall account for most recent edition of Prevailing Wage Rates set forth by the State of Wisconsin – Douglas County.
   1. https://dwd.wisconsin.gov/er/laborstandards/prevailingwage/

C. The bidders shall account for most recent edition of Prevailing Wage Rates set forth by the U.S. Department of Labor.

D. Project is Tax-Exempt.

END OF SECTION

SECTION 00 31 00
AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 GEOTECHNICAL REPORT

A. Geotech Evaluation Report for proposed Town of Brule Public Works Garage in Brule, WI by Twin Ports Testing, dated December 5, 2025. Appended to this section.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Twin Ports Testing
1301 N 3rd St. • Superior WI 54880 • 715-392-7114 • 1-800-373-2562 • F 715-392-7163 • www.twinportstesting.com

Geotechnical Evaluation Report

Proposed Town of Brule Public Works Garage
Brule, Wisconsin

Prepared for:

DSGW Architecture

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Wisconsin.

Michael A. Haapala, PE
License Number: E-40299
December 5, 2025



TPT Project Number: 25G2116

December 5, 2025 TPT Project No. 25G2116

Nick Hulstrom, AIA, NCARB
Architect
DSGW Architecture
14 East Bayfield Street
Washburn, WI

Re: Proposal for Geotechnical Services
Town of Brule Public Works Garage
Town of Brule
Douglas County, WI

Dear Mr. Hulstrom:

Enclosed is our geotechnical evaluation report for the above referenced project. We have prepared this report and based our conclusions upon current applicable professional standards.

If you have any questions concerning the data, the recommendations presented, or if we may be of further service on this project, please contact us at 715.392.7114. We appreciate the opportunity to be of service to you.

Sincerely,

Twin Ports Testing

Brett Carlson, PE (MN)
Geotechnical Engineer

Michael A. Haapala, PE
Principal Engineer

Attachment:
Geotechnical Evaluation Report

1 Introduction
1.1 Scope of Services 1
1.2 Proposed Project 1
2 Site Conditions 2
2.1 Site Locations and Existing Conditions 2
2.2 Topography 3
2.3 Geologic Setting 3
3 Field Procedures 4
3.1 Boring Locations and Elevations 4
3.2 Sampling 4
3.3 Boring Logs 5
3.4 Water Level Readings 5
4 Subsurface Conditions 5
4.1 Soil 5
4.2 Groundwater 6
5 Laboratory Testing 6
4.1 Water Content 6
4.2 Sieve Analysis 7
6 Analysis and Design Recommendations 7
6.1 Design Considerations 7
6.2 Site Preparation 7
6.3 Shallow Foundations 7
6.4 Slabs 9
6.5 Retaining Structures and Lateral Earth Pressures 10
6.6 Slopes and Drainage 11
6.7 Backfill and Fill 11
6.7 Parking an Drive Areas 12
7 Recommendations for Construction 13
7.1 Excavations and Grading 13
7.2 Observation 14
7.3 Frequency of Testing 14
8 Limitations of Evaluation and Report 15
8.1 Site Variations 15
8.2 Design Review 15
8.3 Continuity of Professional Responsibility 15
8.4 Safe Working Conditions 15
8.5 Exclusive Use 15

Appendix: Boring Location Map, Boring Logs B-1 through B-8, Boring Log Notes and Soil Classification Data

1 Introduction

This report presents the results of our geotechnical evaluation for the proposed Town of Brule Public Works Garage and Administration Office on Old Highway 2 in Brule, Wisconsin.

1.1 Scope of Services

Our scope of services for this geotechnical evaluation as outlined in our proposal 25G2116 dated October 24, 2025 included:

- Performing an exploration program consisting of eight (8) Standard Penetration Test (SPT) borings: four (4) to depths of 25 feet or refusal within the building footprint, three (3) to depths of 15 feet or refusal within the stormwater pond footprint, and one (1) to a depth of 10 feet or refusal within the parking area footprint.
- Performing laboratory tests and observations of soil samples to evaluate pertinent engineering properties of materials encountered.
- Preparing a report containing a description of the drilling program, a description of the geology and subsurface conditions encountered, groundwater conditions, boring logs with a boring location sketch, results of laboratory testing, and recommendations for site preparation, foundation design, pavement design, and construction.

Twin Ports Testing II, Inc. (TPT) prepared this report for design purposes only. It may not have sufficient subsurface information to prepare an accurate construction bid. We recommend that contractors preparing bids or proposals for this project be provided with a complete copy of this report as a supplement to the plans and specifications.

1.2 Proposed Project

We understand that DSGW Architects is in the design process to construct a public works garage and administration office in Brule, Wisconsin. Additional site work includes concrete sidewalks, paved parking and drive areas, and a stormwater pond. The building construction type and building loads are not known at the time of this report; though we assume column loads less than 50 kips and wall loads less than five kips per lineal foot.

Changes in the nature, design, and location of all or parts of this project may occur. The conclusions and recommendations contained in this report shall not be considered applicable to changes unless they are reviewed by the geotechnical engineer of record. We will then make necessary changes or modifications to this report in writing only.

1.2.1 Reference Information

We referenced the following documents as part of this project:

- Wisconsin Geological and Natural History Survey titled, "Quaternary Geology of Wisconsin," dated 2025, prepared by J. Elmo Rawling III, Eric C. Carson, John W. Attig, David M. Mickelson, William N. Mode, Mark D. Johnson, and Kent M. Syverson.
- *Web Soil Survey* website, prepared by the United States Department of Agriculture and the Natural Resources Conservation Service. http://websoilsurvey.nrcs.usda.gov.
- Google Earth™

2 Site Conditions

2.1 Site Location and Existing Conditions

The proposed site is located around 500 feet northeast of the intersection of Old Highway 2 and Hill Drive in Brule, Wisconsin as shown in Figure 1 below. The current building footprint and parking area were cleared and graded. The surrounding areas and stormwater pond area currently consist of wooded areas.



Figure 1: Site Location (Google Earth™)

2.1.1 Review of Historical Images

As part of our evaluation we looked at historical images of the site using Google Earth. Based upon available imagery, this site has changed little since the first available image dated 1992.

2.2 Topography

This site has been previously graded and is relatively flat. Elevations between the boring locations varied by less than 3 ½ feet.

2.3 Geologic Setting

Through an understanding of the geologic history and processes of an area, we are better able to define and understand the range of geotechnical properties observed in the geological materials encountered at the site. Knowledge of the anticipated subsurface profile at the site is important for interpreting and correlating the borings from the field exploration program.

Based upon information from geologic survey reports, the geology local to the site generally consists of glacial sediment of the Copper Falls Formation and lake sediment. Glacial sediment is defined as reddish-brown to brown sandy till and similar sediment deposited by the Langlade, Wisconsin Valley, Chippewa, Superior, and Ontonagon lobes late in the Wisconsin Glaciation. Areas of hummocky topography with typically 10 m of relief. Contains areas of sandy and gravelly outwash and sandy and silty lake sediment. Ice-walled lake plains are common. Lake sediment is defined as stratified and well-sorted sandy gravel, sand, silt, and clay deposited along shorelines of the Great Lakes and ice-marginal lakes; includes dunes, wave-cut benches, sand bars, spits, and offshore plains. (Rawling III, Carson, Attig, Mickelson, Mode, Johnson, and Syverson)

2.3.1 Results of Web Soil Survey

As part of our evaluation for this project we reviewed the Web Soil Survey website. The Web Soil Survey consists of publically available soils information prepared by the United States Department of Agriculture and the Natural Resources Conservation Service (NRCS). Our review of this information identified one primary soil unit throughout the project area consisting of “Rubicon sand”. In general, the Web Soil Survey suggests these soils consist of outwash sands. In general, soil units in the Web Soil Survey correspond well with the results of our field investigation.

2.3.2 Geologic Hazards

The potential for most geologic hazards is generally low for this site. A hazard potential summary is shown in Table 1.

Table 1: Geologic Hazard Summary

Geologic Hazard	Present?	Comments
Earthquake/Seismic Activity	No	The proposed site is in an area of low seismic activity.
Flooding	Unlikely	This site is not located in areas with historic flood activity. However, the proposed site is relatively flat and may collect some stormwater.
Slope Failure/Landslides	No	The proposed site is relatively flat with little to no potential for slope failures.
Made Ground	No	The proposed site has only been graded for drilling access at the time of this report.
Swelling/Shrinking Soil	Unlikely	Glacial and lake sediment soils at the site have low to moderate potential for swelling and shrinking when exposed to changes in water content or freezing temperatures.

3 Field Procedures

Field procedures for this project included performing Standard Penetration Test (SPT) borings at eight (8) locations; four (4) SPT borings within the proposed building footprint to depths of 20 feet, three (3) SPT borings within the proposed stormwater ponds to depths of 15 feet, and one (1) SPT boring within the proposed parking areas to a depth of 10 feet.

SPT borings were performed with a Geoprobe Systems 7822DT track mounted drill rig using hollow stem auger drilling methods. Drilling procedures were performed on November 13, 2025 and November 14, 2025.

3.1 Boring Locations and Elevations

Boring locations were staked in the field by Pine Ridge Surveying prior to our field crews' arrival on site. The approximate boring locations are shown on the Boring Location Map in the Appendix. Boring elevations were recorded in the field by TPT personnel using a surveying level and rod. The base of the west side entrance gate was used as a benchmark and was assigned an elevation of 100 feet. Boring elevations can be found on the boring logs included in the Appendix.

3.2 Sampling

3.2.1 Standard Penetration Test (SPT) Borings

At selected depth intervals in the borings, Standard Penetration Tests (SPT) were conducted in substantial compliance with ASTM Method D1586. The SPT "N" values shown on the boring logs

are the number of blows required to drive a standard split barrel sampler 12 inches (two six-inch increments) into undisturbed soil using a 140 pound drive hammer dropped 30 inches per blow after an initial "set" of six inches. The "N" value is an index of the relative density of cohesion-less soils and consistency of cohesive soils. The values shown on the boring logs are field values and have not been corrected for hammer energy, surcharge, etc. Partially disturbed samples obtained from the SPT borings were sealed in glass jars and returned to the laboratory for testing.

3.3 Boring Logs

A field boring log was prepared for each boring by our field supervisor. These logs contain factual information and field interpretation of the soil conditions observed, as described in substantial compliance with ASTM D420 and D2488.

Final boring logs are included in the Appendix. The final logs represent our interpretation of the contents of the field logs after laboratory observations by a geotechnical engineer and laboratory tests of the field samples were complete. Soils are described in this report according to the Unified Soil Classification System (USCS), as outlined in the Boring Log Notes and Soil Classification Data in the Appendix.

3.4 Water Level Readings

Water level readings were observed in the borings at the times and under the conditions stated on the boring logs. We have reviewed the data and have reported interpretations in the text of this report. However, it must be noted that fluctuations in the level of ground water may occur because of variations in rainfall, temperature, subsurface materials and other conditions or factors different from those observed at the time of our measurements. It should be noted that such conditions are subject to change.

4 Subsurface Conditions

4.1 Soil

The subsurface soils encountered at this site generally consisted of four stratigraphic units: (1) Topsoil, (2) Silty Sand, (3) Poorly Graded Sand with Silt, (4) Silt with Sand. These units are described below.

4.1.1 Topsoil

Topsoil was encountered in all boring locations from the surface to depths up to six inches. Topsoil generally consisted of silty sand, contained trace roots and fibers, was fine to medium grained, dark brown, and moist.

4.1.2 Silty Sand

Silty sand soils were encountered below the topsoil in all boring locations at varying depths and thicknesses. Silty sand soils generally contained trace gravel, were fine to medium grained, brown to light brown, and moist. Trace organics, roots, and fibers were encountered to depths up to 6 feet.

SPT N-values suggest that silty sand soils generally ranged from loose to medium dense in relative density.

4.1.3 Poorly Graded Sand with Silt

Poorly graded sand with silt soils were encountered below the topsoil in all boring locations excluding B-6 and B-7, at varying depths and thicknesses. Poorly graded sand with silt soils generally contained trace gravel, were fine to medium grained, brown to light brown, and moist. Trace organics, roots, and fibers were encountered to depths up to 6 feet.

SPT N-values suggest that poorly graded sand soils generally ranged from loose to medium dense in relative density.

4.1.4 Silt with Sand

Silt with sand soils were encountered below the silty sand soils in Borings B-3 and B-4 at varying depths and thicknesses. Silt with sand soils were brown and moist.

SPT N-values suggest that silt with sand soils generally ranged from loose to medium dense in relative density.

4.2 Groundwater

Groundwater was not encountered within our borings during field procedures at this site. Perched water may be encountered during excavation activities. A detailed evaluation of groundwater levels at the site would require long term monitoring of piezometers and was not included in the scope of this evaluation.

5 Laboratory Testing

Results of the field testing and observed subsurface conditions were evaluated to develop a laboratory testing program. Laboratory testing of collected samples included visual classification by a geotechnical engineer, water content testing, and sieve analysis. Results of laboratory tests are shown on the boring logs in the Appendix.

5.1 Water Content

Laboratory water content testing was performed in accordance with ASTM D2216 on select collected samples from the field exploration. Values of water content are shown on the Boring Logs in the Appendix.

5.2 Sieve Analysis

Sieve analysis testing of material passing the #200 sieve was performed in general accordance with ASTM D1140 procedures on two individual split spoon samples. Test results are shown in Boring Logs in the Appendix.

Table 2: Summary of Sieve Analysis Results

Boring	Depth (feet)	Description of Material	% Passing #200
B-3	2.0-3.5	SP-SM	7.9
B-5	2.0-3.5	SP-SM	7.3

SP-SM = Poorly Graded Sand with silt

6 Analyses and Design Recommendations

6.1 Design Considerations

6.1.1 Topsoil and Soils Containing Organics

Topsoil and soils containing organics, roots and fibers were encountered at all boring locations at this site to depths up to six feet. It is possible that these soils will cause settlement beyond the allowable limits of the structures when loaded.

6.2 Site Preparation

Topsoils and soils containing organics, roots, and fibers were encountered at all boring locations at this site from the surface to depths up to six feet. We recommend **removing all topsoil, fill soils, and soils containing organics (>5%) encountered within the footprint and influence area** (1H:1V out from the outside edge of slabs/footings of the proposed structure) and replacing with compacted engineered fill to reach design elevations. We also recommend removing all fill and organic soils within existing utility trenches, if encountered, during excavation. Excavations of six feet or greater should be anticipated.

6.3 Shallow Foundations

It is our understanding that frost depth footings are the preferred foundation option for this project. Both frost depth footings and frost protected shallow foundations are feasible options at this site. Recommendations for both systems are provided below.

6.3.1 Frost Depth Footings

Frost depth footings bearing on native sand soils or compacted engineered fill over native sand soils are a feasible option for this site. We recommend that footings and column pads for unheated structures, as well as isolated exterior footings, bear a minimum of six feet below grade. Footings for heated structures should bear a minimum of five feet below grade to provide frost protection. Interior footings may bear directly below slabs.

6.3.2 Frost Protected Shallow Foundations

Frost protected shallow foundations are also a feasible option for this site. We recommend using design methods outlined in ASCE 32-01 "Design and Construction of Frost-Protected Shallow Foundations." Recommended R-Values for insulation assuming a design Air Freezing Index of 3,000º F days are provided for unheated structures as shown in Table 3 below.

Table 3: Minimum Insulation R-Values

Structure Type	Vertical Insulation R-Value	Horizontal R-Value, Along Walls	Horizontal R-Value, At Corners
Heated Structure	7.8	6.5	8.6
Unheated Structure	-*	18.2	18.2

*** =** No vertical insulation required for unheated structures. Assumes a continuous layer of insulation beneath the footing and extending outward.

For heated structures, insulation should extend out at least 24 inches horizontally within 40 inches of outside corners and at least 12 inches horizontally away from outside corners. Vertical insulation should be extended from the sill plate to the bottom of the footing to avoid cold bridging. Insulation above grade should be provided with UV protection.

For unheated structures, insulation should extend horizontally a minimum of 79 inches outside of foundations both along walls and at corners.

If non-frost susceptible fill soil extends to a depth of six feet or more beneath shallow foundations, insulation is not required to provide frost protection. Insulation may be required to meet energy code requirements. We recommend a minimum footing depth of 18 inches for frost protected shallow foundations.

6.3.3 Net Allowable Bearing Stress

Results of the field and laboratory testing program were used to evaluate the net allowable bearing stress for shallow foundations. **In our opinion, a net allowable bearing stress (with a minimum factor of safety of at least 3.0) of 3,000 psf (pounds per square foot) may be used to design footings placed on native soils or engineered fill over native soils.**

6.3.4 Settlement Estimate

For foundations designed according to the net allowable bearing stresses outlined above, we estimate total settlement of less than one inch and differential settlements of less than ½ inch.

6.3.5 Inclined and Eccentric Loads

Loading a footing eccentrically will reduce the bearing capacity of the footing. Footings should be designed so that the resultant load is applied to the middle third (kern) of the footing. This will allow the contact stress to remain greater than zero over the area of the footing.

6.3.6 Lateral Resistance

A coefficient of friction of 0.4 between compacted engineered fill and concrete footings may be used for this project. Additional lateral resistance will also be provided by the passive earth pressure between the side of the footing and adjacent soil. Lateral earth pressure parameters for soil types encountered at this site are shown in Table 4.

6.3.7 Uplift

For a conservative approach, uplift of a footing can be resisted by the weight of the footing plus the effective weight of the soil above the footing. If necessary, additional uplift resistance can also be provided by the effective weight of the wedge of soil defined by a line extending up and out from the edge of the footing at an angle of 30 degrees from vertical. Estimated unit weights of soils types encountered at this site are shown in Table 4.

6.4 Slabs

6.4.1 Heated Structures

Interior slabs for heated structures can be supported on a layer of granular fill material placed over engineered backfill. We recommend that a minimum of six inches of well-graded granular material (classifying as SP in the Unified Soil Classification System) be used beneath slabs.

6.4.2 Unheated/Exterior Slabs

Unheated slabs may be constructed as part of this project. Soils encountered near the surface at the site are considered frost susceptible. If provided a water source and freezing temperatures, several inches or more of frost heave can occur. We recommend that slabs be provided with frost protection as outlined in Section 6.3.2.

Heave can also be prevented by removing frost susceptible soils down to a depth of six feet below slabs and replacing with non-frost susceptible soils having less than 5% passing the No. 200 sieve or by supporting slabs on frost depth foundations and leaving a void space for frost heave.

6.4.3 Modulus of Subgrade Reaction

Slabs are anticipated to bear on native sand soils or compacted engineered fill over native sand soils. The anticipated slab subgrade is a minimum of six inches of granular fill over native sand soils. It is our opinion that a modulus of subgrade reaction, k, of 150 pounds per square inch per inch of deflection (pci) may be used to design slabs.

6.5 Retaining Structures and Lateral Earth Pressures

Retaining walls or below-grade structures should be designed to resist lateral earth pressures. Recommendations are provided below.

6.5.1 Lateral Earth Pressure Parameters

Lateral earth pressures are an important part of designing underground structures including retaining walls. Free standing walls where some displacement at the top of the wall is acceptable can be designed to resist active lateral earth pressures. If no displacement at the top of the wall is acceptable, such as basement walls, walls should be designed to resist at-rest lateral earth pressures. Anchored walls should be designed to resist passive lateral earth pressures. Estimated lateral earth pressure coefficients are shown in Table 4 below. Design of retaining structures should account for any surcharge loads at the surface.

The estimated soil friction angles and coefficients of lateral earth pressure provided in Table 4 are for sustained loads (loads defined as permanent or semi-permanent such as dead weight). Sustained loads allow time for excess soil pore water pressures to dissipate, resulting in drained soil conditions. An effective stress analysis is used for sustained loads.

The soil parameters shown in Table 4 are estimates based on data from the borings and past experiences near the site. A more extensive laboratory testing program would be required to more accurately determine soil strength parameters.

Table 4: Estimated Soil Strength Parameters for Effective Stress Analysis

Soil Type	Dry Unit Weight (pcf)	Friction Angle (ϕ', degrees)	Cohesion (C', psf)	Coefficients of Lateral Earth Pressure		
				K_0	K_A	K_P
ENGINEERED FILL*	120	33	0	0.46	0.29	3.4
SP-SM (Native)	125	34	0	0.44	0.28	3.5
SM (Native)	120	33	0	0.46	0.29	3.4
ML (Native)	110	28	0	0.53	0.36	2.8

SP-SM = Poorly Graded Sand
SM = Silty Sand
ML = Silt with Sand
*Soil parameters for engineered fill are conservative estimates. Additional laboratory testing would be required to more accurately estimate soil parameters once an engineered fill source has been selected.

6.5.2 Drainage

If water percolates down alongside the wall it may become perched within the wall backfill. Collecting run-off and discharging it well away from the foundation(s) and sloping the surface down and away from the retaining wall are two common methods of reducing infiltration and percolation. To collect surface water infiltration within the wall backfill we recommend installing a perimeter foundation drain system. The drain system should consist of perforated

pipe embedded in gravel and placed at an invert within two inches of the bottom-of-footing elevation. A geotextile filter fabric should encase the pipe and gravel. The drain system should be routed to a storm sewer, sump pump, low area on the site, or other suitable drainage channels. Another suitable drainage system for non-basement retaining includes placing a layer of free-draining granular material behind the walls, connected to “weep holes” in the face of the walls.

6.6 Slopes and Drainage

We recommend sloping backfill next to the proposed structures away from the foundation at a minimum slope of 10H:1V to promote drainage away from the structure. It is our understanding that stormwater collection ponds or infiltration basins are not part of this project. Therefore, we have not provided recommendations for soil infiltration rates. We can provide this information upon request if necessary.

6.7 Backfill and Fill

A wide variety of materials can be considered as suitable for engineered backfill and fill. The choice of materials is a function of structural requirements, water table conditions, seasonal construction constraints, placement and compaction methods, and other site or project specific needs. Soils which classify as SP or SP-SM in the Unified Soil Classification System (ASTM D2487) are usually the most available suitable soils for engineered backfill and fill.

6.7.1 Recommended Gradation for Engineered Backfill and Fill

Table 5: Recommended Gradation for Engineered Backfill and Fill

Sieve Size	Percent Passing
3''	100
2''	85-100
3/4''	71-100
#4	35-100
#200	0-7

Alternative gradations should be evaluated by a geotechnical engineer for acceptability if these guidelines cannot be satisfied by locally available backfill materials.

6.7.2 Re-using Existing Soils

Existing native sand soils appear to be suitable for re-use as engineered fill. If soils are encountered during excavation activities that are desired for re-use we recommend that the suitability be confirmed with laboratory testing of bulk samples

6.7.3 Compaction Standard

We recommend using ASTM D1557 - Modified Proctor as the laboratory compaction standard.

6.7.4 Density

We recommend compacting each lift to a minimum of the following percentage of the above compaction standard for the respective types of fill materials:

Table 6: Compaction Recommendation

Type of Engineered Fill	% Minimum Compaction
Foundation Structural Backfill	95%
Slab-on-Grade Backfill	95%
Non-structural Foundation Backfill	90%
Utility Trenches	90%
Within 3 Feet of Pavement Section	95%

6.7.5 Lift Thickness

Place engineered backfill and fill materials in lifts not to exceed eight inches in a loose condition, unless the contractor can demonstrate satisfactory results when placing thicker lifts. Maximum compacted lift thickness should not exceed 12 inches in a loose condition.

6.7.6 Moisture

In general, granular fill materials should be placed and compacted within two percent of optimum moisture content, as determined by the above applicable compaction standard. When fill materials are not in this range of moisture content, compaction to the required density may be difficult if not impossible. The excavating contractor is responsible for controlling and adjusting moisture content of backfill materials.

6.8 Parking and Drive Areas

Parking and drive areas at this site will likely be subjected to passenger vehicle traffic and some truck traffic. As such, pavement sections throughout truck areas are expected to consist of medium duty sections. Light duty sections may be used in automobile parking areas not subjected to trucks. It is our understanding that either asphalt (flexible) or concrete (rigid) pavements may be used.

6.8.1 Preparation

Prior to placing materials in parking or drive areas, the site should be scarified and any observed soft or organic soils should be fully removed until competent material is encountered. These areas should be brought to the desired subgrade elevations using compacted engineered fill. After initial grading procedures, subgrade soils should be proof-rolled and observed by a geotechnical engineer or designated representative to determine if soft areas are still present. Any observed soft areas should be removed and replaced with compacted engineered fill to provide a stable subgrade.

We recommend that a geotextile fabric (WisDOT type SAS or equivalent) be placed between the subgrade and the engineered pavement section to provide separation and promote drainage.

6.8.2 Pavement Sections

Recommended pavement sections for asphalt pavements are provided below assuming a 20-year design life.

Table 9: Recommended Pavement Section – Light Duty

Pavement Type	Wear Course (in)	Non-Wear Course (in)	Aggregate Base (in)	Granular Sub-base (in)
Asphalt	1 ½	2	6	10

Table 10: Recommended Pavement Sections – Medium Duty

Pavement Type	Wear Course (in)	Non-Wear Course (in)	Aggregate Base (in)	Granular Sub-base (in)
Asphalt	2	2	8	12

We recommend using aggregate base meeting the specifications of WisDOT ¾" Dense Graded Base. Granular subbase should meet the requirements of WisDOT Granular backfill - Grade 1. Base and subbase should be compacted to 95 percent of their Modified Proctor dry density.

6.8.3 Subgrade Drainage

For drive areas constructed on granular material amongst clay soils, we recommend that surfaces adjacent to drive and parking areas be properly sloped to promote drainage away from the site and reduce the potential for creating a "bathtub" effect in roadway areas.

If surface drainage cannot be achieved, we recommend installing drain tile beneath the pavements in low areas or around catch basins. The drain tile should be routed to a nearby manhole, daylight, or other suitable collection point.

6.8.4 Maintenance

Achieving the best performance and lifespan of a pavement section requires routine maintenance throughout the pavement life. We recommend that facility operations include plans for performing crack sealing and seal coating of pavements as needed.

7 Recommendations for Construction

We offer the following recommendations for use during construction of this project.

7.1 Excavation

7.1.1 Dewatering

Groundwater was not encountered at this site at depths affecting construction. However, if excavations extend below the hydrostatic groundwater surface an advanced dewatering system will be required. An experienced dewatering contractor should be contacted for excavations below the hydrostatic groundwater level.

7.1.2 Over Sizing

Excavations for the placement of engineered backfill should extend horizontally at least a minimum of one foot beyond the bottom of footing for every one foot of over excavation depth required below the footing as shown in Figure 2 below.

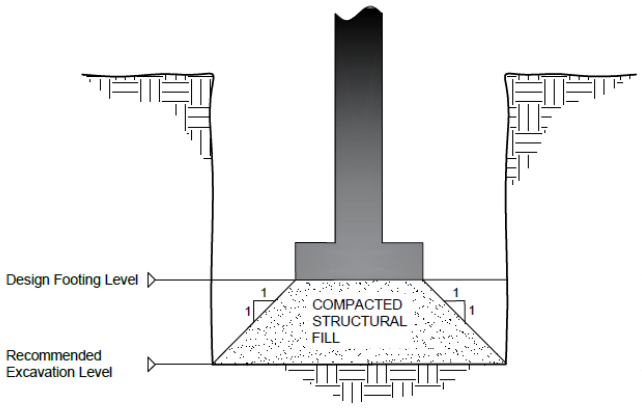


Figure 2: Oversizing Example

7.1.3 Frozen Materials

If construction occurs during temperatures below freezing, the base of all excavations and backfill materials should be protected from freezing. Excavated surfaces which become frozen should be completely thawed before placing of backfill or pavement. If freezing has loosened the excavation surface, remove the frozen material to the undisturbed surface. Frozen material should not be used as backfill.

7.2 Observation

7.2.1 Excavations

Excavation bottoms and engineered fill operations should be observed by a geotechnical engineer or a designated representative to assure that the recommendations in this report are being followed. In-place density testing should be performed to document that project specifications are met.

7.2.2 Foundations

Installation of foundations should be observed and documented by a qualified technician or engineer. We recommend that at a minimum, concrete be tested for air content, temperature, slump, and compressive strength.

7.3 Frequency of Testing

For this project, we recommend a minimum density testing frequency of one test per 1,000 square feet of backfill area of backfill and fill (per lift), with a minimum of one test per lift. For isolated locations or questionable areas, we recommend a minimum of one test per occasion.

8 Limitations of Evaluation and Report

8.1 Site Variations

We have based the analyses and recommendations submitted in this report in part on the data obtained from eight (8) SPT borings. The nature and extent of variations at the site will not become evident until construction. Where major variations appear it will be necessary for us to re-evaluate the recommendations of this report.

8.2 Design Review

As the geotechnical engineer for this project, we recommend that we be provided an opportunity to perform a general review of final plans and specifications for this project to determine that recommendations provided have been properly interpreted and included in the design. We assume no responsibility for misinterpretation or improper application of our recommendations and conclusions by others.

8.3 Continuity of Professional Responsibility

We recommend that we be retained to provide geotechnical engineering services during construction. This would allow us to observe compliance with the plans, compliance with the specifications and recommendations, provides continuity of professional responsibility, and allows design changes to be made in the event that subsurface conditions differ from those anticipated.

8.4 Safe Working Conditions

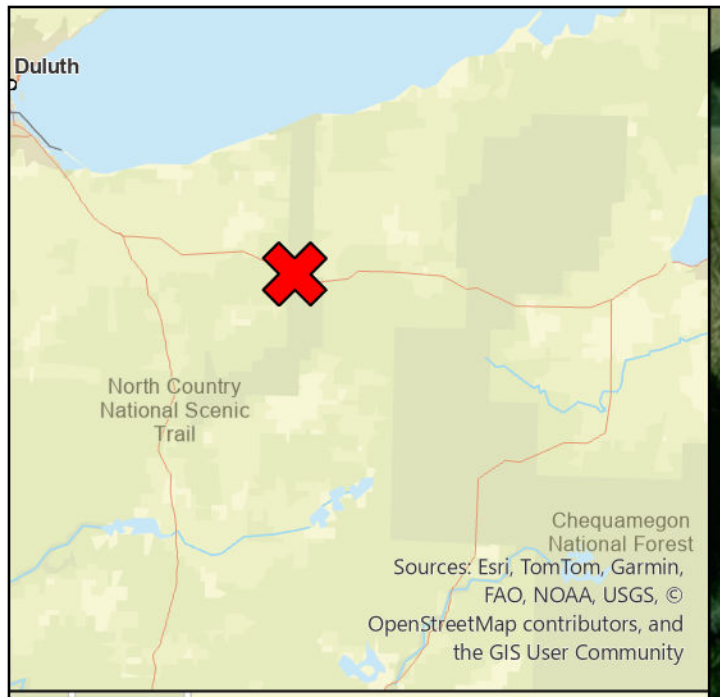
Responsibility to provide safe working conditions for earthwork and below grade aspects of this project is solely that of the contractors working on the project. It appears that the on site soils are generally OSHA Type A and C soils. However, our site exploration was limited to eight boring locations, and therefore excavations should be evaluated individually at the time of construction by the contractor. All local, state and federal requirements, statutes, ordinances, and building codes relating to slopes or temporary sheeting and bracing of trenches and excavations must be observed during construction.

8.5 Exclusive Use

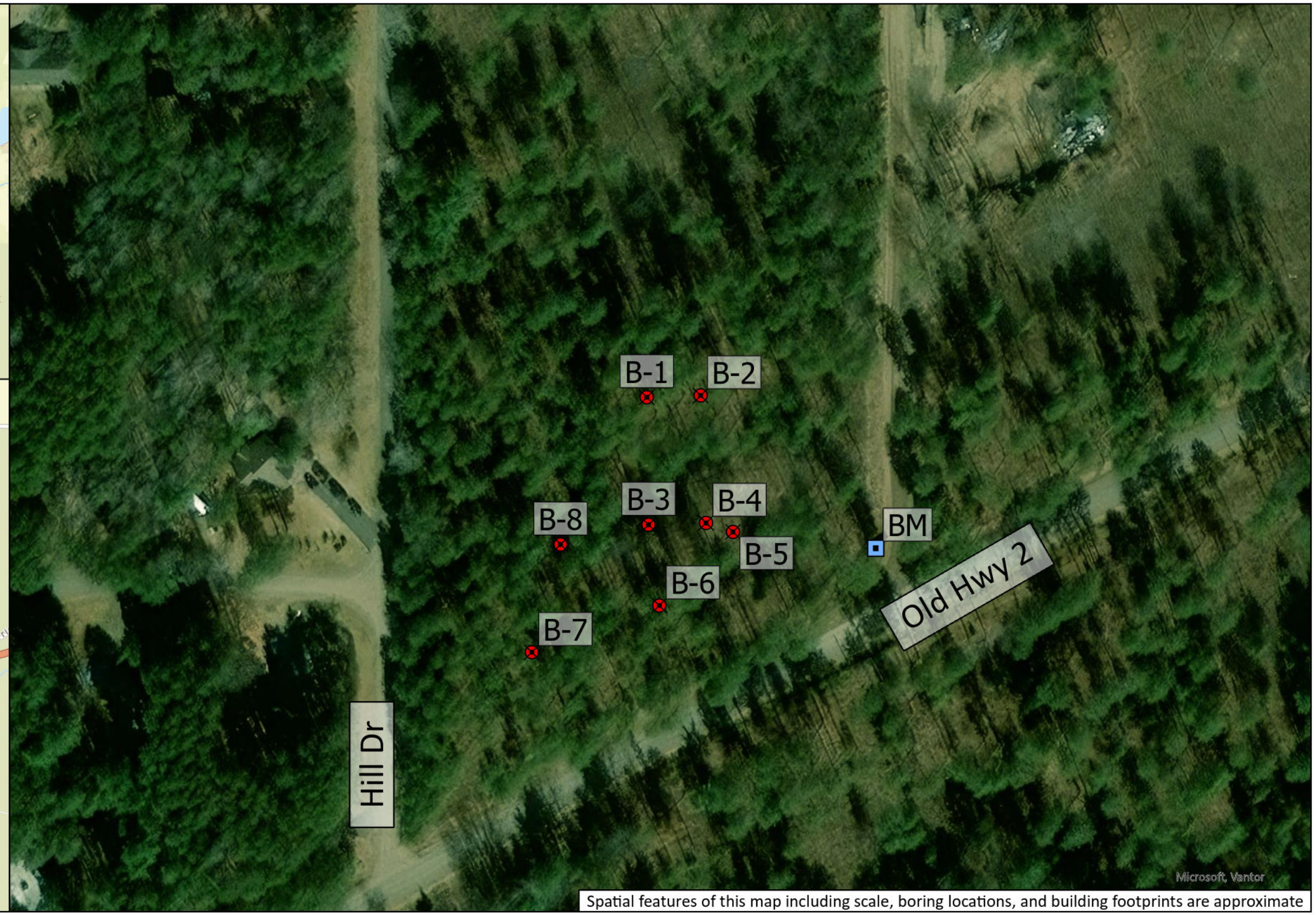
We have prepared this report for the exclusive use of DSGW Architects for specific application to the design of the proposed Town of Brule Public Works Garage and Administration Office on Old Highway 2 in Brule, Wisconsin. Professional services provided to this project by us were completed, findings obtained, and recommendations prepared using generally accepted engineering principles and practices. Conclusions and recommendations contained herein are based upon the applicable standards of our profession at the time this report was prepared. No warranty, express or implied, is made.

APPENDIX

Boring Location Map (1 Page)
Boring Logs B-1 through B-8 (8 Pages)
Soil Classification Data/Boring Log Notes (2 Pages)







Spatial features of this map including scale, boring locations, and building footprints are approximate

Twin Ports Testing

Boring Location Map

Town of Brule Public Works Garage
Town of Brule
Douglas County, Wisconsin

Project No.: 25G2116
Date: 11/20/2025

N

100 feet

Legend

- Soil Boring
- Site Location
- Elevation Benchmark (BM)

TwinPortsTesting

B-1

BORING LOG

PROJECT:	CLIENT:	TPT Project No.:
Town of Brule Public Works Garage	**DSGW Architecture**	**25G2116**

ARCHITECT - ENGINEER:	SITE LOCATION:
DSGW Architecture	**Brule, Wisconsin**

BORING LOCATION:	REPORT DATE:
See Boring Location Map	**11/14/25**

SURFACE ELEVATION: **101.7 ft**

DEPTH (ft) / ELEVATION (ft)	SAMPLE NO.	SAMPLE TYPE	STRATA CHANGE DEPTH	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST N-VALUE
0.0 / 101.7	1	SS	0.3	(TOPSOIL) Silty Sand, trace roots and fibers, fine to medium grained, dark brown, moist	3
	2	SS		(SP-SM) POORLY GRADED SAND with Silt, trace gravel, trace roots and fibers, fine to medium grained, light brown, moist, very loose to loose	5
	3	SS		no roots and fibers	5
	4	SS			7
10.0 / 91.7	5	SS	9.0	(SM) SILTY SAND, fine to medium grained, light brown to brown, moist, loose to medium dense	10
	6	SS			7
	7	SS			9
20.0 / 81.7	8	SS			13
	9	SS			5
30.0 / 71.7			26.0	Boring then Backfilled with Bentonite Chips End of Boring	

UNCONFINED COMPRESSIVE STRENGTH (TONS/FT^2): 1 2 3 4 5

☆ PERCENT PASSING #200 SIEVE: 10 20 30 40 50

× PLASTIC LIMIT % ● WATER CONTENT % △ LIQUID LIMIT %: 10 20 30 40 50

⊗ STANDARD PENETRATION TEST N-VALUE: 10 20 30 40 50

WATER LEVEL		
NE WD	*THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.*	
WATER LEVEL	BORING STARTED **11/13/25**	BORING COMPLETED **11/13/25**
WATER LEVEL	CAVE IN LEVEL	
SPT HAMMER **Autohammer**	RIG **7822DT**	CREW CHIEF **CH**

ABBREVIATIONS: ACR-After Casing Removal, BCR-Before Casing Removal, AB-After Boring, WD-While Drilling, WS-While Sampling, NE-None Encountered, DB-Diamond Bit, HSA-Hollow Stem Auger, RB-Rock Bit, SS-Split Spoon, ST-Shelby Tube, PA-Power Auger, MR-Mud Rotary, CS-Continuous, RP-Rock Probe, PH-Percussion Hammer, WL-Water Level, WOH-Weight of Hammer, EIL-Exceeds Instrument Level, TS-Topsoil, PP-Pocket Penetrometer

BOREHOLE LOG 25G2116 BRULE PUBLIC WORKS.GPJ TWINPORT.GDT 12/5/25

TwinPortsTesting

B-2

BORING LOG

PROJECT:	CLIENT:	TPT Project No.:
Town of Brule Public Works Garage	**DSGW Architecture**	**25G2116**

ARCHITECT - ENGINEER:	SITE LOCATION:
DSGW Architecture	**Brule, Wisconsin**

BORING LOCATION:	REPORT DATE:
See Boring Location Map	**11/14/25**

SURFACE ELEVATION: **102.0 ft**

DEPTH (ft) / ELEVATION (ft)	SAMPLE NO.	SAMPLE TYPE	STRATA CHANGE DEPTH	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) / STANDARD PENETRATION TEST N-VALUE
0.0 / 102.0	1	SS	0.4	(TOPSOIL) Silty Sand, trace roots and fibers, fine to medium grained, dark brown, moist	2
	2	SS		(SP-SM) POORLY GRADED SAND with Silt, trace gravel, with roots and fibers, fine to medium grained, brown, moist, very loose to loose	5
		HSA	4.0	(SP-SM) POORLY GRADED SAND with Silt, fine to medium grained, brown, moist, loose	
	3	SS			6
		HSA			
	4	SS			6
		HSA			
10.0 / 92.0	5	SS	9.0	(SM) SILTY SAND, fine to medium grained, brown, moist, loose	8
		HSA			
	6	SS			10
		HSA	14.0	(SP-SM) POORLY GRADED SAND with Silt, fine grained, light brown, moist, loose to medium dense	12
	7	SS			
		HSA			
20.0 / 82.0	8	SS		*silt lenses at 15-20 feet	12
		HSA			
	9	SS			6
30.0 / 72.0			26.0	Boring then Backfilled with Bentonite Chips End of Boring	

UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²): 1 2 3 4 5

PERCENT PASSING #200 SIEVE: 10 20 30 40 50

PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION TEST N-VALUE: 10 20 30 40 50

WATER LEVEL		
NE WD	*THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.*	
WATER LEVEL	BORING STARTED **11/13/25**	BORING COMPLETED **11/13/25**
WATER LEVEL	CAVE IN LEVEL	
SPT HAMMER **Autohammer**	RIG **7822DT**	CREW CHIEF **CH**

ABBREVIATIONS: ACR-After Casing Removal, BCR-Before Casing Removal, AB-After Boring, WD-While Drilling, WS-While Sampling, NE-None Encountered, DB-Diamond Bit, HSA-Hollow Stem Auger, RB-Rock Bit, SS-Split Spoon, ST-Shelby Tube, PA-Power Auger, MR-Mud Rotary, CS-Continuous, RP-Rock Probe, PH-Percussion Hammer, WL-Water Level, WOH-Weight of Hammer, EIL-Exceeds Instrument Level, TS-Topsoil, PP-Pocket Penetrometer

BOREHOLE LOG 25G2116 BRULE PUBLIC WORKS.GPJ TWINPORT.GDT 12/5/25

TwinPortsTesting

B-3

BORING LOG

PROJECT:	CLIENT:	TPT Project No.:
Town of Brule Public Works Garage	**DSGW Architecture**	**25G2116**

ARCHITECT - ENGINEER:	SITE LOCATION:
DSGW Architecture	**Brule, Wisconsin**

BORING LOCATION:	REPORT DATE:
See Boring Location Map	**11/14/25**

SURFACE ELEVATION: **100.3 ft**

DEPTH (ft) / ELEVATION (ft)	SAMPLE NO.	SAMPLE TYPE	STRATA CHANGE DEPTH	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) / STANDARD PENETRATION TEST N-VALUE
0.0 / 100.3	1	SS	0.5	(TOPSOIL) Silty Sand, trace roots and fibers, fine to medium grained, dark brown, moist	3
	2	SS		(SP-SM) POORLY GRADED SAND with Silt, trace gravel, trace organics, fine to medium grained, light brown, moist, very loose to loose	3
		HSA			
	3	SS			5
		HSA			
	4	SS	6.5	(SM) SILTY SAND, trace gravel, fine to medium grained, brown, moist, loose	5
		HSA			
10.0 / 90.3	5	SS			8
		HSA			
	6	SS	12.5	(ML) SILT with Sand, brown, moist, loose	8
		HSA	13.0	(SM) SILTY SAND, fine to medium grained, brown, moist, loose	
	7	SS	15.0	(ML) SILT with Sand, brown, moist, loose	7
		HSA			
			18.0	(SM) SILTY SAND, fine to medium grained, brown, moist, loose	
20.0 / 80.3	8	SS			5
		HSA	22.5	(ML) SILT with Sand, brown, moist, medium dense	
	9	SS			15
			26.0	Boring then Backfilled with Bentonite Chips End of Boring	
30.0 / 70.3					

UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²): 1 2 3 4 5

PERCENT PASSING #200 SIEVE: 10 20 30 40 50

PLASTIC LIMIT % ✕ WATER CONTENT % ● LIQUID LIMIT % △: 10 20 30 40 50

STANDARD PENETRATION TEST N-VALUE ⊗: 10 20 30 40 50

WATER LEVEL: **NE WD**	*THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.*	
WATER LEVEL	BORING STARTED: **11/13/25**	BORING COMPLETED: **11/13/25**
WATER LEVEL	CAVE IN LEVEL	
SPT HAMMER: **Autohammer**	RIG: **7822DT**	CREW CHIEF: **CH**

ABBREVIATIONS: ACR-After Casing Removal, BCR-Before Casing Removal, AB-After Boring, WD-While Drilling, WS-While Sampling, NE-None Encountered, DB-Diamond Bit, HSA-Hollow Stem Auger, RB-Rock Bit, SS-Split Spoon, ST-Shelby Tube, PA-Power Auger, MR-Mud Rotary, CS-Continuous, RP-Rock Probe, PH-Percussion Hammer, WL-Water Level, WOH-Weight of Hammer, EIL-Exceeds Instrument Level, TS-Topsoil, PP-Pocket Penetrometer

BOREHOLE LOG 25G2116 BRULE PUBLIC WORKS.GPJ TWINPORT.GDT 12/5/25

TwinPortsTesting

B-4

BORING LOG

PROJECT:	CLIENT:	TPT Project No.:
Town of Brule Public Works Garage	**DSGW Architecture**	**25G2116**

ARCHITECT - ENGINEER:	SITE LOCATION:
DSGW Architecture	**Brule, Wisconsin**

BORING LOCATION:	REPORT DATE:
See Boring Location Map	**11/14/25**

SURFACE ELEVATION: **100.7 ft**

DEPTH (ft) / ELEVATION (ft)	SAMPLE NO.	SAMPLE TYPE	STRATA CHANGE DEPTH	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) / STANDARD PENETRATION TEST N-VALUE
0.0 / 100.7	1	SS	0.5	(TOPSOIL) Silty Sand, trace roots and fibers, fine to medium grained, dark brown, moist	3
	2	SS		(SM) SILTY SAND, trace gravel, trace roots and fibers, fine to medium grained, brown, moist, very loose to loose	5
		HSA			
	3	SS			4
		HSA			
	4	SS	7.0	(ML) SILT with Sand, brown, moist, medium dense	11
		HSA	8.5	(SP-SM) POORLY GRADED SAND with Silt, fine to medium grained, light brown, moist, loose	
10.0 / 90.7	5	SS			9
		HSA			
	6	SS			7
		HSA			
	7	SS			6
		HSA			
20.0 / 80.7	8	SS	18.0	(SM) SILTY SAND, fine to medium grained, light brown to brown, moist, loose	6
		HSA			
	9	SS			8
30.0 / 70.7			26.0	Boring then Backfilled with Bentonite Chips End of Boring	

UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²): 1 2 3 4 5

☆ PERCENT PASSING #200 SIEVE: 10 20 30 40 50

✕ PLASTIC LIMIT % ● WATER CONTENT % △ LIQUID LIMIT %: 10 20 30 40 50

⊗ STANDARD PENETRATION TEST N-VALUE: 10 20 30 40 50

WATER LEVEL	*THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.*
NE WD	

WATER LEVEL	BORING STARTED	BORING COMPLETED
	11/13/25	**11/13/25**

WATER LEVEL	CAVE IN LEVEL	

SPT HAMMER	RIG	CREW CHIEF
Autohammer	**7822DT**	**CH**

ABBREVIATIONS: ACR-After Casing Removal, BCR-Before Casing Removal, AB-After Boring, WD-While Drilling, WS-While Sampling, NE-None Encountered, DB-Diamond Bit, HSA-Hollow Stem Auger, RB-Rock Bit, SS-Split Spoon, ST-Shelby Tube, PA-Power Auger, MR-Mud Rotary, CS-Continuous, RP-Rock Probe, PH-Percussion Hammer, WL-Water Level, WOH-Weight of Hammer, EIL-Exceeds Instrument Level, TS-Topsoil, PP-Pocket Penetrometer

BOREHOLE LOG 25G2116 BRULE PUBLIC WORKS.GPJ TWINPORT.GDT 12/5/25

TwinPortsTesting

B-5

BORING LOG

PROJECT:	CLIENT:	TPT Project No.:
Town of Brule Public Works Garage	**DSGW Architecture**	**25G2116**

ARCHITECT - ENGINEER:	SITE LOCATION:
DSGW Architecture	**Brule, Wisconsin**

BORING LOCATION:	REPORT DATE:
See Boring Location Map	**11/14/25**

SURFACE ELEVATION: **100.5 ft**

DEPTH (ft) / ELEVATION (ft)	SAMPLE NO.	SAMPLE TYPE	STRATA CHANGE DEPTH	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) / STANDARD PENETRATION TEST N-VALUE
0.0 / 100.5				(TOPSOIL) Silty Sand, trace roots and fibers, fine to medium grained, dark brown, moist	
	1	SS	0.5	(SP-SM) POORLY GRADED SAND with Silt, trace roots and fibers, fine to medium grained, brown, moist, very loose	2
	2	SS			2
		HSA			
	3	SS			4
		HSA			
	4	SS	6.5	(SM) SILTY SAND, fine to medium grained, brown, moist, medium dense	16
		HSA			
10.0 / 90.5	5	SS	9.0	(SP-SM) POORLY GRADED SAND with Silt, fine to medium grained, light brown, moist, medium dense	12
			11.0	Boring then Backfilled with Bentonite Chips End of Boring	

WATER LEVEL: **NE WD**	*THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.*	
WATER LEVEL	BORING STARTED: **11/14/25**	BORING COMPLETED: **11/14/25**
WATER LEVEL	CAVE IN LEVEL	
SPT HAMMER: **Autohammer**	RIG: **7822DT**	CREW CHIEF: **CH**

ABBREVIATIONS: ACR-After Casing Removal, BCR-Before Casing Removal, AB-After Boring, WD-While Drilling, WS-While Sampling, NE-None Encountered, DB-Diamond Bit, HSA-Hollow Stem Auger, RB-Rock Bit, SS-Split Spoon, ST-Shelby Tube, PA-Power Auger, MR-Mud Rotary, CS-Continuous, RP-Rock Probe, PH-Percussion Hammer, WL-Water Level, WOH-Weight of Hammer, EIL-Exceeds Instrument Level, TS-Topsoil, PP-Pocket Penetrometer

BOREHOLE LOG 25G2116 BRULE PUBLIC WORKS.GPJ TWINPORT.GPJ 12/5/25

TwinPortsTesting

B-6

BORING LOG

PROJECT:	CLIENT:	TPT Project No.:
Town of Brule Public Works Garage	**DSGW Architecture**	**25G2116**

ARCHITECT - ENGINEER:	SITE LOCATION:
DSGW Architecture	**Brule, Wisconsin**

BORING LOCATION:	REPORT DATE:
See Boring Location Map	**11/14/25**

SURFACE ELEVATION: **99.7 ft**

DEPTH (ft) / ELEVATION (ft)	SAMPLE NO.	SAMPLE TYPE	STRATA CHANGE DEPTH	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) / STANDARD PENETRATION TEST N-VALUE
0.0 / 99.7				(TOPSOIL) Silty Sand, trace roots and fibers, fine to medium grained, dark brown, moist	
	1	SS	0.5	(SM) SILTY SAND, fine to medium grained, brown, moist, very loose to medium dense	1
	2	SS			2
		HSA			
	3	SS			5
		HSA			
	4	SS			8
		HSA			
10.0 / 89.7	5	SS			16
		HSA		trace gravel	
	6	SS			9
		HSA			
	7	SS			10
			16.0	Boring then Backfilled with Bentonite Chips End of Boring	
20.0 / 79.7					

UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²): 1 2 3 4 5

PERCENT PASSING #200 SIEVE: 10 20 30 40 50

PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION TEST N-VALUE: 10 20 30 40 50

WATER LEVEL		
NE WD	*THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.*	
WATER LEVEL	BORING STARTED **11/14/25**	BORING COMPLETED **11/14/25**
WATER LEVEL	CAVE IN LEVEL	
SPT HAMMER **Autohammer**	RIG **7822DT**	CREW CHIEF **CH**

ABBREVIATIONS: ACR-After Casing Removal, BCR-Before Casing Removal, AB-After Boring, WD-While Drilling, WS-While Sampling, NE-None Encountered, DB-Diamond Bit, HSA-Hollow Stem Auger, RB-Rock Bit, SS-Split Spoon, ST-Shelby Tube, PA-Power Auger, MR-Mud Rotary, CS-Continuous, RP-Rock Probe, PH-Percussion Hammer, WL-Water Level, WOH-Weight of Hammer, EIL-Exceeds Instrument Level, TS-Topsoil, PP-Pocket Penetrometer

BOREHOLE LOG 25G2116 BRULE PUBLIC WORKS.GPJ TWINPORT.GDT 12/5/25

TwinPortsTesting

B-7

BORING LOG

PROJECT:	CLIENT:	TPT Project No.:
Town of Brule Public Works Garage	**DSGW Architecture**	**25G2116**

ARCHITECT - ENGINEER:	SITE LOCATION:
DSGW Architecture	**Brule, Wisconsin**

BORING LOCATION:	REPORT DATE:
See Boring Location Map	**11/14/25**

SURFACE ELEVATION: **98.3 ft**

UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) 1 2 3 4 5
PERCENT PASSING #200 SIEVE 10 20 30 40 50
PLASTIC LIMIT % 10 20 30 40 50 | WATER CONTENT % | LIQUID LIMIT % 10 20 30 40 50
STANDARD PENETRATION TEST N-VALUE 10 20 30 40 50

DEPTH (ft) / ELEVATION (ft)	SAMPLE NO.	SAMPLE TYPE	STRATA CHANGE DEPTH	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST N-VALUE
0.0 / 98.3				(TOPSOIL) Silty Sand, trace roots and fibers, fine to medium grained, dark brown, moist	
	1	SS	0.5	(SM) SILTY SAND, trace gravel, trace roots and fibers, fine to medium grained, brown, moist, very loose to medium dense	2
	2	SS			4
		HSA			
	3	SS			7
		HSA			
	4	SS			8
		HSA			
10.0 / 88.3	5	SS			6
		HSA			
	6	SS		*silt lenses at 12 feet	7
		HSA			
	7	SS			8
			16.0	Boring then Backfilled with Bentonite Chips End of Boring	
20.0 / 78.3					

WATER LEVEL	*THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.*
NE WD	

WATER LEVEL	BORING STARTED	BORING COMPLETED
	11/14/25	**11/14/25**

WATER LEVEL	CAVE IN LEVEL	

SPT HAMMER	RIG	CREW CHIEF
Autohammer	**7822DT**	**CH**

ABBREVIATIONS: ACR-After Casing Removal, BCR-Before Casing Removal, AB-After Boring, WD-While Drilling, WS-While Sampling, NE-None Encountered, DB-Diamond Bit, HSA-Hollow Stem Auger, RB-Rock Bit, SS-Split Spoon, ST-Shelby Tube, PA-Power Auger, MR-Mud Rotary, CS-Continuous, RP-Rock Probe, PH-Percussion Hammer, WL-Water Level, WOH-Weight of Hammer, EIL-Exceeds Instrument Level, TS-Topsoil, PP-Pocket Penetrometer

BOREHOLE LOG 25G2116 BRULE PUBLIC WORKS.GPJ TWINPORT.GDT 12/5/25

TwinPortsTesting

B-8

BORING LOG

PROJECT:	CLIENT:	TPT Project No.:
Town of Brule Public Works Garage	**DSGW Architecture**	**25G2116**

ARCHITECT - ENGINEER:	SITE LOCATION:
DSGW Architecture	**Brule, Wisconsin**

BORING LOCATION:	REPORT DATE:
See Boring Location Map	**11/14/25**

SURFACE ELEVATION: **100.4 ft**

UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) 1 2 3 4 5
PERCENT PASSING #200 SIEVE 10 20 30 40 50
PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50
STANDARD PENETRATION TEST N-VALUE 10 20 30 40 50

DEPTH (ft) / ELEVATION (ft)	SAMPLE NO.	SAMPLE TYPE	STRATA CHANGE DEPTH	DESCRIPTION OF MATERIAL	N-VALUE
0.0 / 100.4				(TOPSOIL) Silty Sand, trace roots and fibers, fine to medium grained, dark brown, moist	
	1	SS	0.5	(SM) SILTY SAND, trace gravel, trace roots and fibers, fine to medium grained, brown, moist, very loose to loose	1
	2	SS			2
		HSA			
	3	SS			2
		HSA		not roots and fibers	
	4	SS			7
		HSA			
10.0 / 90.4			9.0	(SP-SM) POORLY GRADED SAND with Silt, fine to medium grained, light brown, moist, loose	
	5	SS			7
		HSA		*trace silt lenses	
	6	SS			5
		HSA			
	7	SS			6
			16.0	Boring then Backfilled with Bentonite Chips End of Boring	
20.0 / 80.4					

WATER LEVEL		
NE WD	*THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.*	
WATER LEVEL	BORING STARTED **11/14/25**	BORING COMPLETED **11/14/25**
WATER LEVEL	CAVE IN LEVEL	
SPT HAMMER **Autohammer**	RIG **7822DT**	CREW CHIEF **CH**

ABBREVIATIONS: ACR-After Casing Removal, BCR-Before Casing Removal, AB-After Boring, WD-While Drilling, WS-While Sampling, NE-None Encountered, DB-Diamond Bit, HSA-Hollow Stem Auger, RB-Rock Bit, SS-Split Spoon, ST-Shelby Tube, PA-Power Auger, MR-Mud Rotary, CS-Continuous, RP-Rock Probe, PH-Percussion Hammer, WL-Water Level, WOH-Weight of Hammer, EIL-Exceeds Instrument Level, TS-Topsoil, PP-Pocket Penetrometer

BOREHOLE LOG 25G2116 BRULE PUBLIC WORKS.GPJ TWINPORT.GDT 12/5/25

Twin Ports Testing Inc.

BORING LOG NOTES

Water Level

Water levels indicated on the boring logs are as measured at stated times. In clean sand soils, the elevations indicated are considered relatively reliable levels. However, in less permeable soils, even after several days of monitoring, accurate determinations may not be possible. Therefore, additional/alternative methods of groundwater elevation monitoring should be sought.

Commonly Used Moisture Conditions of Soils

Term	Meaning
Dry	Requires the addition of considerable moisture to attain optimum for compaction
Moist	Near optimum moisture for compaction
Wet	Requires drying to attain optimum moisture for compaction
Waterbearing	Saturated granular soils

Gradation Description and Terminology

Soil Type	Particle Name	Size Range
Coarse Grained Soils	Boulders	Over 12”
	Cobbles	3”-12”
	Gravels	#4-3”
	Gravels – Coarse	¾”-3”
	Gravels – Fine	#4-¾”
	Sands	#200-#4
	Sands – Coarse	#10-#4
	Sands – Medium	#40-#10
	Sands – Fine	#200-#40
Fine Grained Soils	Silt	0.005 mm-#200
	Clay	Less than 0.005 mm

Descriptive Terms of Components Present in Sample (other than ASTM D 2487)

Term	Percent of Dry Weight
Trace	1-5%
With	5-12%
Some	12-30%
And	30-50%

Relative Density of Granular Soils

N-Value (SPT)	Relative Density	Standard “N” Penetration
0-4	Very Loose	Blows per foot of a 140 pound hammer
5-10	Loose	falling 30” on a 2” outside diameter
11-30	Medium Dense	split barrel sampler
31-50	Dense	
Over 50	Very Dense	

Consistency of Cohesive Soils

N-Value (SPT)	Consistency	(Q, tsf or kg/cm^2)
0-2	Very Soft	Less than 0.25
3-4	Soft	0.25-0.50
5-8	Medium	0.50-1.00
9-15	Stiff	1.00-2.00
16-30	Very Stiff	2.00-4.00
Over 30	Hard	4.00-8.00

Twin Ports Testing Inc.

UNIFIED SOIL CLASSIFICATION SYSTEM – ASTM D 2487

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

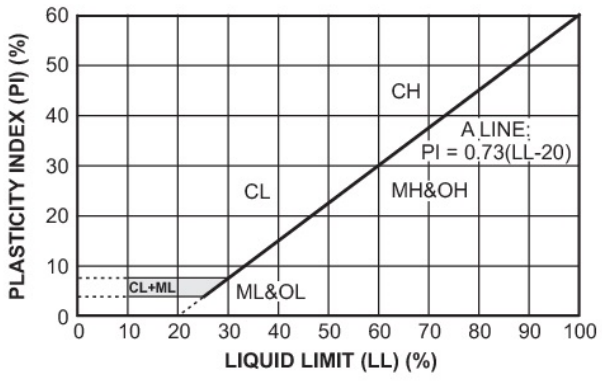
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



SECTION 00 40 00

BID FORMS - INSTRUCTIONS

Loose copies or photocopies of the bid form following this Section shall be used by the bidder in submitting his bid (do not remove the attached forms from this document).

The Bidder shall complete all the following items or the bid may be rejected. (See Sections 00 21 13 and 00 22 13 for additional requirements).

1. Date the Bid.
2. Clearly state the amount of the Base Bid in Written and Numerical Form.
3. Acknowledge receipt of all Addenda.
4. Complete any remaining required items.
5. Sign and indicate current mailing address, telephone and telefax numbers.
6. Include all required prevailing wage rates as related to section 00 22 13 & 00 73 00.
7. Include number of days of construction (schedule).

END OF SECTION

SECTION 00 41 00

BID FORM

THE PROJECT AND THE PARTIES

1.01 TO:

A. Brule Public Works Garage
Brule, WI

1.02 FOR:

A. BRULE PUBLIC WORKS GARAGE

1.03 DATE: _____ (Bidder to enter date)

1.04 SUBMITTED BY: (Bidder to enter name and address)

A. Bidder's Full Name_____

1. Address _____
2. City, State, Zip_____
3. Contact_____
4. Phone_____
5. Email_____

1.05 BASE BID

A. Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by DSGW Architects for the above-mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

_____ dollars

($_____), in lawful money of the United States of America.

1.06 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for thirty days from the bid closing date.

B. If this bid is accepted by Owner within the time period stated above, we will:
1. Execute the Agreement within ten days of receipt of Notice of Award.
2. Furnish the required bonds within ten days of receipt of Notice of Award.
3. Commence work within seven days after written Notice to Proceed of this bid.

1.07 CONTRACT TIME

A. Bidder agrees to commence the work after a "Notice to Proceed" has been issued by the Owner.

B. Contractor to finish the work in ____ weeks.

1.08 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.
   1. Addendum # _____ Dated _____.
   2. Addendum # _____ Dated _____.
   3. Addendum # _____ Dated _____.

1.09 OWNER'S RIGHT TO REJECT

A. In submitting this Bid, the Bidder understands that the right is reserved by the Owner to reject any and all Bids, and to waive any informalities and irregularities in the Bids received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

1.10 OWNER'S REQUIREMENTS

A. In submitting this Bid, the Bidder must include all information related to Fond du Lac tribal requirements included in section 00 73 00.

1.11 BID SECURITY

A. Enclosed herewith is a certified check_____, cashier's check_____, bidder's bond_____, (check one), in the amount of: $_____ _____Dollars ($_____), being at least 5% of the amount of the proposal, made payable to the Owner as a proposal guarantee which it is agreed by the undersigned will be forfeited to the Owner as Liquidated Damage in the event I (we) fail to enter into a Contract or fail to furnish the required Performance and Payment Bonds within ten (10) days after received Notice of Award and acceptance of this Bid by the Owner.

B. *If base bid is less than $500,000, leave this section blank.*

1.12 BID FORM SIGNATURE(S)

A. The Corporate Seal of

_____
(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____
(Authorized signing officer, Title)
(Seal)

_____
(Authorized signing officer, Title)

END OF BID FORM

SECTION 00 43 25
REQUEST FOR APPROVAL OF SUBSTITUTION

Damberg Scott Gerzina Wagner Architects, Inc.

DATE:_____

BRULE PUBLIC WORKS GARAGE
DSGW PROJECT NO.: 25170.00

BID DATE:_____

We hereby submit for your consideration the following product to replace the specified item for the above project.

SECTION	**LINE NO.**	**SPECIFIED ITEM**
_____	_____	_____

Proposed Substitution:_____

[ ] Complete technical data, including laboratory tests, if applicable, is attached (include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its installation).

Does the substitution affect dimensions shown on Drawings? [ ] Yes [ ] No

If Yes Describe:_____

Will the undersigned pay for changes to the building design, including Engineering and detailing costs caused by the requested substitution? [ ] Yes [ ] No

Does substitution affect other trades? [ ] Yes [ ] No

If Yes Describe:_____

Does substitution impact construction schedule? [ ] Yes [ ] No

If Yes Describe:_____

Manufacturer's guarantees of the proposed and specified items are different? [ ] Yes [ ] No
(Explain on attachment)

Submitted By:

_____
Signature

_____
Firm

_____
Address

Date:_____

Telephone:_____

Email Address:_____

*Written response will be made if stamped self-addressed envelope is submitted with this request.

RESPONSE OF ARCHITECT*

[ ] Request is approved subject to compliance with the Specification and an Addendum will be issued.

[ ] Approval cannot be granted because this request did not reach this office within the specified time.

[ ] Approval cannot be granted at this time.

[ ] Prior Approval for this substitution is not required by the Specification

By:_____
Signature

Date:_____

END OF SECTION

SECTION 00 72 00

GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 THE GENERAL CONDITIONS APPLICABLE TO THIS CONTRACT IS INCLUDED BY REFERENCE. A COPY OF THE GENERAL CONDITIONS IS ON FILE AT THE OFFICE OF THE ARCHITECT FOR THOSE WISHING TO VIEW IT.

RELATED REQUIREMENTS

2.01 AIA DOCUMENT A201, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, 2017 EDITION, IS THE GENERAL CONDITIONS BETWEEN THE OWNER AND CONTRACTOR.

SUPPLEMENTARY CONDITIONS

3.01 REFER TO DOCUMENT 00 73 00 - SUPPLEMENTARY CONDITIONS FOR AMENDMENTS TO THESE GENERAL CONDITIONS.

END OF SECTION

SECTION 00 73 00

SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

1.02 THESE SUPPLEMENTARY CONDITIONS AMEND AND SUPPLEMENT THE GENERAL CONDITIONS DEFINED IN DOCUMENT 00 72 00 - GENERAL CONDITIONS AND OTHER PROVISIONS OF THE CONTRACT DOCUMENTS AS INDICATED BELOW. PROVISIONS THAT ARE NOT SO AMENDED OR SUPPLEMENTED REMAIN IN FULL FORCE AND EFFECT.

1.03 THE TERMS USED IN THESE SUPPLEMENTARY CONDITIONS THAT ARE DEFINED IN THE GENERAL CONDITIONS HAVE THE MEANINGS ASSIGNED TO THEM IN THE GENERAL CONDITIONS.

1.04 MODIFICATIONS TO GENERAL CONDITIONS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

MODIFICATIONS TO AIA A201

4.01 ARTICLE 1.1.1 - THE CONTRACT DOCUMENTS

A. Add the following sentence to the end of Subparagraph 1.1.1:
   1. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

4.02 ARTICLE 1.2 - CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

A. Add the following Subparagraph 1.2.4 to Paragraph 1.2:

B. 1.2.4: If there is an inconsistency in the quality or quantity of Work required by the Contract Documents, the greater quality or quantity of Work indicated shall be provided in accordance with the Architect's interpretation, and no change in the Contract Sum will be permitted.

4.03 ARTICLE 1.5 - OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

A. Add the following Subparagraph 1.5.3 to Paragraph 1.5:
   1. 1.5.3 Contractor's Use of Instruments of Service in Electronic Form.
   2. 1.5.3.1The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.
   3. 1.5.3.2The Contractor shall not transfer or reuse instruments of Service in electronic or machine readable form without prior written consent of the Architect.

4.04 ARTICLE 4.2 - ARCHITECTS ADMINISTRATION OF THE CONTRACT

A. Add clause 4.2.2.1 to Subparagraph 4.2.2:
   1. 4.2.2.1The Contractor shall reimburse the Owner for compensation to the Architect for additional site visits made necessary by the fault, neglect or request of the Contractor.

4.05 ARTICLE 11.1 – CONTRACTOR’S INSURANCE AND BONDS

A. ADD the following Subparagraphs to 11.1.2:

B. Add the following Clauses 11.1.2.2 through 11.1.2.2.3 to Subparagraph 11.1.2:
   1. 11.1.2.2: The limits for Worker's Compensation and Employers' Liability insurance shall meet statutory limits mandated by State and Federal Laws. If (1) limits in excess of those required by statute are to be provided or (2) the employer is not statutorily bound to obtain such insurance coverage or (3) additional coverages are required, additional coverages and limits for such insurance shall be as follows:

2. 11.1.2.2.1: The limits for Commercial General Liability insurance including coverage for Premises-Operations, Independent Contractors' Protective, Products -Completed Operations, Contractual Liability, Personal Injury and Broad Form Property Damage (including coverage for Explosion, Collapse, and Underground Hazards) shall be as follows:
    a. $1,000,000 Each Occurrence
    b. $1,000,000 General Aggregate
    c. $1,000,000 Personal and Advertising Injury
    d. $1,000,000 Products-Completed Operations Aggregate
        .1: The policy shall be endorsed to have the General Aggregate apply to this Project only.
        .2: The Contractual Liability Insurance shall include coverage sufficient to meet the obligations in AIA Document A201-2017.
        .3: Products and Completed Operations Insurance shall be maintained for a period of at least (1) year(s) after either 90 days following Substantial Completion or final payment whichever is earlier.
3. 11.1.2.2.2: Automobile Liability insurance (owned, non-owned and hired vehicles) for bodily injury and property damage shall be as follows:
    a. $1,000,000 Each Accident
4. 11.1.2.2.3: Umbrella or Excess Liability coverage shall be as follows:
    a. $1,000,000 Each Occurrence

4.06 ARTICLE 11.1.3 - CONTRACTORS LIABILITY INSURANCE

A. Add the following sentence to Subparagraph 11.1.3:
1. If this insurance is written on a Commercial General Liability policy form, the certificates shall be ACORD form 25-S, completed and supplemented in accordance with AIA Document G715, Instruction Sheet and Supplemental Attachment for ACORD Certificate of Insurance 25-S.

4.07. ADDITIONAL LAWS AND REGULATIONS

A. The Bidder's attention is directed to the fact that all applicable State laws, County and municipal ordinances and the Rules and Regulations of all authorities having jurisdiction over the construction of the project shall apply to the contract throughout and they will be deemed to be included in the Contract the same as though written.

B. The bidders shall account for most recent edition of Prevailing Wage Rates set forth by the State of Wisconsin – Douglas County.
1. https://dwd.wisconsin.gov/er/laborstandards/prevailingwage/

C. The bidders shall account for most recent edition of Prevailing Wage Rates set forth by the U.S. Department of Labor.

D. Project is Tax-Exempt.

END OF SECTION

SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Brule Public Works Garage

B. Owner: City of Brule

C. Architect's Name: DSGW Architecture
   1. 2 West First Street, Suite 201
   2. Duluth, MN 55802
   3. Phone: 218-727-2626

D. Structural Engineer: Northland Consulting Engineers L.L.P.
   1. 102 South 21st Avenue West, Suite 1
   2. Duluth, MN 55806
   3. Phone: 218-727-5995

E. Civil/Mechanical/Electrical Engineer: Windsor Engineers
   1. 4802 Oneota St – Suite 2
   2. Duluth, MN 55807
   3. Phone: 612-389-1658

F. The Project consists of a new commercial transportation garage building for the City of Brule in Brule, Wisconsin. The work includes construction of a Pre-Engineered Metal Building. Construction includes but is not limited to: foundation work for structure, concrete, minimum steel/metals work, carpentry/woods/plastics and composites, thermal properties, openings, finishes, specialties, furnishings, mechanical, electrical, plumbing, and civil work. See drawings and specifications herein. Coordinated work to be in compliance with most recent prevailing wage rates and the requirements of the State of WI building code requirements. Project is Tax-exempt.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in the drawings and specifications.

B. These Specifications with the accompanying Drawings are intended to describe and illustrate all work necessary to carry out the work of the project listed.
   1. Provide labor, materials articles, equipment, incidentals, items, tools, services, supplies, methods, operations, skills in such quantities as may be necessary to complete Project within the intent of the Contract Documents. Singular notations shall be considered plural where plural application is reasonably inferable. Mention or indication of extent of work under any work Division or Specification Section is done only for convenience of Contractor and shall not be construed as describing all work required under that Division or Section.
   2. Drawings: The List of Drawing Sheets is included in Section 00 01 15. Contractors and all Subcontractors shall be bound by the information and requirements provided by the complete set of Drawings. Individual Detail Sheets shall be considered with and as a part of the Drawings and the overall Contract Documents.
   3. The Divisions and Sections of the Technical Specifications primarily apply to the various trade divisions, but Contractor and all Subcontractors shall be bound to the information and requirements of the complete set of Specifications.
   4. Other Requirements: The requirements of all Sections of Divisions 00 and 01 apply to and shall govern the Contractor and all Subcontractors for this Project. Supplementary General Conditions and all Sections Division 01 shall govern Work of all technical Sections. Where provisions and requirements are referred to as the responsibility of the Contractor or a particular Subcontractor, he shall have the primary responsibility to accomplish, provide, assume, and enforce, but the Contractor and all Subcontractors shall be governed by the requirements and cooperate fully in fulfilling the requirements.

5. Examination of Site and Documents: In submitting a bid and in accepting a Contract award, the Contractor represents he has examined the site, existing conditions as well as the entire set of documents, in accordance with the General Conditions and agrees to be bound by all conditions of the site, existing conditions, and all documents, without additional cost.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is shown on drawings and specified in Section 02 41 00. Design intent is to match that of existing conditions/systems.

1.04 WORK BY OWNER

A. Refer also to document 00 72 00, General Conditions, Article 6.1.

B. The Owner reserves the right to let other contracts in connection with this Project. This Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and execution of their work, and shall properly connect and coordinate his work with theirs.

C. The Owner reserves the right to jointly occupy the premises with the Contractor in the performance of his duties and functions. The Owner also reserves the right to: enter into the Project and premises at all times; make installations of materials and equipment at appropriate times as the Work progresses; install equipment, furniture, and furnishings when spaces are at appropriate stages of completion. Contractor shall coordinate work with the Owner and cooperate with the Owner to minimize undue interferences.

D. If any part, unit, phase, or the entire Project is substantially complete or ready for occupancy, the Owner may, upon notice to the Contractor, and without prejudice to any of the rights of the Owner or Contractors, enter into and make use of the Work that is substantially complete.

1.05 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Do not infringe on areas outside of the established construction limits indicated on Drawings or designated by the Owner without permission of the Owner. Arrange temporary easements which may be required for construction operations, maintain safety precautions, and return to original conditions upon completion of the Contract. The Owner may caution Contractor about conditions which they observe, but shall not be held responsible to provide such advice or for enforcing any protection.

B. Contractors and all other persons connected with this project shall only use parking areas approved.

C. Contractors shall use and maintain in clean condition site access route as designated. No other access shall be used for vehicles or men.

D. Move any stored products which interfere with operations of Owner or other Contractors.

E. Do not load structures with weights which will endanger the structure.

F. Maintain site in safe condition and keep free of construction materials and debris.

G. Maintain fire protection and access at all times. Permit immediate access by firefighting equipment.

H. Hazardous Protection: Warning signals, barricades and other protective measures for hazard shall be in place or operate 24 hours per day.

I. The Contractor shall do all patching of existing property on or adjacent to the site, including but not limited to: walks, pavements, roadways, structures, and utilities which are cut or damaged by construction and are not designated for removal, relocation or replacement in the course of the construction.

J. Work occurring on public property shall be constructed in accordance with all laws, ordinances, rules, regulations and orders of any public authority having jurisdiction.

K. Site Management Requirements:
   1. The Prime Contractor shall coordinate all work on site with the Owner and Architect.
   2. General: Upon commencement of the Work at the site, the Prime Contractor shall assume the site management at areas within construction limits as agreed to by the Owner and Contractor, other areas where work is to be performed and adjacent storage areas, to provide proper direction to all contractors, subcontractors and workmen. Site management shall be coordinated with the Owner and shall include maintaining areas as specified and required to be free of construction activity, parking and storage where it is necessary to provide clear access and areas for the Owner's functions.
   3. Responsibilities: Site management and maintenance shall include, but not be limited to: enforcement of access, parking, delivery, storage, noise and other restrictions; maintenance of fences in good condition; providing and maintaining temporary facilities as specified; dewatering the excavations, except water in trenches and excavations made by subcontractors solely for their own work; protection of adjacent structures as may be damaged caused by water; overall fire and safety management; protection for site features to remain; temporary partitions, closures, dust barriers and similar to separate work areas in existing building spaces; and similar overall or general management of the site and adjacent public and other property to fulfill the obligations of this Contract.
   4. Fencing: Not applicable.
   5. Use of Streets: Where the conduct of the work requires the obstruction or use of a roadway or parking lot, it shall be the responsibility of the respective Contractor to secure all necessary permission from the Owner. Contractors shall be responsible for the protection of the public in the vicinity of the work and nothing in these specifications shall be construed to relieve him of said responsibility. Protective devices shall conform to the requirements of the Highway Department having jurisdiction and/or the proper public authorities and shall be installed as required by the Owner.

L. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

1.07 WORK SEQUENCE

A. Schedule Information:
   1. The Notice to Proceed will not be issued until Owner and Architect have reviewed and approved all bidding information.

B. Begin work when scheduled by general contractor to achieve substantial completion as scheduled to prevent delay in the work by others.

C. Deviations in the schedule must be authorized by the architect and owner.

D. Time Set by Schedule: Where the constraints, completion and timing of Work specified in this or other Sections do not have specific dates or time imposed by the Contract Documents, they shall be considered and incorporated as established dates in the final Construction Schedule of the Prime Contractor. Where the activity affects the Owner, the time or dates established in the construction schedule shall be maintained, as the Owner will plan his activities accordingly.

E. Other Considerations: In addition to the time of commencement, substantial completion and final completion dates, all other events, fasteners, and constraints shall be carefully considered in establishing the work program and schedule of the Project. The Contractor and subcontractors shall work closely in timing of operations and shall have materials, equipment and other elements ready to be able to immediately fulfill their obligations in the overall schedule.

F. Final Completion: Within 10 days after substantial completion.

G. Time of Completion:
   1. The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will ensure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.
   2. Delays and Extension of Time: All time limits stated in the Contract Documents are of the essence of the Contract. The Contractor may be granted an extension of time and/or relief of Liquidated Damages because of causes beyond the Contractor's control which constitute a justifiable delay. The Owner will extend the time subject to the following provisions:
      a. Claims for extension of time shall be made per Article 8 of the GENERAL CONDITIONS.
      b. Written notice of the delay, an explanation of the cause and an estimate of the length of delay shall be forwarded to the Architect within five days of the beginning of such delay.
      c. Claims for extension of time shall be stated in numbers of whole calendar days. The actual dates on which the delay(s) occurred must be stated. In the case of claims for extension of time because unusual inclement weather prevented the execution of major items of the Work on normal working days, calendar days shall be computed by multiplying normal work days (five days per week) by a factor of 1.4. Contractor must provide documentation of all weather related delays and claims for the extension will be allowed only if the weather is distinctly out of line with the ten year average.
      d. Any claim for extension of time for strikes or lockouts shall be supported by a situation of facts concerning the strike, including but not limited to, the dates, the craft concerned, and the reason for the strike, efforts to resolve the dispute, and efforts to minimize the impact of the strike in progress.
      e. Any claims for extension of time for delays in transportation or for failure of suppliers shall be supported by a citation of facts demonstrating that the delays are beyond the Contractor's control, including, but not limited to, his efforts to overcome such delays.
      f. The time extensions for changes in the Work will depend upon the extent, if any, by which the changes cause delay in the completion of various elements of construction.
      g. A Change Order granting the time extension may provide that the Contract Completion Date will be extended only for those specific elements so delayed and that the remaining work will not be altered. Further, the amended completion date shall be of essence to this contract and shall be subject to the same conditions as the original completion time.
   3. Project Schedule:
      a. General: The General Contractor shall prepare the Final Contractors Construction Schedule for the Work. The location and nature of the Project, the requirement to maintain the operation, functions, and services of the Owner dictates careful planning, scheduling and close cooperation between the Contractor, subcontractors and the Owner. The Contractor shall keep the Owner advised of his intended operations and schedule and be guided by other constraints or timing of work that may develop during construction. It is the intent of the Owner to cooperate as far as possible to minimize hampering of operations and the Contractor may suggest schedules and timing which will facilitate progress.
      b. Within ten work days after award of the Contract, prepare, submit and review with the Owner and Architect a detailed schedule addressing work activities and estimate duration of the activities. This schedule shall be prepared in such detail and form as the Architect may require and will be subject to the Approval of the Architect and Owner.

c. In general, the schedule shall indicate the various phases of work coordinated and integrated time-wise with the other work. The schedule shall also indicate the various activities of each of the areas, stages, and phases of work, with integrated and coordinated commencement and completion times. After review by the Owner, including any revised sequencing proposed by the Contractor or Owner to improve the progress or minimize the disruption of the Owner's functions, the Contractor shall revise the schedule as the "final" schedule, which will provide the planning information for the Owner's relocation and other operations.
d. Submit schedule updates and Material Status Report updates with applications of payments as requested by the Architect.
e. Furnish manpower staffing information as requested by the Owner or Architect.
f. Coordinate the letting of subcontracts, material purchases, shop drawings submissions, delivery of materials, sequence of operations, etc., to conform to the Project Schedule and furnish proof of same as may be required by the Architect.
g. Revise and periodically update the Project Schedule as necessary to conform to the current status of the project and furnish copies to the Owner, Architect, and subcontractors.

4. Commencement of Work:
   a. No Contractor shall commence Work nor allow any Subcontractor or Sub-subcontractor to commence the Work until:
      1) The Contract has been fully executed; and the Owner, has issued a Notice to Proceed.
      2) The Owner has approved evidence of the Contractor's Liability Insurance and any other insurance required to be purchased by the Contractor.
5. Performance/Payment Bond: Required
6. Other Bonds, Permits, Fees:
   a. The GENERAL CONTRACTOR shall secure and pay the cost of the building permit for the Project. Included will be the building permit fees, plan check fees, State surcharge, and other fees customarily charged for the building permit.
   b. The GENERAL CONTRACTOR shall secure and pay any additional costs for the Certificate of Occupancy for the Project.
   c. Each CONTRACTOR OR SUBCONTRACTORS shall secure and pay for all other bonds, permits, governmental fees, license and inspections required necessary for the proper execution and completion of this work.
7. Layout of the Work:
   a. The PRIME CONTRACTOR shall be responsible for and shall assist Subcontractors and Prime Trade Contractors in the location of walls, partitions, columns, beams, floors, ceilings, and openings therein where their work must be located and placed prior to the erection of these items.
   b. The Contractor and/or Subcontractor is responsible for the accuracy with respect to layout of their work. Immediately report any perceived discrepancies or errors in the Drawings to the Architect and make adjustments in accordance with instructions given by the Architect.
   c. The contractor and subcontractor shall recognize that the drawings necessarily are diagrammatic in many instances. All work and in particular exposed piping, ducts, conduit and similar items shall be neatly and carefully laid out to provide the most useful space utilization and the most orderly appearance. Piping and similar work shall be installed as close to ceilings and walls as conditions permit, located to prevent interference with other work or with the use of the spaces in the manner required by the functions of the room and staff. Valves shall be located in inconspicuous but accessible places. Before proceeding with any work, particularly where exposed, the Contractor shall carefully plan the layout and review it with the Architect for acceptability of location.
8. Openings, Blocking, Backing and Grounds:
   a. Each Trade Contractor shall be responsible for providing backing and grounds in all walls and above ceilings necessary for the installation of all contracted work.

b. Make suitable preparations for the hangers, inserts, anchors, grounds and supports that are to be embedded in concrete, masonry walls, floors, partitions or structural members, or that are to pass through or be attached thereto. Provide and install proper sleeves, boxes, receptacles or chases for all openings or recesses to receive work occurring in or passing through any such members, all of which shall be located accurately and secured firmly in place before any such masonry has been erected, concrete poured or walls/ceilings enclosed.

9. Field Dimensions: The need to obtain accurate file dimensions in ample time to permit fabrication of materials and equipment, for delivery and installation in accordance with the schedule, shall be recognized. Each Contractor and all subcontractors shall cooperate in completing work phases to accommodate the schedule for obtaining dimensions and to prevent fabrication delay. In the event it is impractical to have work in place to permit field dimensions, the Contractor shall guarantee necessary dimensions, before construction, to the various fabricators and be responsible to ensure the dimensions.
10. Reference to Standards and Codes:
    a. Notice of Variance: If a Contractor observes that the drawings and specifications are at variance with any applicable code or regulation of a governmental unit having authority, he shall promptly notify the Architect in writing, and any necessary changes shall be adjusted as provided in the Contract for Changes in the Work. If a Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Architect, he shall bear all costs and damages arising therefrom.
    b. Reference Standards: For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes and other standards.
    c. Effect of Standards: The standards referred to, such as ASTM, Federal Specifications, NFPA and similar standards, shall have full force and effect as though printed in the Specifications, except as modified in the Specification. These standards are not furnished to bidders and Contractors as it is assumed that these standards are readily available and that the manufacturers and trades involved are familiar with their requirements.
    d. Date of Standard: Any material specified by reference to the number, symbol or title of a specific standard, such as ASTM, Commercial Standard, a Federal Specification, a trade association standard, or other similar standard, shall comply with the requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the Contract Documents, unless otherwise noted.
    e. Certificate: For products specified in accordance with a Federal Specification, ASTM Standard, American National Standards Institute or similar association standards, upon request the Contractor shall provide an acceptable affidavit by independent testing laboratory or other source approved by the Architect, certifying that product furnished for this Project complies with the particular standard specifications. Where necessary, requested or specified, supporting test data shall be submit to substantiate compliance. The manufacturer is subject to Architect's acceptance.
11. Coordination Requirements:
    a. General: The nature of the Project makes it imperative the Contractor and all subcontractors and prime trade contractors coordinate their work and cooperate with each other and the Owner from the start of the Project to completion. PRIME CONTRACTOR shall be the Prime Coordinator for the Project and shall establish the overall schedule for the progress of the Project, the sequence of completion and general use of the site.
    b. Off-Site Fabrication: With the restricted site, off site fabrication is encouraged as much as possible and schedule of deliveries so materials and equipment can be installed immediately after delivery. The Project Coordination Administrator shall alert and advise subcontractors and suppliers of the need to hold deliveries until they are notified the materials are required on the site.

c. Equipment: With respect to mechanical and electrical features of equipment, complete data must be exchanged directly between the Contractors and subcontractors involved as the progress of the Project requires. The person requesting the information shall advise when it will be required. The suppliers of equipment are expressly required to provide large scale layout drawings showing the required rough-in locations of all services (dimensioned from building features) service characteristics. In the event of incorrect, incomplete, delayed or improperly identified information, the party causing the delay or error shall be responsible and pay for any modifications or replacements necessary to provide a correct, proper and new installation, including relocations required.

1.08 GENERAL PROTECTION AND SAFETY

A. General: In accordance with best construction practices, the Prime Contractor shall be responsible for conditions of the job site, including safety of all persons and property affected directly or indirectly by his operations during the performance of the Work. This requirement shall apply continuously 24 hours per day until acceptance of the Work by the Owner and shall not be limited to normal working hours.

1.09 PHOTOGRAPHS / PRESS RELEASES

A. Do not take, or cause any photographs to be taken at the job site without prior approval of the Owner / Architect.

B. Do not issue any press releases or disseminate information concerning the project to the news media without prior approval of the Owner / Architect.

1.10 WORKING HOURS

A. This project shall be scheduled by the Prime Contractor to operate on a 5-day, 40-hour per week basis. Contractors employing trades who work other than the above hours must provide for coordination of their work as it relates to the work of other trades which work the above hours at no additional cost to the Owner. This schedule may be changed or modified with the approval of the Owner / Architect.

1.11 HAZARDOUS MATERIAL REMOVAL

A. If during the construction of the Project hazardous material is suspected or encountered by the Contractor, the Contractor shall promptly notify the Architect and the Owner, with their own forces or by separate contract, shall be responsible for complete removal and disposition of the hazardous material.

B. If the Contractor claims that delay and additional cost is involved because of this action, they shall make claim as provided elsewhere in the Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

1.02 RELATED REQUIREMENTS

A. Document 00 72 00 - General Conditions and Document 00 73 00 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.

1.03 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values in triplicate within 15 days after date of Owner-Contractor Agreement.

D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization and bonds and insurance.

E. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

F. Include within each line item, a direct proportional amount of Contractor's overhead and profit.

G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Execute certification by signature of authorized officer.

E. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.

F. Round off all figures on all progress payments to the nearest dollar, any adjustment required shall be made on the final application for payment.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

H. Submit three copies of each Application for Payment. Upon review and approval, the Architect will sign and forward three (3) copies to the Owner with their recommendations.

I. Include the following with the application:
   1. Affidavits attesting to off-site stored products.
      a. No payment will be made to a contractor on account of materials and equipment in transit or stored at off site locations unless prior approval is received from the Owner and Architect. Proof of proper insurance must be submitted for materials stored of site before approval will be considered.

2. Lien Waivers: Will be required for each payment request by each Contractor and Subcontractor. First lien waivers to be submitted with Payment Request No. 2 covering payment for Payment Request No. 1. They shall then continue with subsequent payment requests covering the preceding payment.
    a. With submission of the final payment request, or upon request for reduction of retainage, the Contractor shall provide lien waivers from all subcontractors and suppliers covering all dollar amounts for which a lien waiver has not yet been submitted.
3. Payroll Records: Will be required for each pay request by each Contractor and Subcontractor carrying out work on the site. Each application for payment submitted shall be accompanied by payroll records current to within twenty-one (21) days of the date of the application.
    a. Final payment to a contractor will not be made until payroll records are submitted covering completed project.

J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 RETAINAGE

A. To ensure the proper performance of the Contract, the Owner will retain FIVE PERCENT of the amount of each Certificate for Payment issued by the Architect. Such amount will be retained by the Owner until Substantial Completion. At substantial completion the withholding amount will be reduced to Two Percent.

B. In event of a very minor amount of work, incomplete or not corrected due to weather, unsuitable conditions for testing or similar conditions preventing the General Contractor from proceeding, the retained amount may be reduced to three times the value of the incomplete work upon recommendation of the Architect and approved by the Owner.

1.06 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
    1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
    2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
    1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
    2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
    3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

F. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Percentages allowed for Overhead and Profit shall be as listed in the Supplementary General Conditions, Section 00 73 00.

H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.07 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Coordination drawings.

E. Submittals for review, information, and project closeout.

F. Number of copies of submittals.

G. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Document 00 72 00 - General Conditions: Dates for applications for payment.

B. Document 00 73 00 - Supplementary Conditions: Duties of the General Contractor.

C. Section 01 10 00 - Summary: Stages of the Work, Work covered by each contract, occupancy.

D. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

E. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 PROJECT COORDINATION

A. Project Coordinator: General Contractor.

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner- Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract and Architect.
   6. Designation of personnel representing the parties to Contract, General Contractor, Major Subcontractors, Owner and Architect.
   7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   8. Rules and regulations governing performance of Work.
   9. Procedures for safety and first aid, security, quality control housekeeping, and other related matters.
   10. Scheduling.
   11. Any additional Owner or Architect/Engineer requirements.

D. Record minutes and distribute electronic copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to Work.

E. Record minutes and distribute electronic copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PRE-INSTALLATION CONFERENCES

A. When required in individual specification section, the Architect shall convene a pre-installation conference at work site prior to commencing work of the Section. When possible this shall be scheduled to coincide with a regular progress meeting.

B. Attendance will be required by all parties directly affecting, or affected by, work of the specific Section.

C. Notify all parties seven days in advance of meeting date.

D. The Architect shall, preside at conference, record minutes, and distribute copies to all participants.

E. Review conditions of installation, preparation and installation procedures, and coordination with related work.

3.04 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.05 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. Allow for at least two weeks review of submittals to avoid delay of work.

E. Include with submittal preparation, field construction criteria, verification of catalog numbers and similar data, and coordination of Work requirements and Contract Documents.

F. Make all submittals to the Architect through the project coordination administrator unless specified otherwise.

G. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - CLOSEOUT SUBMITTALS.

3.06 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. No shop drawings of equipment brochures, cuts of fixtures, etc. Such copies of standard manufactured items in the form of manufacturer's catalog sheets showing sizes, dimensions, performance characteristics, capacities, clearances, wiring diagrams, and shall be furnished in electronically unless otherwise specified. Electronic copies will be stamped, and electronic copies will be returned to the Project Coordination Administrator for distribution to the subcontractor or supplier. If notations and marks indicate that revised information is required before shop fabrications (or other work represented) can proceed, revised or corrected information shall be submitted.

C. Unless otherwise specified, submit to the Architect two representative samples of size and nature representing typical qualities. Where required, submit a sufficient number of samples to demonstrate the complete range of variations of the material or quality. Written acceptance of the Architect is required prior to ordering any item for which samples are required.

D. Submit samples to Architect securely packaged, with the name of the Project clearly indicated on the package exterior. Firmly attach a label or tag to the sample, with the following information: a) Name of Project; b) Name of Supplier; 3) Name of Trade Contractor, and, d) Product information such as manufacturer's designation, finish, type, class, grade, etc., as is appropriate.

E. Erect field samples and mock-ups at the project site, unless otherwise specified in the Contract Documents, at a location acceptable to the Project Coordination Administrator, Architect and Owner.

F. Review of shop drawings, product data and samples by the Architect or his consultant does not relieve the Contractor, Subcontractor or Supplier of responsibility for compliance with the Contract Documents, confirming and correlating quantities and dimensions, selecting fabrication processes and techniques of construction, coordination of the work represented by each submittal with other trades, performing the work in a safe and satisfactory manner, compliance with the Project Schedule and all other provisions of the agreements.

G. The Architect's/Engineer's notation on the submittals is not an authorization for additional work or additional cost. If any notations represent a change to the Contract Sum, submit a cost proposal to the Architect, through the Project Coordination Administrator for the change in accordance with the procedures specified before proceeding with the work. Notify the Project Coordination Administrator by letter within five days of returned submittal. Resolve such issues before proceeding with the work.

H. The Contractor, Subcontractor or supplier shall not begin fabrication until all specified submittal procedures have been fulfilled.

I. In order to guarantee the delivery of materials for timely completion of the work, and to relieve the Contractor of direct responsibility in the event of materials shortages or transportation delays, the Supplier shall, within two (2) weeks after the receipt of Notice to Proceed, furnish to the Architect, confirmed orders showing the anticipated date of delivery to the site, for materials for all of the principle parts of the work and for such others as the Architect/Engineer or Owner may direct.

J. In addition to Warranty provisions of the General Conditions, provide all extended warranties, bonds and service contracts as required by individual specification sections.

K. Assemble and submit to the Architect warranties, bonds, and service and maintenance contracts as specified in the respective section of the Specifications. In conjunction with the submittals of Section 01 78 00, the table of contents for this submittal shall include the product of work item, the form, with the name of the principal, address and telephone number, scope, date of beginning of the warranty, bond or service maintenance contract, duration, information for the Owner's personnel providing the proper procedure in case of a failure and instances which might affect the validity of the warranty or bond.

L. The beginning date of the warranty will be the date that the project is substantially completed.

M. Reports of inspections, tests and approvals required by the Contract Documents shall be submitted to the Architect, through the Project Coordination Administrator, in the quantities indicated.

N. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.

3. Warranties.
4. Bonds.
5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

3.08 SUBMITTALS

A. Documents for Review:
1. Transmit electronic copies of each shop drawing to Project Coordination Administrator.
a. The Project Coordination Administrator shall generally review shop drawings for compliance with the Drawings and Specification.
b. Electronic copies of shop drawings individually stamped by Project Coordination Administrator will be sent to Architect for review.
2. Architect or their consultant will review all shop drawings and will return electronic copies to the Project Coordination Administrator stamped to indicate action taken.
a. The electronic copies of any shop drawings that are not satisfactory to the Architect or his consultant will be returned to the Project Coordination Administrator for necessary revision and resubmittal.
b. Electronic copies of shop drawings that do not require major revisions, will have corrections, if any, noted, and will be stamped to indicate Architect's action.

B. Documents for Information: Submit electronic copies.

C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES

A. Transmit each submittal with letter of transmittal.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Deliver submittals to Architect at business address.

F. Schedule submittals to expedite the Project, and coordinate submission of related items.

G. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

I. Provide space for Contractor and Architect review stamps.

J. When revised for resubmission, identify all changes made since previous submission.

K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

L. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Control of installation.

C. Tolerances.

D. Testing and inspection services.

E. Manufacturers' field services.

1.02 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008.

B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

E. ASTM E329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.

1.03 SUBMITTALS

A. Test Reports: After each test/inspection, promptly submit electronic copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

B. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

C. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

D. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

E. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Field offices.

1.02 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power and metering, consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.

B. Temporary Light and Power:
   1. Prime Contractor Responsibilities:
      a. The Prime Contractor shall coordinate temporary light and power during construction phases of the project.
      b. The Prime Contractor shall pay for all electrical energy used.
      c. Coordinate with the sitework contractor.
   2. Electrical Sub-Contractor responsibilities:
      a. Provide temporary ties into an existing panel/panels within the general proximity of the remodeling and new construction.
      b. Provide at least one 20 amp., 120 volt, temporary branch circuit with three grounding, duplex receptacles for each 7500 sq. ft. of floor area. Locate receptacles so that extension cords will not exceed 100 feet in length. The temporary branch circuits may be used for portable tools, portable lights and other small power loads.
      c. Provide at least one 200 watt incandescent lamp, or the equivalent lighting for each 625 sq. ft. of floor area with at least one light in each room. Provide additional lights in corridors and stairwells as necessary to provide adequate illumination. Furnish all light bulbs for the temporary lighting system.
      d. Maintain the temporary electrical service and lighting during the normal work week which is defined as five days a week, including one-half hour before regular working hours and one-half after regular working hours for each trade. (10 hours per day)
      e. Remove the temporary light and power system and the temporary service terminals when no longer required, and repair any damage caused by the temporary system.
   3. Separate Contractor/Subcontractor responsibilities:
      a. If 3-phase power or voltage higher than 120 volts is required, provide the necessary temporary wiring, and pay the cost thereof. Coordinate installation with Electrical Contractor.
      b. Do not use the temporary light and power system for electric welders, hoists, or heating.
      c. Maintain temporary electrical service and lighting if used beyond the normal work week.
      d. Each subcontractor shall make arrangements and pay the costs for electrical service, lighting and power for his field office, storage sheds, and other temporary buildings.
      e. Each Sub-Contractor shall furnish extension cords and contractors requiring supplemental lights shall furnish their own portable lights.

4. Use of permanent electrical system: when installation of the permanent electric system is sufficiently complete to be operated safely and system may be used to provide construction light and power, and testing and operating of permanent equipment.
5. Permanent light and power: The Owner will assume the responsibility and pay the costs of providing electrical light and power including the energy cost on the date of his occupancy or the date of Substantial Completion of the Project, whichever is sooner.

C. Water:
1. Water is available at the site for use by the Contractor. Contractors shall make every effort to conserve the use of water.
2. Water consumption cost will be paid by the Owner.
3. Contractors/Subcontractors are responsible for providing their own hoses to bring water from the temporary water source to their work areas. Only heavy duty 3/4" hose in good condition will be permitted. The discharge end of each hose will be equipped with a means of positive shut-off. Do not use hoses which leak at connections or elsewhere throughout their length. Disconnect all hoses from hose bibs when not in use and before the end of the work day.
4. Each Contractor/Subcontractor shall provide remote sanitary drinking water dispensers for use of their own personnel, convenient of work stations.
5. Those using the water shall protect or remove water supply during freezing temperatures.

1.03 CONSTRUCTION HEAT PRIOR TO ENCLOSURE

A. Adhere to the approved Project Schedule, regardless of weather conditions, during the period when work is scheduled to be performed. All required work and the cost thereof to meet this obligation will be included in the Contractor's base proposal and in the resulting Contract Sum. No claim for an extension of Contract Time, or for an increase in Contract Sum will be honored by the Owner, if such claim is based upon the cost of providing construction heat as specified above.

B. Each Contractor or Subcontractor to be responsible for providing temporary weather-tight enclosures as approved by the Owner and Architect, as work progresses, and as necessary to provide acceptable working conditions to accomplish their work without causing a delay in the project.

1.04 CONSTRUCTION HEAT AFTER ENCLOSURE

A. For construction heat purposes, the building or portion thereof will be declared enclosed when all enclosing walls are erected, roof or floor construction above is installed, and all doors, windows, or openings in the exterior walls are covered.

B. After enclosure, if required, the General Contractor shall provide, operate, and maintain a temporary system for heating the enclosed area of the building. This system shall consist of direct fired L.P. gas, temporary heat units or other devices as required to maintain the specified temperatures.

C. After enclosure of the building, a minimum temperature of 50 degrees F. shall be maintained at all times. During the placing of interior millwork, resilient flooring, acoustic tile, ceramic tile, plaster, painting and decorating, and similar finish materials, and continuing until the Owner assumes responsibility for heating the building, the minimum temperature shall be 60 degrees F. It shall be the responsibility of each Contractor to coordinate with the General Contractor to assure that all temporary enclosures remain in the closed position.

D. The General Contractor shall arrange for the ventilation of enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, and gases.

E. This temporary heating and ventilation shall remain in place until the permanent heating and ventilation systems are installed, including ductwork.

1.05 USE OF PERMANENT HEATING AND VENTILATING SYSTEMS:

A. If required, the General Contractor and the Heating Contractor shall operate and maintain the equipment during its use for temporary heating.

B. The cost of fuel and utilities used in the operation of the permanent heating system will be paid for by General Contractor.

C. Warranties shall begin upon Substantial Completion.

D. The permanent system shall be operated, after final review and acceptance, with a full complement of disposable filters which shall be replaced by the Mechanical Contractor upon completion of the project.

1.06 VENTILATION

A. The General Contractor shall arrange for the ventilation of enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, and gases.

1.07 TELECOMMUNICATIONS SERVICES

A. Each contractor shall be responsible for installation, payment of charges, and removal of any telephone they may require in their office or storage trailer.

B. Use of cellular phones will be permitted.

1.08 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

C. The Prime Contractor shall provide & maintain one or more portable “Satellite type” temporary toilets convenient to each major area of construction, for the use of all Contractors, subcontractors, their personnel and employees.

1.09 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Each Contractor shall furnish and maintain all necessary informational signs required to help maintain the safety and health at the work site such as "Danger" "High Voltage", etc.

C. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.10 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.11 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.12 CONSTRUCTION ACCESS AND BARRIERS

A. Each Contractor shall provide temporary construction access consisting of OSHA approved ladders and/or scaffolding required to carry out the work of their contract. These shall be placed at a location approved by the General Contractor.

B. Each Contractor and Subcontractor shall provide hoisting facilities for his own use.

C. Each Contractor shall provide temporary sheeting and shore and brace excavations and new construction as necessary for the safe and proper execution of the Work. Remove temporary supports when backfilling is complete or new construction can safely support the loads.

D. The General Contractor shall provide protective fences, barricades and lights as required to prevent unauthorized entry to construction areas to meet all safety requirements of OSHA and to protect existing facilities and adjacent properties from damage from their construction operations.
   1. Any contractor carrying out excavation or requiring excavations shall protect excavations, trenches, etc. from accidental access by placing protective fencing around openings.

E. Protective fencing at all excavations shall be provided by the Excavator.

F. Protective fencing at storage areas shall be provided by the Contractor who's materials require fencing.

1.13 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. The General Contractor shall be responsible for security of the building and site. Exterior openings at which work cannot be completed within one working day's time will be closed to prevent entry into existing buildings or new construction.

C. This shall include those temporary closures as required under Construction Heat after enclosure.

D. Each Contractor will be responsible for the security of his own property.

1.14 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

E. Parking locations will be designated by the General Contractor.

F. Trucks and other vehicles belonging to Contractors, Subcontractors and suppliers may be parked on the site provided space is available and the vehicles are identified. Such parking shall be subject to the direction of the General Contractor.

G. Perform cleaning of concrete equipment at location designated by the General Contractor. Remove from the site all residue accumulated from the cleaning operations of concrete equipment.

H. Contractors failing to adequately clean vehicles or otherwise causing dirt or debris to be deposited on any public street or highway shall be responsible for all costs in connection with the cleaning thereof whether performed by the General Contractor, or at the direction of any public authority having jurisdiction.

I. Access to the site shall be by roadways, approved by the Owner.

J. Access Roads shall be established and maintained by the Earthwork Contractor, as directed the General Contractor.

1.15 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

E. Each contractor/subcontractor shall collect waste from the construction areas & dispose of in dumpsters as provided by the Prime Contractor.

F. If contractor/subcontractor does not remove this waste on a timely basis, the Owner/Architect may direct the prime contractor to remove waste and the contractor/subcontractor may be back charged by the prime contractor for this removal.

G. Separate construction waste & recycle dumpsters may be provided, and if so, all contractors shall separate all waste materials as directed and place into proper dumpster.

1.16 WATER AND EROSION CONTROL

A. Any Contractor carrying out excavating or requiring excavations shall protect excavations, trenches, other temporary work, the building, and other work of the Project from damage from water (including ground water, rain water, backing up of sewers, and drains and ice and snow). Keep excavations and trenches free from water during the progress of the Work, and provide temporary enclosures, pumps and equipment and do all grading, pumping, bailing, or other work necessary to ensure this protection.

B. Plan and execute construction and earth work by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
   1. Hold the areas of bare soil exposed at one time to a minimum.
   2. Provide temporary control measures such as berms, dikes, drains and silt fences as necessary.

C. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.

D. Protect site from puddling or running water. Provide water barriers and slope protection as required to protect site from erosion.

E. Each Contractor shall provide protection against wind, storms, frost, rain, snow, heat and cold to avoid injury to material in transit, stored material, and Work in place.

F. Periodically inspect earthwork to detect any evidence of the start of erosion, apply corrective measures as required to control erosion.

G. Remove all items not required to remain upon completion of the project and approval of the General Contractor.

H. Clean streets & walks adjacent to the project of dirt, mud or other materials on a weekly basis.

I. Provide silt fences and other runoff control devices as required by agencies having jurisdiction.

1.17 TREE AND PLANT PROTECTION

A. The General Contractor shall arrange for and pay the cost of all tree protection. This shall generally consist of a project boundary fence, which shall be erected immediately upon the start of construction of the Project.

B. Each Contractor/Subcontractor shall be responsible for carefully supervising all work to prevent injury to trees and plants and to replace, or suitably repair, trees and plants which are damaged or destroyed due to construction operations.

1.18 PROTECTION OF INSTALLED WORK

A. Each Contractor shall see to it that protection is provided for work as follows:
   1. Protect installed Work and provide special protection where specified in individual specification Sections.
   2. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.
   3. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
   4. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
   5. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

B. The Contractor shall arrange for the correction of any damage caused by the operations of themself or any Subcontractor and shall deduct the cost of corrections from monies due the Contract.

1.19 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. If space is available, contractors may provide a field office for their own use, installed at a suitable location on the site as designated by the General Contractor. Provide and pay for all utilities used in conjunction with field office.

D. Locate offices a minimum distance of 30 feet from existing and new structures.

1.20 TEMPORARY STORAGE

A. Contractors may provide storage sheds and/or trailers as their needs may require, and as space is available, coordinate the location with the General Contractor. All temporary structures will be removed before final acceptance of the Work.

B. Limit use of the premises for work and for storage. Cooperation with all separate contractors on the project shall be under the direction of the General Contractor.

1.21 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Re-use of existing products.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

C. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Provide interchangeable components of the same manufacture for components being replaced.

2.03 PRODUCT OPTIONS

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

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Replace damaged materials at no additional cost to the owner.

G. Deliver items required to be built into masonry or concrete promptly to the site so they may be built in as the work progresses. Provide templates showing exact locations.

H. Do not deliver materials subject to damage unduly long before they are required in the work and suitable storage facilities are available at the site.

I. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

L. Arrange storage of products to permit access for inspection. Periodically inspect to ensure products are undamaged and are maintained under specified conditions.

M. Replace damaged materials at no additional cost to the owner.

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, except payment procedures.

1.02 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located.

1.05 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. This PROJECT COORDINATION ADMINISTRATOR shall coordinate the work of this project, including the work of his subcontractors.

B. This PROJECT COORDINATION ADMINISTRATOR shall coordinate all work of the project with the Owner, the Architect and other contractors carrying out work at the site.

C. Each Sub-Contractor and Material Supplier shall coordinate the work of his and that of related contractors, subcontractors and material suppliers with the aid of the Project Coordination Administrator.

D. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

E. Notify affected utility companies and comply with their requirements.

F. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

G. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

H. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

I. Coordinate completion and clean-up of work of separate sections.

J. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute electronic copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.

b. Provide temporary connections as required to maintain existing systems in service.

4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

I. Clean existing systems and equipment.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

K. Do not begin new construction in alterations areas before demolition is complete.

L. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Patching work shall be done by skilled mechanics experienced in the particular type of work involved. Patching work shall conform to the standards of the Specifications where applicable and where not specified, work shall conform to the highest standards of the trade.

G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

H. Restore work with new products in accordance with requirements of Contract Documents.

I. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

J. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

K. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

L. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.08 PROGRESS CLEANING

A. The Contractor and Subcontractors will be responsible for their own cleanup as specified and removal of their own debris. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

E. Do not throw waste material and rubbish down from upper levels.

F. Hammer in or bend over flush with the wood protruding nails in boards, planks, timbers, etc.

G. Dispose of hazardous wastes in accordance with applicable laws and regulations.

H. Promptly remove from the work area all waste materials and rubbish resulting from the performance of the work. Clean up on a day-to-day basis throughout the construction period.

I. Perform continuous clean-up of flammable debris to prevent accumulation.

J. Contractors and Subcontractors shall provide for the removal of stains and overages caused by operations, such as mastics, mortar, concrete, joint compounds, paint, caulking, etc.

K. The Contractor shall provide periodic broom cleaning of project areas using sweeping compound as required to prevent airborne dust.

L. The Architect may require the Contractor to broom clean any area or areas of the project at any time he feels there is excess dust or dirt, which inconveniences building occupants or finishing operations.

M. If the premises and the site are not maintained properly at all times, the Owner may have any accumulation of waste materials or trash removed and charge the cost to the Contractor who is responsible.

N. In addition to cleaning above, each Contractor or Subcontractor shall thoroughly clean and vacuum floors prior to the installation of the finish flooring, such as sealing exposed slabs, ceramic or quarry tile, sheet vinyl flooring, V.C.T., carpet, etc.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.12 ADJUSTING

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

3.13 FINAL CLEANING

A. At Completion of the Work promptly remove tools, equipment, machinery, and surplus materials from the Project site.

B. The Masonry Trade Contractor is responsible for final cleaning of all masonry surfaces.

C. Use cleaning materials that are nonhazardous.

D. Leave all surfaces broom clean and ready for final cleaning unless otherwise required by the Specifications.

E. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

F. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

G. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

H. The Mechanical Contractor shall clean all ductwork and grills (in and out), and polish all plumbing fixtures, trim, etc.

I. If air handling equipment is operated during construction, filters for air handling equipment shall be replaced or thoroughly cleaned according to manufacturer's instructions, by the HVAC contractor. Clean filters of operating equipment.

J. The electrical subcontractor shall wash, vacuum, dust or otherwise clean light fixtures and other electrical work in finished spaces as necessary to remove all stains, dust and dirt. Other electrical equipment in mechanical rooms, transformer vaults, switch gear rooms, and similar unfinished spaces shall be left "broom clean". Burned out lamps shall be replaced.

K. All areas within lights, ducts, chases and other items, areas or equipment which will be "closed up" by the Contractor, as a part of the work of their contract, shall be thoroughly cleaned by the Contractor prior to closing up.

L. Clean debris from roofs, gutters, downspouts, and drainage systems.

M. Clean site; sweep paved areas, rake clean landscaped surfaces.

N. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

O. The Contractor shall arrange for professional cleaners or experienced workmen for other final cleaning, to remove dust, dirt, finger prints and labels from all interior and exterior surfaces and to polish glossy surfaces to a clear shine.

P. The Work shall be maintained in a clean condition until the Architect determines that the Project is substantially complete.

Q. Cleaning required by subsequent work done after Substantial Completion shall be carried out by the Contractor or Subcontractor of the required work and shall be accomplished prior to Final Completion.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Notify Architect when work is considered ready for Substantial Completion.
   1. When the Work is considered Substantially Complete, as defined in the General Conditions THE PRIME OR PRIME TRADE CONTRACTOR shall submit to the Architect:
      a. A written notice that the Work, or designated portion thereof, is substantially complete.
      b. A list of items to be completed or corrected.

2. Within a reasonable time after receipt of such notice, Architect will make a pre-final inspection to determine the status of completion.
3. Should the Architect determine that the Work is not Substantially Complete:
    a. Architect will promptly notify the Contractor in writing, giving the reasons therefor.
    b. Contractor will remedy the deficiencies in the Work, and send a second written notice of Substantial Completion to the Architect.
    c. The Architect will reinspect the Work.

C. Should the Architect determine that the Work is not Substantially Complete:
1. Architect will promptly notify the Contractor in writing, giving the reasons therefor.
    a. Contractor will remedy the deficiencies in the Work, and send a second written notice of Substantial Completion to the Architect.
    b. The Architect will reinspect the Work.
    c. When the Architect finds that the Work of all Contractors is Substantially Complete, the Architect will execute and deliver to Certificates of Substantial Completion to the Prime contractor with a revised list of items to be completed or corrected before final payment.

D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

F. Notify Architect when work is considered finally complete.
1. When the Work is considered complete, submit written certification to the Architect along with a copy of the punch list confirming completion of each individual item listed, that:
    a. Contract Documents have been reviewed.
    b. Work has been inspected for compliance with Contract Documents.
    c. Work has been completed in accordance with Contract Documents.
    d. Equipment and systems have been tested in the presence of the Owner's Representative and are operational.
    e. Work is clean and ready for final inspection.
2. Upon receipt of the above certification, the Architect/Engineer shall set a date for final inspection to be made only when the project is complete and when all deficiencies of the pre-final inspection have been corrected.
3. One week prior to this date, the Architect will inform the Owner and contractors of this inspection in writing.
4. Immediately following this inspection, the Architect shall prepare a written report listing the names of all persons present at the inspection and the Architect shall prepare a punch list of all deficiencies for completion and correction. Copies of this report will be provided to the Owner, General contractor and the bonding company.
5. Should Architect consider that the Work is incomplete or defective:
    a. Architect will promptly notify the Contractor or Contractors in writing, listing the incomplete or defective work.
    b. Contractor will take immediate steps to correct the stated deficiencies, and send a second written certification to Architect that the Work is complete.
    c. Architect will re-inspect the Work.
    d. Contractor or Contractors will be responsible for any reinspection cost incurred by Owner due to the necessity of the Architect's re-inspection.

G. Final Completion:
1. Test Reports and Certificates: Provide all test reports and certificates required in the technical sections, prior to final payment. Provide a check list of required reports and certificates, by Specifications sections.
2. Retention of Records: Retain all records as required by law and good business practice.
3. Remove all temporary utilities as the job progress permits.

4. Temporary Facilities: As the job progresses and facilities are no longer needed, they shall be removed by the Contractor. Prior to final payment, remove temporary sheds, fences, barricades, surplus materials, debris and other material or items not part of the Project.

H. Closeout Submittals:
   1. When the Owner has determined that the Work is acceptable under the Contract Documents and the Contract fully performed, Contractor shall prepare and submit final Application for Payment to the Architect together with the following:
      a. Insurance: Refer to Section 00 73 00.
         1) The specified Property Insurance (Multiple Peril Builder's Risk) shall be maintained until final acceptance by the Owner of the entire Project.
      b. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706.
      c. Consent of surety to final payment of Consent of Surety Company to Final Payment, AIA Document G707. The Consent of the Surety Company must be obtained prior to any reduction of retained percentage and prior to final payment.
      d. Minnesota Department of Revenue "Withholding Affidavit for Contractors" document IC-134, fully completed and certified.
      e. Evidence of Compliance with requirements of governing authorities:
         1) Certificate of Inspection from all required agencies and departments.
         2) Certificate of Occupancy.
      f. Operating and Maintenance Data, Instructions to Owner's Personnel.
      g. Warranties and Bonds.
      h. Project Record Documents.
      i. Special tools required for Owner maintenance.
   2. Submit four copies each of Items “b” and “c” above, and two copies each of Items “a” and “d” through “f”.

I. Complete items of work determined by Architect's final inspection.

J. Final Adjustment of Accounts:
   1. Submit a Final Statement of accounting to the Architect.
   2. Reflect all adjustments to the Contract Sum in the statement as follows:
      a. The original Contract Sum.
      b. Additions and deductions resulting from:
         1) Previous Change Orders
         2) Unit Prices.
         3) Deductions for uncorrected Work.
         4) Deductions for Re-inspection Payments.
         5) Other Adjustments.
      c. Total Contract Sum, as adjusted.
      d. Previous Payments.
      e. Sum Remaining Due.
   3. Submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

K. Corrective Work & Follow-Up Inspections: The Owner shall notify the Contractor of required corrective work after completion, and the Contractor shall actively supervise such Work. The Institution shall not be inconvenienced as to prompt service and/or corrections by the Contractor that may be necessary.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Prepare data in the form of an instructional manual for use by the Owner's personnel.
   2. Format shall conform to the following:
      a. Size 8-1/2" x 11"
      b. Text: Manufacturer's printed data, or neatly typewritten.
      c. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
         1) Title of Project
         2) Identity of separate structure as applicable.
         3) Identity of general subject matter covered in the manual.
      d. Provide fly-leaf for each separate product, or each piece of operating equipment.
         1) Provide typed description of product, and major component parts of equipment.
         2) Provide indexed tabs.
      e. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
         1) Title of Project
         2) Identity of separate structure as applicable.
         3) Identity of general subject matter covered in the manual.
   3. Binders
      a. Commercial quality three-ring binders with durable and cleanable plastic covers.
      b. When multiple binders are used, correlate the data into related consistent groupings.

C. Content of Manual:
   1. Arrange neatly a typewritten table of contents for each volume, in the following systematic order.
      a. Trade Contractor, name of responsible principal, address and telephone number.
      b. A list of each product required to be included, indexed to the content of the volume.
      c. List, with each product, the name, address and telephone number of:
         1) Trade Contractor or installer
         2) Maintenance contractor, as appropriate
         3) Identify the area of responsibility of each
         4) Local source of supply for parts and replacement

d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

2. Product Data
   a. Include only those sheets which are pertinent to the specific product.
   b. Annotate each sheet to:
      1) Clearly identify the specific product or part installed.
      2) Clearly identify the data applicable to the installation.
      3) Delete references to inapplicable information.
3. Written text, as required to supplement product data for the particular installation:
   a. Organize in a consistent format under separate headings for different procedures.
   b. Provide a logical sequence of instructions for each procedure.
   c. Do not use Project Record Documents as maintenance drawings.
4. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
5. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
6. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
7. Submit two sets of revised final documents in final form within 10 days after final inspection.

D. Warranties and Bonds:
1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
4. Copy of each warranty, bond and service contract issued.
   a. Provide information sheet for Owner's personnel, give:
      1) Proper procedures in the event of failure.
      2) Instances which might affect the validity of warranties or bonds.
   b. Provide a logical sequence of instructions for each procedure.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.
7. Architect/Engineer Field Orders or written instructions.
8. Field test records.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Maintain record documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

F. Make record documents and samples available at all times for inspection by Architect and/or Owner.

G. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

H. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Changes made by Field Order or by Change Orders.
   6. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

C. Include color coded wiring diagrams as installed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties and bonds.

J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

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

END OF SECTION

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing.

B. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2010.

1.04 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for design, fabrication, erection and removal of formwork.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

2.02 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor.

2.03 REMOVABLE PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.04 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.
   1. Sonneborn - Cast-Off
   2. Sika - Formtex
   3. W.R. Meadows - Duogard II
   4. Tamms: Aquaform
   5. Substitutions: See Section 01 60 00 - Product requirements.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

D. Embedded Anchor Shapes, Plates, Angles and Bars: As specified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.05 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.
   1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
   2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.06 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.07 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2020.

B. ACI 318 - Building Code Requirements For Structural Concrete and Commentary; American Concrete Institute International; 2014 (Errata 2018).

C. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International; 2004.

D. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement 2019.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2020.

F. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society; 2018.

G. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

B. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Deformed billet-steel bars.
   2. Unfinished.

B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Conform to applicable code for concrete cover over reinforcement.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete building frame members.

B. Floors and slabs on grade.

C. Joint devices associated with concrete work.

D. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 07 90 05 - Joint Sealers: Sealants for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete 2016.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

F. ACI 305R - Guide to Hot Weather Concreting 2010.

G. ACI 306R - Guide to Cold Weather Concreting 2016.

H. ACI 308R - Guide to External Curing of Concrete 2016.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

J. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2020.

L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

M. ASTM C150/C150M - Standard Specification for Portland Cement 2020.

N. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete 2016.

O. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2019.

P. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing 2017.

Q. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete 2013.

R. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures 2020.

S. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types) 2018.

T. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting 2015.

U. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers 2020.

V. ASTM E1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers (Metric) 2014.

W. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Submit concrete mix design to the Architect for approval

C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

D. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C 33.

1. Course Aggregate Material: Strong, clean crushed granite or limestone gravel, are subject to approval as to use, other inert material having similar characteristics, free from adherent coatings and injurious amount of friable or fragile pieces, flake organic matter, or other deleterious substances, all meeting the following gradation requirements:
    a. Footings - 1"
    b. Foundations - 1"
    c. Slabs - 1"
2. Fine Aggregate Material: Clean, strong, natural are subject to approval and authorization as to use, other inert material suitable for the work to be done, having characteristics similar to natural sand, free of frozen materials, all meeting the following grading limits:
    a. Passing No. 4 Sieve: 95% to 100%
    b. Passing No. 14 Sieve: 45% to 80%
    c. Passing No. 50 Sieve: 10% to 30%
    d. Passing No. 100 Sieve: 2% to 10%

C. Fly Ash: ASTM C618, Class F.

D. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

E. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C 260 to produce Air Entrainment of between 5% to 7%. None - N/A Air entrainment admixture shall be used in strict accordance with the manufacturers recommendations and shall be one of the following or approved equal:

1. W.R. Grace - Darex AEA

2. Protex Industries - Pro-Air
3. W.R. Meadows - Sealtight Air Entrainment Agent
4. Sika - Sika AER
5. Euclid - Air Mix

C. Chemical Admixtures: ASTM C 494/C 494M, Type A - Water Reducing.
1. Provide products manufactured by Sika Corporation or The Euclid Chemical Company.
2. Water reducing admixtures are required for concrete slabs on grade to produce a water to cement ratio of 0.45. Submit manufacturer's literature for the specific water reducing admixture to be provided based on mix designers experience for results to be achieved based on specific conditions of the concrete pour.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: High density polyethylene meeting the requirements of ASTM E 1745, Class A and with the following minimum characteristics:
1. Tensile Strength per ASTM E 154, Section 9: 45.0 lbf/in.
2. Puncture Resistance per ASTM D 1709, Method B: 2200 grams.
3. Permeance per ASTM E 96: 0.018 perms.
4. Under Slab Vapor Retarders shall be as manufactured by one of the following or approved equal:
a. Barrier Bac, Inc. - VB 250; 509 South Wall Street, Calhoun, GA 30701; phone 877-237-2841.
b. Raven Industries Inc. - Vapor Block 15; 1812 E. Ave., Sioux Falls, SD 57104; phone 800-635-3456.
c. Reef Industries, Inc. - 15 Mil Green; PO Box 750250, Houston, TX 77275-0250; phone 713-507-4200.
d. W.R. Meadows, Inc. - Perminator 15 Mil; P.O. Box 338, Hampshire, IL 60140-0338; phone 800-342-5976.
e. Stego Industries LLC - Stego Wrap 15 mil Class A, 27442 Calle Arroyo, Suite A, San Juan, CA 92675; phone 877-464-7834.
f. Insulation Solutions Inc. - Viper VaporCheck II 15 mil Class A, 401 Truck Haven Road, East Peoria, Il 61611; phone 866-698-6562.
5. Furnish all sealants, sealing tapes, pipe boots and other accessories as required by the manufacturer for a complete installation.

B. Underslab Vapor Retarder: ASTM E 1745, Class A, as specified in herein. Single ply polyethylene is prohibited.

C. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited. Vapor Retarder shall be as specified in Section.
1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.

D. Moisture-Retaining Cover: ASTM C171; clear polyethylene.

E. Underlayment for leveling floors to tolerances shall be portland cement based pourable underlayment. Furnish primers as recommended by the manufacturer. Self-leveling underlayment shall be as manufactured by one of the following or approved equal:
1. Ardex Inc. - K-15
2. Sika - Sikaset
3. Euclid Chemical Company - Flo-Top
4. Tamms - Thin Patch

F. Liquid Densifier/Sealer: Sodium Silicate Concrete Compound, liquid type. Chemical Hardener shall be as manufactured by one of the following or approved equal:
1. Sonneborn - Kure-N-Hard
2. TK Products - TK-5329 Floor Hardener and Densifier.

3. L&M Construction Chemicals - Chem Hard
4. Euclid - Euco Diamond Hard
5. Vexcon Chemicals, Inc. - Starseal PS Clear.
6. Curecrete Chemical Company, Inc. - Ashford Formula

G. Curing/Sealing Concrete Surfaces: Curing/Sealing compound shall be high solids, non-yellowing methyl methacrylate polymers conforming to ASTM 1315, Type 1, Class A. Compound shall be VOC compliant material to render the surface with a glossy appearance resistant to dirt and moisture penetration. All exposed aggregate floors shall receive two coats of the following or approved equal:
1. TK Products - Bright Kure & Seal.
2. The Euclid Chemical Company - Super Diamond Clear.
3. Vexcon Chemicals - Vexcon Starseal 1315.
4. Degussa Construction Chemicals - Kure-N-Seal 25LV.
5. W.R. Meadows - Epoxo-Gloss.

H. Waterstop: shall be a flexible strip of Bentonite waterproofing compound American Colloid Company - Volclay Waterstop RX or approved equal. Provide primer and adhesive as required by the manufacturer.

2.06 BONDING AND JOINTING PRODUCTS

A. BOND BREAKER: at juncture of interior concrete slabs and adjacent walls shall be 15 lb. felt with adhesive on one side.

B. Expansion Joint Filler: shall be an asphalt, vegetable fibers and mineral filler joint formed under heat and pressure between two asphalt felt liners conforming to ASTM D994. It shall be resistant to oil, solvents, ozone and weathering. Joint Filler shall be as manufactured by W.R. Meadows, Inc. - Sealtight Asphalt Expansion Joint Filler.

C. Sealant and Primer: As specified in Section 07 90 05.

2.07 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Furnish the following types of concrete:
1. Footings - 1" aggregate, 4000 psi, non-air entrained.
2. Foundations - 1" aggregate, 4000 psi, non-air entrained.
3. Slabs - 1" aggregate, 4000 psi, non-air entrained, water reducing admixture to produce a water to cement ratio of 0.45..
4. Exterior Concrete - 1" aggregate, 4500 psi, air entrained.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

D. Fiber Reinforcement: Add to mix at rate of 1 pound per cubic yard.

2.08 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

B. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

C. Install vapor retarder under interior slabs on grade, as shown on drawings. Lap joints minimum 12 inches and seal watertight by taping edges and ends. All penetrations of the vapor retarder shall be sealed. Any stakes driven through the vapor retarder shall be sealed.

3.03 PLACING UNDERSLAB VAPOR BARRIER

A. Install materials in accordance with manufacturer's instructions.

B. Level and compact granular base as required.

C. Unroll vapor retarder with the longest dimension of the pour and pull out the folds to the full width of the product.

D. Lap vapor retarder onto the foundation wall to the height of the concrete slab and seal with two sided tape.

E. Seal around all pipe penetrations with pipe boots or material and tape as per manufacturer's instructions. Seal around all other penetrations with an elastomeric sealant to create a monolithic membrane between the surface of the slab and moisture sources below and at the slab perimeter as per manufacturer's instructions.

F. Holes or punctures through the vapor retarder shall be sealed with a patch and seaming tape prior to pouring concrete.

G. Protection: When installing reinforcing steel and utilities in addition to the placement of concrete, take precautions to protect the vapor retarder. Provide additional protection in high traffic areas.

H. Use only brick-type reinforcing bar supports to protect the membrane from puncture.

I. Avoid driving stakes through the vapor retarder. If this cannot be avoided, each individual hole must be repaired.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints as indicated on the drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Separate slabs from vertical surfaces with bond breaker.

E. Install joint devices in accordance with manufacturer's instructions.

F. Apply sealants in joint devices in accordance with Section 07 9005.

G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
   1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.
   2. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.
   3. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.
      a. Coordinate with tolerance acceptance of specified products in section 09 30 00 as required.

B. Measure F(F) and F(L) in accordance with ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.

C. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
   2. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than 7 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Curing/Sealing New Concrete:
      a. Apply in accordance with manufacturer's instructions.
      b. Apply immediately after surface water has dissipated, and concrete can withstand weight.
      c. Apply at a rate of 200 - 300 square feet per gallon for the first and second coats using spray brush or roller.
      d. Avoid buildup which can cause slippery conditions or lifting action between coats. Protect from freezing Do not apply if concrete surface and ambient temperatures are below 40 degrees F.

3.09 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cu yd or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

H. Slab Moisture Content: Test concrete slabs on grade in accordance with ASTM F2170 - 02, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes. Flooring materials shall not be installed over floors with a relative humidity greater than 80%.

I. Tested concrete reports need to be coordinated with respective parties and shall be distributed to all associated parties including: Testing firm, Owner, CM or GC, Sub-contractor, and supplier.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud wall framing.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and miscellaneous framing.

B. Section 07 21 00 - Thermal Insulation: Insulation within framing members.

C. Section 07 25 00 - Weather Barriers: Weather barrier over sheathing.

1.03 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2000.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A1003/1003M - Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic Coated for Cold Formed Framing Members.

F. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.

G. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; Current edition.

J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations and installation instructions.

C. Shop Drawings: Provide shop drawings prepared by cold-formed metal framing manufacturer. Indicate component details, framed openings, and accessories or items required of related work.
   1. Indicate stud and floor joist layout.
   2. Describe method for securing studs to tracks and for bolted framing connections.
   3. Provide design engineer's stamp on shop drawings.
   4. Provide details and calculations for factory-made framing connectors, stamped by a Professional Structural Engineer.

D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Calculate structural properties of framing members in accordance with requirements of AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. MiTek Industries, Inc: www.mii.com.
   3. Aegis Metal Framing: www.aegismetalframing.com.

B. Framing Connectors and Accessories:

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Criteria: Provide completed framing system having the following characteristics:
   1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
   3. Design Loads: In accordance with applicable codes.
   4. Live load deflection meeting the following, unless otherwise indicated:
      a. Exterior Walls: Maximum horizontal deflection under wind load of applicability.
         1. L/600 (or L/720) for masonry/stone veneers.
         2. L/360 for metal panels and other siding materials.
      b. Design non-axial loadbearing framing to accommodate not less than 1/2 in vertical deflection.
   5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

C. Metal Framing Connectors and Accessories:
   1. Dietrich Metal Framing: www.dietrichindustries.com.
   2. The Steel Network Inc: www.SteelNetwork.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FRAMING MATERIALS

A. Studs and Track: ASTM A653/653M-07; studs formed to channel shape with punched web; U-shaped track in matching nominal width and compatible height. All stud and tracks shall be 18 gauge minimum with a minimum yield stress Fy of 33 KSI.
   1. Gage and depth: As indicated on the drawings.
   2. Galvanized in accordance with ASTM A653/A653M G60/Z180 coating.

B. Framing Connectors: Factory-made formed steel sheet, ASTM A1003/1003M SS Grade 50, with G90/Z275 hot dipped galvanized coating and factory punched holes.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for thicknesses less than 10 gage (0.118 inch), and factory punched holes and slots.

2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members.
3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
    a. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
    b. Acceptable Products: VertiClip(r) or DriftClip(tm) manufactured by The Steel Network Inc.
    c. Rated Wall locations shall utilize Blazeframe Riptrak or approved equal.
4. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Anchorage Devices: Power actuated.

D. Welding: In conformance with AWS D1.1.

2.06 SHOP FABRICATED ASSEMBLIES

A. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with AISI's Standard Cold Formed Steel Framing - General Provisions. Comply with manufacturers' instructions unless more stringent requirements are indicated.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 16 inches on center.

C. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

D. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

E. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

F. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

G. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

H. Install batt insulation in areas that will be inaccessible after framing is installed, before studs are placed in their final position.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 09 90 00 - Painting and Coatings: Field painting.

1.03 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

F. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

G. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

J. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2021a.

K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2019.

P. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, plain.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 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.

2.03 FABRICATED ITEMS

A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support, and as required, etc. as shown on drawings; prime paint finish. See drawings.

B. Bollards: Schedule 40 Steel Pipe, concrete filled, crowned cap, as detailed; prime paint finish.

1. Bollard Covers: Provide colored covers with two lines of reflective tape, sized as required to fit over pipe bollards. Bollard covers shall be as manufactured by Innoplast; phone 800-516-9287; www.innoplast.com or approved equal. Provide standard color selections.

2.04 FINISHES - STEEL

A. Prime paint steel items.

1. Exceptions: Do not prime surfaces in direct contact with concrete, and where field welding is required.

B. Prime Painting: One coat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials.

B. Miscellaneous framing and sheathing.

C. Communications and electrical room mounting boards.

D. Wood nailers.

E. Concealed wood blocking for support of wall mounted accessories, etc.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 – Gypsum Board Assemblies: Related.

1.03 REFERENCE STANDARDS

A. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

D. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2025.

E. PS 1 - Structural Plywood; 2023.

F. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2025.

G. WWPA G-5 - Western Lumber Grading Rules; Western Wood Products Association; 2025.

H. International Building Code and the State of Minnesota Building Code.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and fire treated materials.

1.05 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

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

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Western Wood Products Association (WWPA).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Dimensional Lumber for framing (2x4 and 2x6):
   1. Species: Spruce, Pine, Fir.
   2. Grade: No. 2 or better, with minimum design values as shown on drawings.

E. Dimensional Lumber (2x8, 2x10, 2x12):
   1. Species: Douglas Fir or Southern Yellow Pine
   2. Grade: No. 2, with minimum design values as shown on drawings.

F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: APA PRP-108, Rated Sturd-I-Floor.
   1. Exposure Class: Exterior.
   2. Span Rating: 24 inches (610 mm).
   3. Thickness: 3/4 inches (19 mm), nominal.

B. Plywood Wall and Roof Sheathing: PS 1, Grade C-D, Exposure I, thickness as shown on drawings. At the Contractors option Oriented Strand Board of similar thickness and rating as the plywood sheathing may be used in lieu fo plywood sheathing.

C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

D. Other Applications:
   1. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

B. Subfloor Glue: APA AFG-01, Waterproof, water base, air cure type, cartridge dispensed.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment: AWPA Treatment C27 for plywood, Interior Type A Low Temperature (low hygroscopic), chemical treatment pressure impregnated; capable of providing a maximum flame spread/smoke development rating of 25 or less / 25 or less. Provide Dricon manufactured by Hickson Corporation or approved equal.

C. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   2. Treat lumber in contact with roofing, flashing, or waterproofing.
   3. Treat lumber in contact with masonry or concrete.
   4. Treat lumber less than 18 inches (450 mm) above grade.

5. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
    a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
    b. Treat plywood in contact with roofing, flashing, or waterproofing.
    c. Treat plywood in contact with masonry or concrete.
    d. Treat plywood less than 18 inches (450 mm) above grade.

D. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative to 0.4 lb/cu ft (6.4 kg/cu m) retention.

E. Preservative Pressure Treatment of Critical Structural Members in Contact with Soil: AWPA Use Category UC6A, Commodity Specification A (Treatment C2) using waterborne preservative to 0.6 lb/cu ft retention.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.05 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

A. Place full width continuous sill flashings under framed walls on cementitious foundations. Lap flashing joints 4 inches (100 mm) and seal.

B. Install soffit vents in locations shown on drawings as per manufacturer's instructions. Butt sections end to end to form a continuous vent.

C. All finished work shall be scribed and coped as required for an accurate fit and erected plumb, true square and in accordance with the drawings. Correlate location of nailers, blocking grounds and similar supports to allow proper attachment or other work. All work shall be secured in place with screws or nails as required. Countersink and fill all nail and screw heads exposed to view.

D. This Contractor shall furnish and install all nails, spikes, screws, bolts and other similar items of rough hardware required in the progress of his work and shall install all items of finish hardware furnished by others.

E. As finish hardware is delivered, this Contractor shall check all items against approved hardware listing and assume full responsibility for same until completion of building. He shall inspect the work of other trades which are to receive hardware and report in writing any defects found in same before installing. Installation of any hardware by this contractor shall imply his acceptance of the work of others.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.
   1. Install flooring with long dimension perpendicular to supports with panels continuous over two or more spans.
   2. Stagger panel end joints between courses. All panel joints shall occur over framing.
   3. Allow 1/8 inch spacing at panel end and edge joints.
   4. Glue panels to framing members with a continuous line of glue on the joists and a continuous line of glue in the panel grooves.
   5. Nail panels with 10d ring shank nails 6 inches on center at panel edges and 10 inches on center at intermediate supports.

B. Wall Sheathing: Secure with long dimension parallel to wall studs, with ends over firm bearing using nails. Stagger vertical joints at least one stud space. Allow 1/8" spacing at panel ends and edges. Attach APA rated wall sheathing to framing members with 6d common nails spaced 6" on center at the edges and 12" on center at intermediate supports.

C. Roof Sheathing: Install APA rated roof sheathing with long dimension at right angles to framing members. Stagger end joints at each alternate course. Allow 1/8" spacing at panel ends and edges. Attach APA rated roof sheathing to decking members with 8d common nails spaced 4" on center at the edges, 6" on center at supports, and 12" on center throughout the field of the panel.

D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications

B. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

C. Section 06 41 00 - Architectural Wood Casework: Related work.

1.03 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada, 8th Ed., Version 2.0.

D. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; National Hardwood Lumber Association.

E. WI (MAN) - Manual of Millwork; Woodwork Institute.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories, to a minimum scale of 1-1/2 inch to 1 ft.

C. Samples: Submit two samples of wood trim 6 inches long.

D. Samples: Submit two samples of Tackboard Fabric for selection by the Architect. Colors will be selected from manufacturer's standard line of colors.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with Woodwork Institute Manual of Millwork, grades as indicated.

B. Grade materials in accordance with the following:
   1. Softwood Lumber: In accordance with rules certified by ALSC; www.alsc.org.
   2. Plywood: Certified by the American Plywood Association.
   3. Hardwood Lumber: In accordance with NHLA Grading Rules; www.natlhardwood.org.

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

D. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

1.07 PROJECT CONDITIONS

A. Do not deliver materials to the site until all masonry, drywall and tile work has been completed and has had sufficient time to dry.

B. Do not deliver materials to the site until the permanent heating system is installed and running so as to maintain a minimum temperature of 60 degrees.

C. Materials shall be delivered to the site at least seven days in advance of installation and stored in the rooms they will be installed in and allowed to acclimate to the site

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Premium Grade. Design intent is to match that of existing conditions/systems.

2.02 WOOD-BASED COMPONENTS

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

2.03 LUMBER MATERIALS

A. Hardwood Lumber: Maple species, Plain sawn, Grade I, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
   1. Trim/mold pieces including but not limited to: chair rail, areas indicated on drawings.

2.04 ADHESIVE

A. Adhesive: Type recommended by laminate manufacturer to suit application.

2.05 FASTENINGS

A. Fasteners: Of size and type to suit application; finish in concealed locations and finish in exposed locations.

B. Concealed Joint Fasteners: Threaded steel, or hardwood biscuits.

C. Furnish "Z" type clips for fastening paneling to walls.

2.06 ACCESSORIES

A. Lumber for Shimming, Blocking, and furring: Softwood lumber of Birch species.

B. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 HARDWARE

A. Shelf Standards: Decorative Heavy Duty double slotted standards, 1-1/16 inch wide x 11/16 inch deep by length as shown on drawings. Shelf standards shall be KV - KV0082 color as selected.

B. Shelf Brackets: double slotted Knife style, Powder Coated finish; KV0182 Bracket manufactured by KV. Bracket length shall be as required for shelving size as shown on drawings.

2.08 FABRICATION

A. All paneling, casework, benches, display cases, etc. shall be fabricated in accordance with Architectural Woodwork Standards 1st edition. Coordinate glass items with Section 08 80 00.

B. Shop assemble work for delivery to site, permitting passage through building openings.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Door frames for all doors shall be fabricated to AWI Quality Standards Section 9, Custom Grade.

E. Paneling: All paneling on walls and on furniture items with edges exposed with a reveal shall have a 1/8 inch hardwood edging of the same species applied.

F. Veneered Wood Paneling: Provide "Z" type fastening clips for hanging panels in place.

2.09 SHOP FINISHING - INTERIOR MOLDINGS, TRIM AND PANELING

A. Apply wood filler in exposed nail and screw indentations.

B. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

C. Finish work in accordance with Woodwork Institute Manual of Millwork, Section 5, System #12 Waterbased Polyurethane.

D. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. See Section 06100 for installation of recessed wood blocking.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. All finished work shall be scribed and coped as required for an accurate fit and erected plumb, true, square and in accordance with the drawings. Correlate location of nailers, blocking grounds and similar supports to allow proper attachment or other work. All work shall be secured in place with screws or nails as required. Countersink and fill all nail and screw heads exposed to view.

E. This Contractor shall furnish and install all nails, spikes, screws, bolts and other similar items of rough hardware required in the progress of his work and shall install all items of finish hardware furnished by others.

F. Install moldings to the following standards:
   1. Moldings to receive transparent finish shall be selected for compatibility of grain and color.
   2. No warped or twisted molding shall be allowed.
   3. All moldings to be set plumb, level and true.
   4. Moldings and trim shall be installed in maximum lengths possible to minimize joints.
   5. All field joints to be tightly fitted and flush.
   6. Field joints in running trim to be diagonal ("scarfed") joints.
   7. Exposed ends of running trim shall have profiled or self-mitered returns.
   8. All exposed fastenings (nails or trim head screws) shall be deep set.
   9. Miters on large members (4" or larger) shall be doweled or splined and glued.
   10. Blind nailing and concealed type fasteners to be used whenever possible.
   11. Cope or miter inside corners where applicable, to produce tight fitting joints.
   12. Miter outside joints to produce tight fitting joints.

G. Install paneling pieces level and plumb in locations shown on drawings. Paneling shall be hung from "Z" clips or by other approved method with reveals as shown on drawings. Provide plastic laminate faced panels.

H. Install shelving standards and brackets as shown on drawings, level and plumb.

I. Install hardware in accordance with manufacturer's instructions.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cabinet units

B. Countertops

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014 (with Errata 2016).

B. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

C. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2020 (ANSI/BHMA A156.9).

D. GSA CID A-A-1936 - Adhesive, Contact, Neoprene Rubber; Federal Specifications and Standards; Revision A, 1996 (validated 2013).

E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2024 (ANSI/HPVA HP-1).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Convene a pre-installation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Provide data for hardware accessories.

1.06 QUALITY ASSURANCE

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

B. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 WOOD-BASED COMPONENTS

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

2.02 CABINETS

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

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets:
   1. Finish - Exposed Exterior Surfaces: Decorative laminate.
   2. Finish - Exposed Interior Surfaces: Decorative laminate.
   3. Finish - Concealed Surfaces: Laminate backing sheet.
   4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   5. Casework Construction Type: Type A - Frameless.
   6. Adjustable Shelf Loading: 50 lbs. per sq. ft.
      a. Deflection: L/144.
   7. Cabinet Style: Flush overlay.
   8. Cabinet Doors and Drawer Fronts: Flush style.
   9. Drawer Side Construction: Manufacturer's option.
   10. Drawer Construction Technique: As recommended by fabricator.

D. Fabrication:
   1. Finish - Exposed Exterior Surfaces:
      a. Standard
   2. Finish - Exposed Interior Surfaces:
      a. Standard laminate.
   3. Finish - Concealed Surfaces: Laminate backing sheet.
      4. Casework Construction Type: Type A - Frameless.
   5. Cabinet Doors and Drawer Fronts:
      a. Flush overlay style, square edge profile,3/4 inch thick with 1mm thin applied band.
   6. Adjustable Shelf Loading: 50 lbs. per sq. ft.
   a. Deflection: L/144.
   7. Drawer Sides, back and sub front Construction: Minimum ¾” thick particleboard, laminated with thermally fused melamine doweled and glued into sides. Top edge banded w/ 1mm PVC
   8. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
   9. All casework shall conform to the standards of the Architectural Woodworking Institute - Section 10 Casework, Custom Grade, Flush Overlay Design. All body members and tops shall be thickness as shown on the drawings or as specified herein, medium density fiberboard or plywood covered on the exposed side with decorative plastic laminate and unexposed side with laminate backing sheet. Wood veneer shall be glued to the particle board under pressure.
   10. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
   11. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
   12. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   13. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

E. Hardware: BHMA A156.9, types as indicated for quality grade specified.
   1. Shelf Brackets: 1/8" diameter steel pins that fit into predrilled holes in the cabinet sides. Pins to have a flattened exposed surface to support the shelf.
   2. Drawer and Door Pulls: Commercial grade standard.
   3. Cabinet Locks:
      a. Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
      c. Locations as indicated on drawings
   4. Catches: Magnetic.
   5. Drawer Slides:
      a. Type: Full extension.
      b. Static Load Capacity: Commercial grade.
      c. Mounting: Side mounted.

d. Stops: Integral type.
e. Features: Provide self-closing/soft close type.

6. Hinges: Commercial grade standard.
7. Stainless steel sink enclosure: ADA Stainless steel enclosure – Type 304, #4 finish, Inter Dyne Systems, Part ADSE-24 or approved equal.
8. Plumbing Shields: ADA shields – Wall mounted shield concealment to hide plumbing piping under tops, size to accommodate, Trueform Concrete or approved equal.

2.03 PANEL MATERIALS

A. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.

B. Particleboard: ANSI A208.1; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips, medium density, made with moisture resistant; of grade to suit application; sanded faces.

2.04 LAMINATE MATERIALS

A. Manufacturers:
1. Formica Corporation: www.formica.com.
2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.
3. Wilsonart International, Inc: www.wilsonart.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Plastic Laminate: In accordance with AWI Quality Standards Illustrated, 0.048 inch General Purpose quality; color, pattern, and gloss surface texture as selected.
1. Standard custom flush overlay spec
2. 3mm PVC edge banding on door and drawer edges
3. Concealed Hinges
4. Standard wire pulls
5. Display cabinets: Glass inserts in doors

C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications and as follows:
1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
4. Flame Retardant Surfaces: HGF, 0.048 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
5. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
6. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.05 COUNTERTOPS

A. Plastic Laminate: locations as indicated on drawings.
1. 3mm PVC edge banding on edges.
2. Backsplashes and sidesplashes.

B. Solid Laminated Surfacing: Economy quality hardwood; As selected by architect, plain sawn, exposed edge grain; laminated with waterproof adhesives; thickness as recommended by fabricator; suitable for transparent finish.
1. Solid Surface: locations as indicated on drawings.
a. Backsplashes and sidesplashes as indicated.
b. At vanities: solid surface aprons, pipe shield.

c. Window sills as indicated on drawings.

C Countertops shall be fabricated to the size and configuration shown on drawings.

D. Materials
1. Solid Surface Material (SSM)
a. Standard.

E. Edge Style: Square, eased edges

F. Back & Side Splash: Set-on style

G. Accessories
1. Adhesive:
a. Type as recommended by manufacturer.
2. Joint Sealer
a. Type as recommended by manufacturer.
3. Metal support concealed brackets: Rakks, EH-1818FM Surface Mount Countertop Support Bracket. Color: TBD

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

C. Field verify dimensions on site prior to fabrication

3.02 INSTALLATION

A. Cabinets
1. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
2. Use concealed joint fasteners to align and secure adjoining cabinet units.
3. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

B. Countertops
1. Install countertops 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.
2. Field Jointing: Where possible make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings. secure field joints with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches.
3. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
4. Anchor countertops securely to cabinets or other support framing.
5. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
6. Secure backsplashes to wall with adhesive.
7. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
8. Polish exposed undersurfaces of counters to match top finish.
9. Install enclosures and shields are required. See drawings, coordinate with Mechanical.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

C. Adjust joints to provide uniform surface appearance.

D. Repair or replace damaged work which cannot be repaired to architect’s satisfaction.

3.04 CLEANING

A. Clean casework, counters, window stools, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 06 82 13
FIBERGLASS REINFORCED WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary Wall Panels (FRP).

1.02 RELATED SECTIONS

A. Section 09 21 16 - Gypsum Board Assemblies.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's literature and installation instructions.

C. Samples: Submit samples for color selection.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

1.05 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Kemlite Company - Fire-X Glasbord

B. Nudo Products Company - Fiber-Lite LP-F9-FR.

C. Crane – Standard selection

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Sanitary Wall Panels shall be a fiberglass reinforced plastic panel with a Class A Surface Burning Characteristic as per ASTM E84. Panels shall be .09 inches thick with an embossed surface finish. Color as selected by Architect from manufacturer's standard line of colors.

B. **See Interior Finish Material Schedule, Architectural drawings.**

2.03 ACCESSORIES

A. Furnish edge trim that matches the panel color as required for a complete installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to which panels will be applied to determine that corners are plumb and straight, surfaces are clean and smooth. Fasteners shall be countersunk, joints and cracks filled and smooth with the adjoining surface.

B. Do not begin installation until backup surfaces are put into satisfactory condition.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Do all cutting with carbide tipped saw blades or drill bits, or with snips.

C. Install panels with manufacturer's recommended gap at panel joints.

D. Clean any adhesive or excessive sealant from panel face using solvent or cleaner as recommended by the panel manufacturer.

END OF SECTION

SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Board Insulation: Rigid insulation board used as protection board.

B. Section 31 23 23 - Fill.

1.03 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 DAMPPROOFING PRODUCTS

A. W.R. Meadows; Product Sealmastic Type I Spray Grade, Emulsion Type.

B. Other Acceptable Manufacturers:
   1. Karnak Chemical Corp - #100AF Non-Fibrated Emulsion Coating www.karnakcorp.com.
   2. Henry Company - 788 Premium Foundation Coating.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COLD ASPHALTIC MATERIALS

A. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

B. Spray-On Bitumen: Emulsified asphalt, ASTM D1187 Type I, and ASTM D1227, Type III Class 1 unreinforced (Type III).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items that penetrate surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

E. Fill voids, cracks and holes in concrete or masonry with cement mortar and allow to dry.

3.03 APPLICATION

A. Prime surfaces in accordance with manufacturer's instructions and allow to dry prior to application of dampproofing.

B. Apply bitumen by spray application.

C. Apply bitumen in one coat, continuous and uniform, at a rate of 2-3 gallons per 100 square feet.

D. Apply from 2 inches below finish grade elevation down to top of footings, including footing.

E. Seal items projecting through dampproofing surface with mastic. Seal watertight.

F. Coating shall be continuous and free of pinholes or holidays. Cover all slots, joints and grooves and apply into all chases and corners.

G. Allow coating to dry minimum of 48 hours prior to backfilling.

H. Place insulation protection board as specified in Section 07 21 00 directly over dampproofing prior to backfilling.

3.04 SCHEDULE

A. Foundation Wall at areas with no below grade occupancy. One coating of asphalt dampproofing.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at areas as required or as shown on drawings.

B. Batt insulation as required or as shown on drawings.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Separate air barrier and vapor retarder materials.

B. Section 07 84 00 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. R-value; 1 inch of material at 72 degrees F: 5, minimum.
   4. Board Size: 48 x 96 inch.
   5. Board Thickness: inches as shown on drawings.
   6. Board Edges: Square.
   7. Thermal Conductivity (R-Value): 5 per inch.
   8. Compressive Resistance: 25 psi.
   9. Water Absorption, maximum: 0.1 percent, volume.
   10. Manufacturers:
      a. Dow Chemical Co: Square Edge
      b. Owens Corning Corp: Foamular 250
      c. Greenguard: CM Insulation Board
      d. Minnesota Diversified Products Inc.: Certifoam.
   11. Substitutions: See Section 01 60 00 - Product Requirements.

B. Extruded Polystyrene Board Insulation (High Load): ASTM C 578, Type VI, Extruded polystyrene board with natural skin surfaces; with the following characteristics:
   1. Board Size: 48 x 96 inch.
   2. Board Thickness: as shown on drawings.
   3. Board Edges: Square.
   4. Thermal Conductivity (R-Value): 5 per inch.

5. Compressive Resistance: 40 psi.
6. Water Absorption, Maximum: 0.1 percent, volume.
7. Manufacturers:
    a. Dow Chemical Co.: High Load 40
    b. Owens Corning Corp: Foamular 400

2.02 BATT INSULATION MATERIALS

A. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
1. Batt shall equal R-25 in cavity as shown on drawings.
2. Thickness: as shown on drawings.
3. Facing: Unfaced.
4. Manufacturers:
    a. CertainTeed Corporation: High Performance Batt Insulation
    b. Johns Manville International, Inc: Unfaced Insulating Blankets
    c. Owens Corning Corp: Pink Fiberglass R-21 Thermal Insulation
    d. Guardian Fiberglass, Inc. - R-Best High Density Batts.

2.03 ACCESSORIES

A. Sheet Vapor Retarder: Specified in Section 07 25 00.

B. Insulation Fasteners: Fasteners for holding above grade foundation insulation to wall shall be expansion type anchors with integral plastic disc washers made specifically to hold insulation in place. Insulation fasteners shall be Styro Tapit Fasteners as manufactured by Styro Industries; P.O. Box 8098 Madison, WI 53708; www.styro.net; or equal.

C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION

A. Install boards.
1. Install in running bond pattern.
2. Butt edges and ends tightly to adjacent boards and to protrusions.
3. Install rigid as shown on drawings.
4. Support insulation as required until sufficient pressure of backfill will hold insulation in place without displacement.
5. Insulation shall be installed in parallel courses with end joints staggered. Joints shall be tightly butted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior stud wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Coordinate work of this section with requirements for vapor retarder specified in Section 07 25 00.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 21 17
PRE-ENGINEERED BUILDING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermal insulation, interior vapor barrier liner, and support strapping.

B. Thermal break materials.

C. Fasteners and sealants.

1.02 RELATED SECTIONS

A. Section 07 21 00 - Thermal Insulation: Related.

B. Section 13 34 19 - Metal Building Systems – Coordinate Silvercote system with metal building.

1.03 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

B. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials in Sheet Form (Procedure B) 2023.

C. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2023.

D. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

E. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

F. ASTM C 1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

1.04 PERFORMANCE REQUIREMENTS

A. Provide insulating system forming a continuous vapor barrier inside of building purlins, girts, and insulation to provide complete isolation from inside conditioned air.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's standard details and catalog data demonstrating compliance with referenced standards; preparation instructions and recommendations; storage and handling requirements and recommendations; and installation instructions.

C. Shop Drawings: Typical installation details illustrating relationship of insulating materials to surrounding construction.

D. Samples of insulation, liner fabric with extrusion welded seam, and painted steel support straps.

1.06 QUALITY ASSURANCE

A. Provide on-site training by manufacturer if requested, to ensure proper installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide materials in original manufacturer's packages.

B. Inspect materials for damage or shortage upon delivery.

C. Store products indoors and protect from moisture, construction traffic, damage, and theft.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide insulation manufacturer's warranty that the actual thermal performance of the insulation system will be equal to the specified insulation level when properly installed at specified thickness and sealed against air and water vapor infiltration. At the manufacturer's option, correct deficiencies of thermal performance or credit to Owner the percentage of the insulation system material cost equal to the percentage of the deficiency.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis of design in Silvercote Envelope Solutions Systems; Energy Savor FP.
   1. Phone: 844 232 3701
   2. https://www.silvercote.com/products/energy-saver-fp/

B. Substitutions: Not permitted.

2.02 MATERIALS

A. Insulation: Fiberglass blanket or batt complying with FS HH-I-558, Form B, Type I; with the following R-value and nominal thickness: To meet code.
   1. At Roof: See drawings.
   2. At Walls: See drawings.

B. Vapor Barrier Liner Fabric: Woven, reinforced, high-density polyethylene yarns coated on both sides with a continuous white or colored polyethylene film, as specified.
   1. Permeance of fabric and seams: 0.025 perms (1.43 ng/Pa s sq m).
   2. Flame Spread Index: Not more than 25, when tested in accordance with ASTM E 84.
   3. Smoke Developed Index: Not more than 50, when tested in accordance with ASTM E 84.
   4. Size and seaming: Manufactured in large custom pieces by extrusion welding from roll goods, and fabricated to substantially fit defined building area with minimum practicable job site sealing.
   5. Stapled seams not acceptable.
   6. Factory-folded to allow for rapid pull-out on strap support system.
   7. Color: White.

C. Vapor Barrier Lap Sealant: Fast tack solvent-based, synthetic rubber adhesive.

D. Vapor Barrier Patch Tape: Double stick sealant tape made from same material as liner fabric.

E. Thermal Breaks: 1/8 inch (3 mm) thick x 3 inch (75 mm) wide white, closed-cell polyethylene foam with pre-applied adhesive film and peel-off backing and polystyrene snap-on thermal blocks.

F. Straps: Woven polyester plastic.

G. Fasteners:
   1. For light gage steel: #12 x 3/4 inch (19 mm) plated Tek 2 screws, painted to match specified color.
   2. For heavy gage steel: #12 x 1-1/2 inch (38 mm) plated Tek 2 screws, painted to match specified color.
   3. For wood, concrete, other materials: As recommended by manufacturer.

H. Wall Insulation Hangers: "Fast-R" hangers.

I. Thermal Break: Standard.

2.03 MATERIALS

A. General: Energy Saver FP™ (OSHA-compliant leading edge fall protection) roof system fabric is installed under the roof secondary structure and is supported by a banding grid system. Unfaced glass mineral wool insulation is installed between and above the purlins in varying thickness combinations to obtain the desired insulating values.
   1. Insulation shall be Energy Insulated Ceiling and Wall System for buildings.
   2. All required installation hardware shall be provided as part of both roof and wall insulation system.

3. Woven HPDE scrim
    a. Coating 2.0 mil/1.25 mil average (47/29 g/m2/side)
    b. Color: White
    c. Weight 4.4 oz/yd2 (149g/m2) +/- 5 %
    d. Thickness Nominal 9 mil (0.22 mm) ASTM D1777

B. Roof:
1. Insulation for the ceiling shall meet the property requirements of Federal Specification HH-1-558C:
    a. The first insulation layer shall be Faced Metal Building Insulation faced with WMP-VRR. The composite product shall have a 25 flame spread rating and a 50 smoke developed rating as tested in accordance with ASTM E84. Facing shall have a perm rating of 0.02 (minimum) as tested in accordance with ASTM E96.
    b. The second insulation layer shall be Unfaced insulation, with a 25 flame spread rating and a 50 smoke developed rating as tested in accordance with ASTM E84.
2. Attaching hardware for roof insulation shall include:
    a. Galvanized lock seam roller tubes 72 inches long for attachment to the purlins for the purpose of supporting the faced insulation.
    b. Galvanized connectors for making end to end connection inside the roller tubes.
    c. Support clips, for support of the tubes.
    d. Bushing for the end of each span of tubes.
    e. Termination bar shall be supplied and shall be of extruded aluminum with baked on white enamel paint for installation at all points where the Faced Insulation will be screwed to the structure.

C. Walls:
1. Insulation for walls shall meet the property requirements of Federal Specification HH-1-558C.
    a. The first insulation layer shall be Faced Metal Building Insulation faced with WMP-VRR. The composite product shall have a 25 flame spread rating and a 50 smoke developed rating as tested in accordance with ASTM E84. Facing shall have a perm rating of 0.02 (minimum) as tested in accordance with ASTM E96.
    b. The second insulation layer shall be Unfaced insulation, with a 25 flame spread rating and a 50 smoke developed rating as tested in accordance with ASTM E84.
2. Attaching hardware for wall insulation shall include:
    a. Roller Tube, Connector, Clip, and Bushing assembly at eave of building to facilitate continuous Faced Insulation from roof to wall.
    b. Self-Drilling Metal Building Tek Screws with 1-1/4 inch plastic washer fastening wall insulation at girts.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure and building systems such as electrical conduit to be concealed are completed and approved.

B. Correct any unsatisfactory conditions before proceeding.

3.02 ROOF INSULATION INSTALLATION

A. Straps:
1. Cut straps to length and install in the pattern and spacings indicated on shop drawings.
2. Tension straps to required value.

B. Vapor Barrier Fabric:
1. Install vapor barrier fabric in large one piece custom fabricated pieces to substantially fir defined building areas with minimum practicable job site sealing.
2. Position pre-folded fabric on the strap platform along one eave purlin.
3. Clamp the two bottom corners at the eave and also centered on the bay.

4. Pull the other end of the pleat-folded fabric across the building width on the strap platform, pausing only at the ridge to fasten the straps and fabric in position where plane of roof changes and to release temporary fasteners on the opposite ridge purlin.
5. Once positioned, install fasteners from the bottom side at each strap/purlin intersection.
6. Trim edges and seal along the rafters.
7. All seams must be completely sealed and stapled seams not acceptable.

C. Insulation:
1. Unpack and shake to a thickness exceeding the specified thickness.
2. Ensure that cavities are filled completely with insulation.
3. Place on the vapor barrier liner fabric without voids or gaps.
4. Place top layer of insulation over and perpendicular to the purlins without voids or gaps, as roof sheathing is applied.

3.03 WALL INSULATION INSTALLATION

A. Insulation:
1. Install thermal break to exterior surface of girts as wall sheathing is applied.
2. Ensure that cavities are filled completely with insulation.
3. Cut insulation to required lengths to fit vertically between girts.
4. Neatly position in place and secure to hangers.
5. Fluff the insulation to exceed the specified thickness.

B. Vapor Barrier Fabric:
1. Apply the vapor barrier fabric by clamping it in position over eave strap.
2. Once in position, install fasteners through the eave strap into each roof strap, permanently clamping the wall fabric between them.

C. Straps: Install vertical straps along each column and 5 feet (1524 mm) on center, maximum, fastening to each girt to retain system permanently in place.

D. Seal wall fabric to the roof fabric, to the base angle, and up the columns.

3.04 ROOF INSULATION INSTALLATION

A. Install Roof insulation in accordance with the Energy Miser Insulated Ceiling System Installation Instructions.

B. All facing seams shall be sealed by folding over the facing and stapling a minimum of every 4 inches to ensure an integral vapor barrier. Any fabrication cuts or patches in facing shall also be stapled.

C. Pull faced insulation tightly and screw securely to eaves to minimize wrinkles and allow no more than 6 inches of sag between roller tubes spaced 10 - 12 feet apart.

D. Place back-fill insulation pieces on top of faced insulation.

3.05 WALL INSULATION INSTALLATION - ENERGY MISER SYSTEM

A. Install Wall insulation in accordance with the Energy Miser Insulated Wall System Installation Instructions.

B. Install screws in every girt every 12 inches horizontally.

3.06 CLEANING

A. Clean dirt and exposed sealant from the exposed vapor barrier fabric.

B. Remove scraps and debris from the site.

END OF SECTION

SECTION 07 21 19

FOAMED-IN-PLACE INSULATION – POLYICYNENE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.

B. Foamed-in-place insulation Polyicynene Spray Insulation at areas indicated on drawings and as necessary.

1.02 REFERENCE STANDARDS

A. Thermal Resistance: ASTM C518 - R-value 3.6 per inch thickness.

B. Water Vapor Transmission: ASTM E96 - 16 perms 941 ng.

C. Surface Burning Characteristics: ASTM E84:
   1. Flame Spread < 20.
   2. Smoke Development < 400.
   3. Fuel Contribution - 0.

D. ASTM D2863, Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-like Combustion of Plastics (Oxygen Index).

E. ASTM E90, Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

F. ASTM E283, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Differences Across the Specimen.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, and preparation requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention

D. Certificates: Certify that products of this section meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

C. Testing agency to monitor thickness and installation of product to meet requirements.

1.06 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this section.

1.07 PROJECT CONDITIONS

A. Sequence work to ensure timely placement of insulation within construction spaces.

1.08 FIELD CONDITIONS

A. Component A must be protected from freezing.

B. Component B can be frozen but must be protected from overheating (120 degrees F) and prolonged storage above 100 degrees F.

C. Component B separates during storage and should be mixed thoroughly prior to use.

D. Toxicity/Hazardous Materials:
   1. Outgassing/Reactivity:
      a. Formaldehyde: Products containing urea-formaldehyde will not be permitted.
      b. Chlorofluorocarbons (CFCs)/HCFCs: Products and equipment requiring or using CFCs or HCFCs during the manufacturing process will not be permitted.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation:
   1. Icynen, Inc.; Product The Icynene Insulation System; 5805 White Road, Suite 110, Mississauga, Ontario L4Z 2J1 Canada. Telephone 888-946-7325. Fax 905-890-7784. Web Site: www.icynene.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Polyicynene Spray Insulation: Icynene; hydrophobic, low-density, closed cell modified polyicynene; conforming to the following:
   1. Component A: Base Seal - Polyisocyanate MDI.
   2. Component B: Gold Seal - Resin.
   3. Thermal Resistance (R-Value/inch): ASTM C518; 3.6 hr/sq ft/degree F/BTU. In.
   4. Air Permeance (for 5.25 inches of material): ASTM E283; 0.0049 l/m2/second.
   5. Water Vapor Transmission (for 5 inches of material): ASTM E96; 10 perms.
   6. Sound Transmission Class (STC): ASTM E90; STC 37 in wood stud wall.
   7. Noise Reduction Coefficient (NRC): ASTM E90; NRC-0.7 in wood stud wall.
   8. Corrosion: No significant corrosion when in contact with steel under 85 percent relative humidity
   9. Bacterial or Fungal Growth: No growth; no material deterioration.

B. Insulation: phenolic based methylene linked synthetic polymers type.
   1. Thermal Conductivity: When tested in accordance with ASTM C 177:
      a. R-value @ 35 degrees F - 5.
      b. R-value @ 75 degrees F - 4.8
      c. Water Vapor Transmission: 15.9 - 16.9 perms, measured in accordance with ASTM C-355.
   2. Compressive Strength: 5 - 45 psi, when tested in accordance with ASTM D 1621.
   3. Density: 0.8 - 1.2 lb/cu ft, when tested in accordance with ASTM D 1622.
   4. Surface Burning Characteristics: Flame spread/Smoke developed index of 5 / 0, when tested in accordance with ASTM E 84.

C. Water Vapor Transmission: 15.9 - 16.9 perms, measured in accordance with ASTM C-355.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Overcoat: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

C. Verify that other work on and within spaces to be insulated is complete prior to application.

D. Notify Architect, in writing, of conditions that would adversely affect the application.

E. Beginning of installation means applicator accepts existing conditions.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Remove foreign materials, dirt, grease, oil, paint, laitance, efflorescence, and other substances that will affect application.

C. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation to a reasonably uniform monolithic density without voids.

C. Apply insulation to fill voids around accessible service and equipment penetrations.

D. Apply insulation to seal voids at ends to prevent wind scouring of ceiling insulation.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

B. Periodic construction observations of installed insulation for thickness.

END OF SECTION

SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vapor Retarders: Materials to make exterior walls and ceilings water vapor-resistant.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

C. Section 07 90 05 - Joint Sealers: Sealant materials and installation techniques.

D. Section 31 23 23 - Fill: Fill to be placed above and below vapor barriers associated with slab on grade construction.

1.03 DEFINITIONS

A. Weather Barrier: A combination of materials and accessories. Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

C. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2021a.

D. ASTM E 1745 - Water vapor retarder to be used in contact with soil or granular fill under concrete slabs; 2017.

E. ASTM E 154 - Water vapor retarder used in contact with earth under concrete slabs, walls or ground cover.

F. ASTM E 1643 - Installation of water vapor retarder used in contact with earth under concrete slabs.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, limitations, and information on all accessory products to be included for a complete installation.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Samples: Submit samples of materials to be used as vapor barrier, sample size shall be 6 inches square.

E. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 ADMINISTRATIVE REQUIREMENTS

A. After product has been selected, applicator or said contractor to comply with technical training by manufacturer for proper installation practices, etc.

B. Upon completion of the installation by the applicator. Product manufacturer to provide certification that all work has been done in strict accordance with the contract specifications and manufacturers requirements, an inspection shall be made by a Technical Representative of product(s) manufacturer to review the installed system.

C. Contractor shall provide written log with images of installation to Architect upon completion of system.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. System Warranty (only products purchased from manufacturer as a certified system are covered under the Warranty): Upon successful completion of the work to product representatives satisfaction and receipt of final payment, the weather barrier System Warranty shall be issued. Warranty shall be of manufacturers standard or as determined in coordination with owner.

C. Applicator Contractor Warranty: The Applicator shall supply the Owner with a separate workmanship warranty. In the event any work related to weather barrier system(s) is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to Owner. The Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to manufacturer.

D. Owner Responsibility: Owner shall notify both manufacturer and the Applicator of any leaks as they occur during the time period when both warranties are in effect.

1.08 QUALITY ASSURANCE

A. Vapor Permeability (Perm): Measure in accordance with ASTM E 96 Procedure E.

1.09 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Air Barrier:
   1. On outside surface of sheathing of exterior walls use air barrier sheet, mechanically fastened type or fluid applied as applicable.

B. Interior Vapor Retarder:
   1. On inside face of studs of exterior walls, under cladding, use mechanically fastened vapor retarder sheet.
   2. On bottom face of rafters, under cladding, use mechanically fastened vapor retarder sheet.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Manufacturers:
   1. DuPont Building Innovations; Tyvek Commercial Wrap D with Tyvek Fluid Applied Flashing - Brush Formulation, Tyvek Fluid Applied Flashing and Joint Compound, FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape: www.dupont.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Air Barrier Sheet, Mechanically Fastened:
   1. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 180 days of weather exposure.
4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
5. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.

2.03 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Wall and Ceiling Vapor Retarders shall be as manufactured by one of the following or approved equal:
   1. Raven Industries Inc. - Vapor Block 10; 1812 E. Ave., Sioux Falls, SD 57104; phone 800-635-3456.
   2. Reef Industries, Inc. - Type - 65; PO Box 750250, Houston, TX 77275-0250; phone 713-507-4200.
   3. Stego Industries LLC - Stego Wrap 10 mil Class C, 27442 Calle Arroyo, Suite A, San Juan, CA 92675; phone 877-464-7834.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Stud Walls and Truss Type Ceilings:
   1. Cross Laminated polyethylene meeting the requirements of ASTM E 1745, Class C and with the following minimum characteristics:
      a. Tensile Strength per ASTM E154, Section 9: 13.6 lbf/in.
      b. Puncture Resistance per ASTM D 1709, Method B: 475 grams.
      c. Permeance per ASTM E96: 0.045 perms.

2.04 ACCESSORIES

A. Furnish all sealants, sealing tapes, pipe boots and other accessories as required by the manufacturer for a complete installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive tapes, adhesives and sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
   4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
   5. Install air barrier and vapor retarder UNDER jamb flashings.

6. Install head flashings under weather barrier.
7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

E. Mechanically Fastened Sheets - Vapor Retarder On Interior:
1. When insulation is to be installed in assembly, install vapor retarder over insulation.
2. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, making air tight seal.
3. Locate laps at a framing member; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet.
4. Seal entire perimeter to structure, window and door frames, and other penetrations.
5. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.

F. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION

SECTION 07 42 14
INSULATED METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled metal panel system for walls, with trim, related flashings and accessory components.

B. Secondary sub-girt framing system, attached to building structural frame.

C. ALTERNATE BID: Bidder shall state the lump sum amount to be added to or deducted from the Base Bid to furnish and install Foamed Metal Faced Wall Panels as specified herein in lieu of the metal building wall panels as specified in Section 13 34 19 and as shown on the drawings.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers.

B. Section 13 34 19 - Metal Building Systems: Building framing system.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot-Plate Apparatus; 2019 with editorial revision (2023).

C. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016 (Reapproved in 2023).

D. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2020.

E. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

G. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design and size to withstand all dead loads and wind loads caused by positive and negative wind pressure acting normal to plane of panel.
   1. Verify structural performance in accordance with ASTM E330, using test pressure 1.5 times design wind pressure, with 10 seconds duration of maximum load.
   2. Design Wind Loads: Calculated in accordance with International Building code.

B. Movement: Accommodate the movement caused by the following without damage to system, components, or deterioration of seals:
   1. Normal movement between system components.
   2. Seasonal temperature cycling.
   3. Dynamic loading and release of loads.
   4. Deflection of structural support framing,
   5. Shortening of building concrete structural columns.
   6. Creep of concrete structural members.

C. Thermal Performance: Provide thermal resistance through entire system.

D. System Configuration:
   1. Accommodate tolerances of building structural framing.
   2. Provide continuity of thermal barrier at building enclosure elements.
   E. 3 hour rating or as shown, required per code.

F. Vendor responsible for fire rating assembly, floor to roof.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on assembled panel structural capabilities.

C. Shop Drawings: Indicate dimensions, panel profile and layout, spans, joints, construction details, and methods of anchorage.

D. Samples: Submit two samples of panel, illustrating finish color, sheen, and texture, for selection by Architect.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 3 years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store pre-finished material off ground with weather protection to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that could cause discoloration or staining.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion, including:
   1. Degradation of panel finish including color fading caused by exposure to weather.
   2. Failure of water tightness, loss of integrity of seals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of design – METL SPAN; Nucor Company

Lewisville, Texas Tel: 972.221.6656; Email: info@metlspan.com; Web: metlspan.com.

   1. Thermalsafe panels.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PANEL SYSTEM

A. Metal Panel System: Factory-assembled metal panel system, with trim, related flashings and accessory components.
   1. Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   2. Accommodate tolerances of building structural framing.
   3. Fire-Resistant-Thermal-Insulation-Core Metal Wall Panels: Structural metal panels consisting of exterior metal sheet with Santa Fe heavy embossing (currently not available in 43-inch width), Light Striated (currently not available in 43-inch width) or Ultra-Light Mesa profile 1/32-inch- (0.79-mm-) and interior metal sheet with Ultra-Light Mesa profile 1/32-inch- (0.79-mm-) deep, with structural mineral wool core factory-bonded during fabrication in thermally-separated profile, with tongue-and-groove panel edges designed to form weathertight seals, attached to supports using exposed or non-exposed fasteners.

B. Performance Requirements: To meet code.
   1. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E72 or ASTM E1592 applied in accordance with ICC AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:
    1. Wind Loads: Determine loads based on applicable building code, wind speed, importance factor, exposure category, and internal pressure coefficient indicated on drawings.
C. Wind Pressure: Certify capacity of metal panels by testing of proposed assembly.
    1. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/240 of the span with no evidence of failure.
D. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction. (UL currently not available in 43-inch width)
    1. The finished panel in an eight (8) inch thickness shall meet the requirements of a three (3) hour fire resistant rating for non-bearing wall listed at UL per design number U050 for US and design number W021 for Canada. Listed by Intertek for US and Canada per design number MSN/IMWP 180-01. (UL currently not available in 43-inch width)
    2. Testing for items 1, 2, 3, 4 and 6 were conducted in accordance with ASTM E119, CAN/ULC S101 and UL 263. (UL currently not available in 43-inch width)
    Fire window and fire door assemblies and penetration assemblies are available that maintain one- and two- hour fire-resistance ratings of wall panels.
    3. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
E. Surface-Burning Characteristics: The insulating core shall have been tested per ASTM E 84.
F. Wall Panels FM Approvals Listing: Comply with FM Approvals 4880. Provide metal wall panel assembly listed in FM Approvals' "Approval Guide." (currently not available in 43-inch width)
G. Combustibility of Core Material: Non-combustible when tested in accordance with ASTM E136.
H. Wall Panel Air Infiltration, ASTM E283:
    1. Maximum 0.04 cfm/sq. ft. (0.20 L/s per sq. m) at static-air-pressure difference of 12 lbf/sq. ft. (575 Pa).
I. Wall Panel Water Penetration Static Pressure, ASTM E331: No uncontrolled water penetration at a static pressure of 20 lbf/sq. ft. (958 Pa).
J. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.
K. Wall Panel Thermal Performance:
    1. Thermal Resistivity and Resistance (R-value) of mineral wool core indicated per ASTM C518 at 75 degree mean temperature.
    2. Heat Transfer Coefficient (U-factor) of panel assembly determined in accordance with one of the following:
        a. ASTM C1363 testing conducted at a mean temperature of 75 deg. F (24 deg. C) heat flow horizontal, utilizing test specimen of minimum 64 sq. ft. (5.9 m2) incorporating at least two side joints, and not including air films
        b. Finite element modeling in accordance with ASHRAE 90.1 Appendix A.

2.03 PANELS AND TRIM

A. Wall Panels: Exterior and interior metal sheet skin, factory-assembled, with foamed in place insulation; exterior and interior sheet interlocking at edges, fitted with continuous gaskets.
    1. Fire-Resistant-Thermal-Insulation-Core Metal Wall Panels: Structural metal panels consisting of exterior metal sheet with Santa Fe heavy embossing (currently not available

in 43-inch width), Light Striated (currently not available in 43-inch width) or Ultra-Light Mesa profile 1/32-inch- (0.79-mm-) and interior metal sheet with Ultra-Light Mesa profile 1/32-inch- (0.79-mm-) deep, with structural mineral wool core factory-bonded during fabrication in thermally-separated profile, with tongue-and-groove panel edges designed to form weathertight seals, attached to supports using exposed or non-exposed fasteners.

a. Basis of Design: Metl-Span, ThermalSafe.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150) prepainted by the coil-coating process per ASTM A 755/A 755M.

B. Internal and External Corners: Same material, thickness, and finish as exterior sheets; factory-fabricated mitered to required angles in one continuous piece with minimum 18 inch (450 mm) returns.

C. Trim, Closure Pieces, Expansion Joints, Caps, Flashings, Fascias, and Infills: Same material, thickness and finish as exterior sheets; factory-fabricated to required profiles; fabricated in longest practicable lengths.

2.04 PANEL MATERIALS

A. Precoated Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) or Forming Steel (FS), with G90/Z275 coating; continuous-coil-coated with acrylic primer coat, silicone polyester top coat, and polyester washcoat for panel back. Exposed Exterior Surfaces: Color as selected from manufacturer's standards. 26 Ga.

B. Foamed-in-Place Insulation: Urethane type.

C. Gaskets: Manufacturer's standard type suitable for use with panel system, permanently resilient; standard color.

D. Panel Sealants: Manufacturer's standard type suitable for use with installation of panel system; non-staining, skinning, non-shrinking, non-sagging.

2.05 ACCESSORIES

A. Subgirts: As required for system design.

B. Anchors: Galvanized steel.

C. Fasteners: Manufacturer's standard type to suit application; of hot-dip galvanized steel; fastener cap same color as exterior panel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panel system on walls in accordance with manufacturer's instructions.

B. Permanently fasten panel system to structural supports; aligned, level, and plumb, within specified tolerances.

C. Locate panel joints over supports.

D. Use concealed fasteners unless otherwise approved by Architect.

E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.02 TOLERANCES

A. Maximum Offset from True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch (6 mm).

3.03 CLEANING

A. Remove site cuttings from finish surfaces.

B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including coping, flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

C. Reglets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Wood Blocking and Curbing: Wood blocking for roof coping substrate profiles.

B. Section 07 90 05 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit samples illustrating metal finish color for selection by Architect.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 10 years of documented experience.

1.07 PRE-INSTALLATION CONFERENCE

A. Convene one week before starting work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum inch thick base metal, shop pre-coated with Kynar 500 coating, color as selected.

B. Coping and other metals exposed to view shall be 24 gauge hot dipped galvanized steel, G-90 commercial quality, extra smooth primed and finished one side with 70% Kynar 500 Based Fluoropolymer Coating 1.0 +/- 0.1 mil total dryfilm thickness. A wash coat of .3 - .4 mil dryfilm thickness shall be applied to the reverse side. Metal sheet stock shall be as manufactured by one of the following or approved equal:
   1. Berridge Manufacturing Company - Coil Stock
   2. Peterson Aluminum Corp. PAC- CLAD
   3. Metal Sales Manufacturing Corp. - Coil Stock
   4. Vincent Metals - Colorklad
   5. AEP Span - Sheet Stock
   6. Copper Sales, Inc. - UNA-CLAD
   7. McElroy Metal, Inc. - Flat Stock

2.02 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

D. Sealant to be Exposed in Completed Work: 1; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

E. Sealant: Type specified in Section 07 90 05.

F. Plastic Cement: ASTM D4586, Type I.

G. Reglets: Surface mounted type, of Kynar colored metal.

H. Solder: 1; Sn50 (50/50) type.

I. Louver Static Vents: GAF Master Flow, 60 sq. in. NFA galvanized slant back roof louver static vent.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, interlocking with sheet.

C. Form pieces in longest possible lengths, but not exceeding 10 feet.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

H. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

I. Fabricate copings to the size and shape as shown on drawings. No individual section of coping shall exceed ten feet in length. Copings shall be continuously held at their bottom edge with a keeper strip

J. Joints in coping shall be covered with a 6 inch wide cleat bent to the profile of the coping.

K. Metal counterflashing shall be the type of flashing locked in to the mortar joint by springlock action and tight to the wall at the bottom edge with Spring Action Contact fabricated to the size and configuration shown on drawings.

2.04 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

E. Install sheet metal coping and other metal exposed to view as shown on drawings using recognized sheet metal practices as per the Sheet Metal and Air Conditioning Contractors National Association, Inc. - Architectural Sheet Metal Manual.

F. Bottom edge of all coping shall be held in place with a continuous keeper strip.

G. Joints in coping shall be set in mastic and butted to allow for expansion. Joint shall be covered with a 6" wide cleat.

H. Joints in brick flashing shall be lapped a minimum of 3".

I. After metal coping, or flashing is in place, remove strippable film protection.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

C. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

D. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration.

C. Product Data: Provide data on product characteristics.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Certificate from authority having jurisdiction indicating approval of materials used.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the specified fire ratings when tested in accordance with methods indicated.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
   2. Current evaluation reports published by CABO, ICBO, or BOCA will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

2.02 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E814 that has F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and that meets all other specified requirements.

B. Manufacturer's:
   1. Fire stopping and fire safing products shall be UL or Warnock Hersey Rated Systems as manufactured by one of the following or approved equal:
      a. Rectorseal Corporation, Metacaulk
      b. Isolatek International, Cafco
      c. 3M
      d. The General Electric Company
      e. Nelson Firestop Products
      f. Hilti Construction Chemicals
      g. Tremco Construction Division
      h. United States Gypsum Company

2.03 MATERIALS

A. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.

B. Foam Firestopping: Single component foam compound.

C. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers.

D. Fiber Packing Material: Mineral fiber packing insulation.

E. Firestop Devices: Mechanical device with incombustible filler and sheet stainless steel jacket;

F. Intumescent Putty: Compound which expands on exposure to surface heat gain.

G. Firestop Pillows: Formed mineral fiber pillows

H. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authority having jurisdiction.

C. Install labeling required by code. All areas shall include with applicable information including product, UL ratings, date, installer, etc.

3.04 PROTECTION

A. Clean adjacent surfaces of firestopping materials.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 90 05
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 REFERENCE STANDARDS

A. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

B. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell); 2005 (Reapproved 2011).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Samples: Submit two samples, in size illustrating sealant colors for selection.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.05 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

A. Non-sag Urethane - Caulking compound shall be one-part polyurethane caulking compound, that meets or exceeds the requirements of Fed. Spec. TT-S-00230C. Compound shall be as recommended by the manufacturer for use without a paint finish and shall form a tough elastic film on the surface, but remain plastic underneath. It shall contain no ingredients which will stain masonry or corrode metals. Color of compound shall be as selected by the Architect. At the contractors option he may use two-part caulking compound of the same materials as those specified herein. Caulking compound shall be one of the following or approved equal:
   1. Mameco International - Vulkem 116 or 227
   2. Sika Chemical Co. - Sika-Flex 1a or 2c NS
   3. Sonneborne - Sonolastic NP1 or NP2
   4. Tremco - Dymonic or Dymeric
   5. Pecora - Dynatrol I or Dynatrol II
   6. PRC - Permapol RC1 or Permapol RC2
   7. Bostick - Chem-Calk 500
   8. May National Associates - Bondaflex PUR 25

B. Interior Silicone - Silicone sealant for joints along backsplash on counters, shelves, cabinets and plumbing fixtures shall be one of the following or approved equal:
   1. General Electric - Sanitary 1700
   2. Dow Corning - 786 Mildew resistant

3. May National Associates - Sil 100 WF

C. Self-Leveling Horizontal Urethane - Self Leveling caulking compound shall be self-leveling or slope grade Two-component Polyurethane Sealant for expansion and contraction joints in concrete floors, walks, paving and decks both interior and exterior, and joints in hard surface floor finish materials such as quarry tile, ceramic tile and terrazzo. Horizontal grade urethane shall remain flexible to -400, shall be abrasion resistant and resist deterioration caused by weather, stress, movement, traffic, water, oils, and road chemicals. Self-Leveling caulking shall be suitable for continuous water immersion. Self-Leveling Caulking shall be as manufactured by one of the following or approved equal:
   1. Sonneborn - SL 2 Sealant
   2. Pecora - Urexpan NR-300
   3. Tremco - THC-900/901
   4. Sika Chemical Co. - Sikaflex 2c SL
   5. Mameco International - Vulkem 245
   6. PRC - Permapol RC-2SL
   7. Bostick - Chem-Calk 550
   8. May National Associates - Bondaflex PUR 2 NS & SL

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width. Sub-caulking shall be one of the following or approved equal:
   1. Dow Chemical - Etha-Foam.
   2. Williams Products - Expand-O Foam.
   3. Grace Co. - Foam Joint Filler.
   4. Sonneborn - Sonofoam Closed Cell Backer Rod.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

H. Pre-compressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

3.06 SCHEDULE

A. Caulking and sealants specified under this Section shall be installed at the intersection of all dissimilar materials not mechanically or adhesively attached to each other, at the expansion and contraction joints of similar or dissimilar materials, and where it is necessary to provide a smooth transition between materials of differing shapes. The following list of areas to be caulked or sealed is intended as a general guide to this Contractor and does not relieve the contractor of providing caulking to all areas shown on the drawings and that fit the above definition:

1. Non-sag Urethane:
    a. Gypsum Drywall Control Joints as shown on drawings.
    b. Around the frames of Doors, Windows & Louvers - each exposed side.
    c. Vertical concrete, and masonry control and expansion joints.
    d. Under door thresholds - at the inside and outside edge of the threshold.
    e. Flashing reglet terminations.
    f. Where gypsum drywall intersects concrete, masonry, wood or other dissimilar material.
    g. Where exterior window sills intersect walls and window frames.
    h. Joints in vertical ceramic tile and other hard surface materials.
    i. All other Joints noted on Drawings as "Caulk" or "Sealant".
    j. All joints which meet the definition of paragraph "A" above.
2. Interior Silicone:
    a. Along Backsplash of Counters & Edges of Casework at Walls.
    b. Along the Edges of Plumbing Fixtures at Walls
    c. Along the edges, or as seating for Toilet Accessories.
    d. As a seating for sinks and other items mounted into countertops.
3. Self-Leveling Horizontal Urethane:
    a. Horizontal and sloped expansion joints in floors and decks.
    b. Horizontal and sloped expansion and control joints in interior hard surface flooring materials.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire rated hollow metal doors and frames.

C. Hollow metal frames for wood doors.

D. Thermally insulated hollow metal doors with frames.

E. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

C. Section 09 90 00 - Painting and Coatings: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2017.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

G. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.

H. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

I. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

J. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

K. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

C. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes installation requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door Products: www.cecodoor.com.
   2. Republic Doors: www.republicdoor.com.
   3. Steelcraft: www.steelcraft.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DESIGN CRITERIA

A. Requirements for All Doors and Frames:
   1. Standard conventional for commercial applications.
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Texture: Smooth faces.
   4. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   5. Galvanizing for Units in Wet Areas: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness
   6. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: N/A.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 3 - Heavy-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 16 gage, minimum.
   2. Core Material: Manufacturers standard core material/construction; styrene and in compliance with requirements.
   3. Door Thickness: 1-3/4 inch, nominal.
   4. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed; A-60) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
   5. Weatherstripping: Refer to Section 08 71 00.

B. Interior Doors, Non-Fire Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gage, minimum.

2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inch, nominal.

C. Interior Doors, Fire-Rated:
1. Grade: ANSI/SDI A250.8 (SDI-100); Level 1 - Standard-Duty, Physical Performance Level C, Model 1 - Full Flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
   a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
   b. Attach fire rating label to each fire rated unit.
3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch w.g. pressure at both ambient and elevated temperatures; with "S" label; if necessary, provide additional gasketing or edge sealing.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. General:
1. Comply with the requirements of grade specified for corresponding door.
   a. ANSI A250.8 Level 2 Doors: 14 gage frames.
   b. ANSI/SDI A250.8 (SDI-100), Level 2 and 3 Door Frames: 14 gage, 0.067 inch, minimum thickness. Exterior 14 gage, Interior 16 gage.
   c. Frames for Wood Doors: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100), Level 1, 16 gage, 0.042 inch, minimum thickness.
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
5. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

C. Exterior Door Frames: N/A.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed; A-60) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Weatherstripping: Separate, see Section 08 71 00.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

E. Interior Door Frames, Fire-Rated: Face welded type.
1. Fire Rating: Same as door, labeled.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

2.05 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

C. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.06 FINISHES

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

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Coordinate installation of hardware.

F. Coordinate installation of glazing.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

B. Hollow Metal Doors:
   1. Interior – 18 Gage
   2. Exterior – 16 Gage

C. Hollow Metal Frames:
   1. Interior – 16 Gage
   2. Exterior – 14 Gage
   3. Wood Door Frames – 16 Gage

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire rated and non-rated.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 71 00 - Door Hardware.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2016.

B. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

D. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

E. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

F. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

G. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Specimen warranty.

E. Samples: Submit two samples of door veneer, illustrating wood grain, stain color, and sheen.

F. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AWS Architectural Woodwork Standards, Section 9, Custom Grade.

B. Finish doors in accordance with AWS Architectural Woodwork Standards, Section 5.

1.06 REGULATORY REQUIREMENTS

A. Fire Door Construction: Conform to NFPA 252.

B. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

C. Smoke and Draft Control Doors : In addition to required fire rating, comply with air leakage requirements of UBC Std 7-2, Part II; with "S" label; if necessary, provide additional gasketing or edge sealing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.08 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Provide warranty for the following term:
   1. Interior Doors: Life of installation.

D. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors - Maple.

B. Veneer Doors, 5 Ply:
   1. Eggers Industries: www.eggersindustries.com.
   2. Marshfield Door Systems, Inc.
   3. VT Industries
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

A. All Doors: See drawings for locations and additional requirements.
   1. Quality Level: Custom Grade, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at all locations.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252 or UL 10B - Negative (Neutral) Pressure; Underwriters Laboratories Inc. (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
   3. Smoke and Draft Control Doors: Tested to ratings indicated on drawings in accordance with International Building Code; UL labeled if required by applicable code; provide gasketing as specified by listing.
   4. Wood veneer facing with factory transparent finish where indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

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

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Fabricate fire rated doors in accordance with UL requirements. Attach fire rating label to door.

D. Provide solid blocks at lock edge for hardware reinforcement.
   1. Provide solid blocking for other through bolted hardware.

E. Vertical Exposed Edge of Stiles - Veneer Faces: N/A.

F. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

G. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

H. Provide edge clearances in accordance with the quality standard specified.

I. Select doors to include integral blind system; manufacturers standard.

a. Blinds that are fitted between the two panes of glass in a double-glazed door.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
      b. Stain: stain color as selected by Architect.
      c. Sheen: Flat.

B. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm).
   1. Trim fire door height at bottom edge only, in accordance with fire rating requirements.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access door and frame units.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 – Rough Carpentry: Related.

B. Section 09 21 16 - Gypsum Board Assemblies: Openings in ceilings.

C. Section 09 90 00 - Painting and Coating: Field paint finish.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of all access door units.

PART 2 PRODUCTS

2.01 ACCESS DOOR AND PANEL APPLICATIONS

A. Access Doors, Interior:
   1. Size: 12 by 12 inches or as shown on drawings.

2.02 MANUFACTURERS

A. Wall and Ceiling Access Doors and Frame Units:.
   1. Acudor Products Inc.
   2. Karp Associates, Inc: Model KDW for gypsum board ceilings; Model DSC-210 for masonry wall applications with Recess for tile. www.karpinc.com.
   3. Nystrom, Inc., 1701 N.E. Madison Street, Minneapolis, MN 55413, (612) 781-3491, - Model NW for gypsum board ceilings;
   4. Williams Bros Corporation of America
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESS DOORS AND PANELS

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

2.04 WALL AND CEILING UNITS

A. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
   1. Material: Steel.
   2. Door Style: Single thickness.
   3. Energy efficient with insulated values.
   4. Pre-finished.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION

SECTION 08 36 13
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead sectional doors, electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2018.

C. ITS (DIR) - Directory of Listed Products; current edition.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

H. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, installation details.

C. Samples: Submit two panel finish samples, illustrating color and finish.

D. Operation Data: Include electrical control adjustments.

E. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Comply with applicable code for motor and motor control requirements.

C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

D. Maximum air leakage rate of .4 CFM/ft2 in accordance with ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf (75pa).

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Warranty: Include coverage for electric motor and transmission.

D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Clopay – 2 Types, Energy Series.
   1. Product: Clopay #3720 – vertical track.
   2. Product: Clopay #3720 – radius track.

B. Substitutions: Not accepted.

2.02 STEEL DOORS

A. Steel Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application. Metal/foam/metal sandwich panel construction, with EPDM thermal break and ship-lap design with rounded water channels. Units shall have the following characteristics:
   1. Door Nominal Thickness: 2 inches thick.
   2. Exterior Surface: Ribbed, textured.
   3. Exterior Steel: 25 gauge, hot dipped galvanized.
   4. End Stiles: 16 gauge with thermal break.
   5. Springs: High cycle, 75,000.
   6. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
      a. Insulation: Foamed-in-place polyurethane, bonded to facing.
   7. Exterior Finish: Factory finished with acrylic baked enamel; color as selected by Architect.
   8. Interior Finish: Factory finished with acrylic baked enamel; color as selected from manufacturers standard line.
   9. High Usage package required.
   10. Wind Load Design: ANSI/NAGDM 102 standards and as required by code.
   11. Weatherstripping: EPDM rubber tube seals fitted inside joints between sections. EPDM rubber bulb-type strip at bottom. Header seal and jamb weatherstripping.

2.03 COMPONENTS

A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.

B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.

D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

F. Head Weatherstripping: EPDM rubber seal, one piece full length.

G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

H. Glazed doors: conventional fabrication/installation.

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Insulation: Foamed-in-place polyurethane, bonded to facing. CFC-free and HCFC-free polyurethane, fully encapsulated.

2.05 SCHEDULE

A. Doors:
   1. Clopay Door #3720, 2" thick urethane core / vertical lift track / full vision windows, 1/2" insulated glass

2. Clopay Door #3720, 2" thick urethane core / 15" radius track / full vision windows, 1/2" insulated glass
3. Window Option: Aluminum full view (3200).

B. Color: Brown.

2.06 ELECTRIC OPERATION

A. Provide UL listed electric operator type as recommended by manufacturer for door conditions.

B. Electric Operators:
1. Mounting: Side mounted on cross head shaft.
2. Motor Enclosure:
3. 1/2 hp ; manually operable in case of power failure, transit speed of not less than 8 inches per second.
4. Motor Voltage: 120 volts, single phase, 60 Hz.
5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
6. Controller Enclosure: NEMA 250, Type 1.
7. Opening Speed: 12 inches per second.
8. Brake: Adjustable friction clutch type, activated by motor controller.
9. Manual override in case of power failure.
10. Refer to Section 26 05 83 for electrical connections.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
1. 24 volt circuit.
2. Surface mounted, at interior door jamb.
3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

E. Disconnect Switch: Factory mount disconnect switch in control panel.

F. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

G. Safety Sensors: Electronic eye type sensors mounted near the floor at each side of door, such that if the electric beam is interrupted the door will not close.

H. Transmitters for each opening: Quantity TBD.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 90 05.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.

B. Maximum Variation from Level: 1/16 inch.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Test sectional doors for proper operation without binding or distortion.

B. Adjust door assembly for smooth operation and full contact with weatherstripping.

C. Touch-up damaged coatings and finishes and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned.

3.06 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

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

B. Clean doors, frames and glazing.

C. Remove temporary labels and visible markings.

D. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass meeting Energy Code Requirements.

B. Aluminum frames.

C. Perimeter sealant.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers: Perimeter sealant and back-up materials.

B. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2024.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand the following load requirements without damage or permanent set, when tested in accordance with ASTM E 330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   1. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

B. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

C. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E 283.

D. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 2.86 lbf/sq ft.

E. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

F. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

G. System is required to have overall NFRC 100 system U-factor of of.29 or better and a NFRC 200 system SHGC of .45 or better, in addition, the glass entry doors need a NFRC system u factor of .77 or to meet Energy Codes compliance.

H. Storefront Thermal Performance: When tested in accordance with AAMA 507, AAMA 1503, and NFRC 100:
   1. Condensation Resistance Factor (CRFf): A minimum of 66

2. Thermal Transmittance Total System U Value: 0.29 BTU/HR/FT²/°F or less. (Zone 7)
3. Note: Thermal Performance for the glazed system as a whole will be affected by the characteristics of the glass specified and percentage of vision area.

I. Entrance Thermal Performance: When tested in accordance with AAMA 507, AAMA 1503, and NFRC 100:
1. Condensation Resistance Factor (CRFf): A minimum of 56
2. Thermal Transmittance Total System U Value: 0.77 BTU/HR/FT²/°F or less. (Zone 7)

*Zone 7 MN codes require 0.63 BTU/HR×FT²×F° or less for entrance doors.
3. Note: Thermal Performance for the glazed system as a whole will be affected by the characteristics of the glass specified and percentage of vision area.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

C. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

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

1.08 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.10 PROJECT CONDITIONS

A. Coordinate the work with installation of firestopping components or materials.

1.11 FIELD CONDITIONS

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

1.12 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Basis of design is Old Castle.

*Products to meet MN energy code requirements.
1. Kawneer North America; Product with Trifab II VG 451UT Framing System Insulclad 560 Wide Stile; Product with Trifab II VG 451UT Framing System: www.kawneer.com.

2. Oldcastle Building Envelope; Product Series WS-500T Doors with FG-3000XT Frame: www.oldcastlebe.com.
3. Tubelite; Product Thermal Block Wide Style with Series TU 14000 I/O Framing.
4. YKK AP; Product Megatherm 50XT Doors with YES 45 XT Framing.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Position: Front set.
a. Not required to be double thermal, but is required to meet Energy Code specified requirements.
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
3. Finish: Superior performing organic coatings.
a. Factory finish all surfaces that will be exposed in completed assemblies.
b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, double thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system. Required to meet Energy Code.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.
3. Thermal spacers.
4. Cross-Section: 1 ¾” x 4-1/4” inch nominal dimension or as shown on drawings.

B. Swing Doors: N/A.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Perimeter Sealant: Type as specified in Section 07 90 05 or as per manufacturer.

D. Glass: As specified in Section 08 80 00 for reference. Storefront supplier to supply related glazing for respective system.

E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 FINISHES

A. Dark bronze anodized.

2.06 HARDWARE

A. Door Hardware: N/A.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce components internally for door hardware and door operators.

G. Reinforce framing members for imposed loads.

H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in caulking bead each edge and secure. Caulking as specified in Section 07 90 05.

J. Install glass and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

K. Install perimeter sealant in accordance with Section 07 90 05.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.04 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.05 PROTECTION

A. Protect installed products from damage during subsequent construction.

B. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

C. Protect finished work from damage.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 CONDITIONS

A. Conditions of the contract (General and Supplementary Conditions) and Division 01 - General Requirements, govern the work of this section.

B. This section includes all material, and related service necessary to furnish all finish hardware indicated on the drawings or specified herein.

C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.

D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

1.2 WORK INCLUDED

A. This section includes the following:

1. Furnish door hardware (for hollow metal, wood) specified herein, listed in the hardware schedule, and/or required by the drawings.
2. Thresholds and Weather-stripping.
3. Electro-Mechanical Devices

B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

C. Systems to meet owners requirements.

1.3 RELATED WORK IN OTHER SECTIONS

A. This section includes coordination with related work in the following sections:

1. Division 08 Section "Hollow Metal Doors and Frames".
2. Division 08 Section "Wood Doors"

1.4 REFERENCES

A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.

1. DHI – Installation Guide for Doors and Hardware (2020).
2. NFPA 80 - Standards for Fire Doors and Windows.
3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
4. UL - Building Material Directory.
5. DHI - Door and Hardware Institute
6. WHI - Warnock Hersey
7. BHMA - Builders Hardware Manufacturers Association
8. ANSI – American National Standards Institute
9. ANSI ICC500 – Standard for the Design and Construction of Storm Shelters)
10. IBC - International Building Code 2018 Edition (as adopted and amended by local building code)

1.5 SUBMITTALS

A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 01 - General Requirements.

B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:

1. Door number, location, size, handing, and rating.
2. Door and frame material, handing.
3. Degree of swing.
4. Manufacturer
5. Product name and catalog number
6. Function, type and style
7. Size and finish of each item
8. Mounting heights
9. Explanation of abbreviations, symbols, etc.
10. Numerical door index, indicating the hardware set/ group number for each door.

C. When universal type door closers are to be provided, the schedule shall indicate the application method to be used for installation at each door: (regular arm, parallel arm, or top jamb).

D. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC), or certified Door Hardware Consultant (DHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed or stamped with the DHI certification seal of the supervising AHC or DHC. The supervising AHC or DHC shall attend any meetings related to the project when requested by the architect.

E. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.

F. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or in compatible items, and proposed substitutions in the hardware schedule.

G. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.

H. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 01 - General Requirements.

I. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.

J. Furnish with first submittal, a list of required lead times for all hardware items.

K. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 01 - General Requirements.

L. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.

M. Furnish necessary diagrams, schematics, systems as required by related trades.

N. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner’s representative to determine keying requirements. Upon completion of initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute’s publication “Keying Procedures, Systems, and Nomenclature”. Submit copies of owner approved key schedule for review and field use in quantities as required by Division 01 - General Requirements. Wiring diagrams shall be included in final submittals transmitted for distribution of field use.

1.6 QUALITY ASSURANCE

A. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division 01 - General Requirements.

B. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the architect.

C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to ensure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.

E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.

F. Hardware supplier shall be factory trained and certified by the manufacture to provide and support all computer managed locks and system components.

G. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years' experience in successful completion of projects similar in size and scope.

H. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.

I. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.

J. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.

1.7 DELIVERY, STORAGE AND HANDLING

A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.

B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.

C. Coordinate with contractor prior to hardware delivery and recommend secure storage and protection against loss and damage at job site.

D. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receipt of material at the job site.

E. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

1.8 PRE-INSTALLATION MEETING

A. Schedule a hardware pre-installation meeting on site to review and discuss required door operating clearances and the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.

B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturers representatives for above hardware items, and any other effected subcontractors or suppliers.

C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.9 WARRANTY

A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division 01 - General Requirements.

B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

PART 2 - PRODUCTS

2.1 FASTENERS

A. All exposed fasteners shall be Phillips head or as otherwise specified and shall match the finish of the adjacent hardware. All fasteners exposed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.

B. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.2 BUTT HINGES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Stanley	Hager	McKinney
1. Standard Weight, Plain Bearing	5PB1	F179	****	T2714
2. Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714
3. Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
4. Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
5. Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.1 (2006). Hinges shall meet or exceed the following ANSI grade requirements as indicated below:

1. Standard Weight, Plain Bearing Hinges: Grade 3
2. Standard Weight, 2 Ball Bearing Hinges: Grade 2
3. Heavy Weight, 4 Ball Bearing Hinges: Grade 1

C. Unless otherwise specified, furnish the following hinge quantities for each door leaf.

1. 3 hinges for doors up to 90 inches.
2. 1 additional hinge for every 30 inches on doors over 90 inches.
3. 4 hinges for Dutch door applications.

D. Unless otherwise specified, top and bottom hinges shall be located as specified in Division 08 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.

E. Unless otherwise specified, furnish hinge weight and type as follows:

1. Standard weight: plain bearing hinge 5PB1 or ball bearing hinge 5BB1 for interior openings through 36 inches wide without a door closer.
2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.

3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
4. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.
5. Heavyweight: 4 ball bearing hinge 5BB1HWss 5" for all exterior doors or 4 ball bearing hinge 5BB1HW 5" for interior doors, that have an automatic operator.

F. At existing frames receiving new hinges, match existing hinge size and weight.

G. Unless otherwise specified, furnish brass, bronze, or stainless-steel base metal for hinges at exterior doors. Unless otherwise specified, furnish steel base metal for hinges at interior and labeled doors.

H. Furnish stainless steel base metal for hinges at showers, pools, and wash bay doors.

I. Unless otherwise specified, furnish hinges in the following sizes:

1. 5" x 5" 2-1/4" thick doors
2. 4-1/2" x 4-1/2" 1-3/4" thick doors
3. 3-1/2" x 3-1/2" 1-3/8" thick doors

J. Furnish hinges with width to accommodate trim and allow for 180-degree swing.

K. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior, and out-swinging lockable interior doors.

L. Unless otherwise specified, furnish all hinges to template standards.

2.3 CONTINUOUS PIN AND BARREL HINGES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Markar	Stanley
1. Edge Mount Pin & Barrel Stainless Steel Continuous Hinge	700 Series	300 Series	650 Series

B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.26, Grade 1 (2012).

C. Continuous hinges shall be full height pin and barrel type hinge providing full height door support up to 600 lbs. Edge mount (unless noted otherwise).

D. Construct hinges of heavy-duty 14-gauge material. The stainless internal pin shall have a diameter of 0.25 and the exterior barrel diameter of 0.438.

E. Hinge shall be non-handed with symmetrical template hole pattern and factory drilled. Hinge must accept a minimum of 21 fasteners on the door and 21 fasteners on the frame.

F. Each knuckle to be 2 inches, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.

G. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours.

H. Provide machine screws for doors which have been reinforced to accept machine screws.

I. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.

J. Provide adjusting screws equal to Ives "Adjust-a-Stud" for continuous hinges specified as 705. Adjustment to be able to correct frame fit problems up to 3/8 inch.

2.4 FLUSH BOLTS AND DUST PROOF STRIKES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Trimco	Hager
1. Dust Proof Strike	DP2	3910	280X
2. Auto Flush Bolt (Metal Door)	FB31P	3810	292D
3. Auto Flush Bolt (Wood Door)	FB41P	3815L	291D
4. Constant Latching Bolt (Metal Door)	FB51P	3820	293D
5. Constant Latching Bolt (Wood Door)	FB61P	3825L	294D
6. Manual Flush Bolt	FB458	3915	282D

B. Unless otherwise specified, provide 12" rods for manual flush bolts for door 7'6" or less, 24" top rods for doors over 7'6" to 8'6".

C. Unless otherwise specified, provide doors over 8'6" with automatic top bolts.

D. Provide automatic flush bolts where required to maintain fire door listing and or egress requirements on pairs of doors.

E. All flush-bolt applications shall be UL listed to be installed with top flush-bolt only. Provide auxiliary fire bolt as required for fire rated openings where less bottom bolt has been specified.

F. Provide all bottom flush bolts with non-locking dust proof strikes.

2.5 EXIT DEVICES

A. Acceptable manufacturers and respective catalog numbers:

	Von Duprin	Falcon	Corbin
1. Wide Stile, Push Pad	99 Series	25 Series	ED5000-M110 Series
2. Wide Stile, Electric Latch Retraction	QEL 99 Series	MEL 25 Series	ED5000S-MELR-M110 Series
3. Lever Trim	996 Series	510L / 511L Series	900 Series
4. Pull Trim	990 Series	512 Series	1300 Series

B. Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3, Grade 1 (2008).

C. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.

E. Quiet Electric Latch Retraction shall be accomplished using a motor driven assembly, and shall incorporate the following features:

1. Motor shall retract both the push pad assembly and latchbolt.
2. Automatic calibration of latch throw and pull.
3. Built-in time delay.
4. On-board installation and troubleshooting diagnostics built into power supply and device.
5. Retry mode if device does not pull on the first try.

F. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.

G. All exit devices shall be provided with flush end caps to reduce potential damage from impact.

H. All exit devices shall be provided with dead-locking latch bolts to ensure security.

I. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.

J. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.

K. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.

L. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)

M. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.

N. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.

O. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.

P. Provide Von Duprin #154 or equivalent mullion/frame stabilizers at the following application(s):

1. Lockable exterior or vestibule paired openings with a fixed or removable hollow metal or aluminum mullion.
2. Lockable exterior or vestibule single doors in aluminum frames.

2.6 LOCKS AND LATCHES

A. Acceptable manufacturers and respective catalog numbers:

	Schlage	Corbin
1. Grade 1 Mortise	L Series 17A	ML2000 PSA
2. Grade 2 Cylindrical	ALX Series SPA	CL3800 PZD

B. Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2011). Mortise locks shall be independently certified by ANSI for compliance with ANSI A156.13 (2012).

C. Minimize transmission of heat to lock trim. Provide temperature control modules (TCM) on all electrified locks when cataloged by the lock manufacturer.

D. Unless otherwise specified, all locks and latches to have:

1. 2-3/4" Backset
2. 1/2" minimum throw latchbolt
3. 1" throw deadbolt
4. 6 pin cylinders
5. ANSI A115.2 strikes

E. Provide guarded latch bolts for all locksets, and latch bolts with throw to maintain fire rating of both single and paired door assemblies.

F. Provide strike with lip length adequate to clear surrounding trim.

G. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

H. Provide Von Duprin #154 or equivalent mullion/frame stabilizers at the following application(s) unless provided with deadbolt:

1. Lockable exterior or vestibule paired openings with a fixed or removable hollow metal or aluminum mullion.
2. Lockable exterior or vestibule single doors in aluminum frames.

I. Bolt code systems: Unican manual code by number system. Mechanical pushbutton lock, keyless at select doors. See schedule.

2.7 PULLS, PUSH BARS, PUSH/PULL PLATES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Burns	Trimco
1. Straight Pull (1" dia., 10" CTC)	8103-0	26C	1195E-2
2. Straight Pull (3/4" dia., 8" CTC)	8102-8	25B	1194E-2
3. Offset Door Pull (1" dia., 10" CTC)	8190-0	39C	1191-3
4. Offset Pull (1" dia., 18" CTC Pull)	8190-18	39G	1191E-5

5.	Push-Bar (1” dia., 10” CTC Pull)	9100	422	1741E
6.	Pull / Push-Bar (1" dia., 10" CTC Pull)	9103-0	422 x 26C	1731EG
7.	Offset Pull / Push-Bar (1" dia., 10" CTC Pull)	9190-0	422 x 39C	1737
8.	Offset Pull / Push-Bar (1” dia., 18” CTC Pull)	9190-18	422 x 39G	1739
9.	Push Plate (.050 4"X 16")	8200 4 x 16	54	1001-3
10.	Push Plate (.050 6"X 16")	8200 6" X 16"	56	1001-9
11.	Pull Plate (1" dia., 10" CTC - .050" X 4" X 16")	8303-0 4" X 16"	5426C	1018-3B
12.	Ladder Pull (1” dia., flat tip)	9266F	VP4241	AP410
13.	Flush Pull	960	459C	1115

B. Adjust dimensions of push plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, push plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled 4 sides and counter sunk.

C. Where required on wide stile doors, install straight pull offset of cylinder to allow for access to cylinder.

D. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

2.8 COORDINATORS

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Trimco	Hager
1. Bar Coordinator	COR x FL	3094	297D x 297F
2. Mounting Bracket	MB Series	3095/3096	297 Series

B. Provide coordinators at all pairs of doors having automatic flush bolts and closers on the inactive leaf, and for pairs of doors having vertical rod/mortise exit device combinations with overlapping astragals.

C. Provide appropriate filler bars, closer mounting brackets, carry bars, and special top latch preparations as required by adjacent hardware.

2.9 CLOSERS

A. Acceptable manufacturers and respective catalog numbers:

	LCN	Norton
1.	4050A / 4050A EDA	R7500 / PR7500

B. Door closers shall be independently certified by ANSI for compliance with ANSI A156.4, Grade 1 (2013).

C. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. Provide extra heavy-duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.

E. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.

F. Closers shall use aluminum cylinders.

G. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.

H. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.

I. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.

J. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.

K. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.

L. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.

M. Door closers shall be provided with a powder coat finish to provide superior protection against the effects of weathering. Powder coat finish shall successfully pass a 100-hour salt spray test.

N. Provide adjustment by microprocessor control for:
   1. Opening speed.
   2. Backcheck.
   3. Hold-open, from 5 to 30 seconds.
   4. Closing speed.
   5. Opening force.
   6. Acceleration during opening and recycling, for soft start.
   7. Door will safely stop and reverse if an object is encountered in the opening or closing cycle.

O. Operator equipment shall be completely electromechanical and include the following features:
   1. Close and center door against stop after each cycle, and hold against drafts, winds and stack pressure.
   2. Manual opening force: 14 lb-force (62 N) maximum.
   3. Closing force: 6 lb-force (26.6 N).
   4. Factory-set door hold-open voltage.
   5. Control box and motor/gear box shall be contained in protective housing; utilize precision-machined gears and bearing seats, all-weather lubricant, and shall be mounted on vibration isolators.
   6. Gears shall be manufactured by operator manufacturer specifically for operators.
   7. Motor shall consist of a DC permanent magnet motor with shielded ball bearings. Motor shall stop when door stops or is fully open and when breakaway is operated.
   8. Door operating arm shall be fabricated from forged steel and attached at natural pivot point of door. Do not use slide block in top of door.
   9. Exposed arms shall be factory-polished and finished to match operator enclosure.
   10. Control circuits for actuators and safeties shall be low-voltage, NEC Class II.
   11. Power operators will require 115 VAC power supply.

P. Enclosure shall consist of a extruded aluminum header concealing all operating parts except arms and manual control switches.

Q. Exterior switches shall be weather resistant and mount on a single gang electrical box furnished by Division 26.

R. Power Operators shall be warranted by the manufacture to be free from defects in material and workmanship for a period of two years.

2.10 OVERHEAD STOPS

A. Acceptable manufacturers and respective catalog numbers:

	Glynn-Johnson	Rixson	Sargent
1. Heavy Duty Surface Mount	GJ900 Series	9 Series	590
2. Heavy Duty Concealed Mount	GJ100 Series	1 Series	690

B. Unless otherwise specified, furnish GJ900 series overhead stop for hollow metal or 1-3/4" solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4" solid core doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.

C. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.

D. Do not provide holder function for labeled doors.

2.11 WALL STOPS AND HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Trimco	Burns
1. Wrought Convex Wall Stop	WS406CVX	1270CX	570
2. Wrought Concave Wall Stop	WS406CCV	1270CV	575

B. Furnish a stop or holder for all doors.

C. Provide concave style wall stop at all adjacent integral push button locks; provide convex style wall stop at all other locations.

D. Where wall stops are not applicable, furnish overhead stops.

E. Furnish floor stops or hinge pin stops only where specified in hardware sets.

F. Do not provide holder function for labeled doors.

2.12 WEATHERSTRIP, GASKETING

A. Acceptable manufacturers and respective catalog numbers:

	Zero	Pemko	NGP	Reese
1. Weatherstrip	429	2891_PK	700NA	755
2. Adhesive Gasket	188	S88	5050	797
3. Mullion Seal/Silencer	8780	5110	5100N	628
4. Meeting Edge Seals	8193	18041	9605	959
5. Adhesive Edge Seal	****	S771	5060	****
6. Automatic Door Bottom (Surface Mtd.)	321	4131	222	320
7. Automatic Door Bottom (HD Concealed) (When Sealing Against A Solid Surface)	360	434_RL	423N	430
8. Automatic Door Bottom (HD Concealed) (When Sealing Against Carpet)	360	434_NBL	683	943
9. Automatic Door Bottom (Concealed)	355	420APKL	320N	****
10. Sweep (Brush)	8192	18061_NB	B606	964
11. Sweep (Neoprene)	39	315_N	200N	323
12. Sweep w/ drip	8198	345_N	C627	354
13. Drip Cap	142	346	16	R201

B. Weatherstrip and gasketing shall be independently certified by ANSI for compliance with ANSI A156.22 (2005).

C. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.

D. Provide weatherstripping all exterior doors and where specified.

E. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.

F. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.

G. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.13 THRESHOLDS

A. Acceptable manufacturers and respective catalog numbers:

	Zero	Pemko	NGP	Reese
1. Saddle Thresholds	8655	171	425	S205
2. Half Saddle Thresholds	1674	227	324	S239
3. Interlocking Threshold	74A	114	442-5	T550
4. ¼" Saddle Thresholds	63	151	411	S263

B. Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2001).

C. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to ensure a smooth transition between threshold and interior floor finish.

D. Threshold Types:

1. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
2. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

2.14 FINISHES AND BASE MATERIALS

A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals (steel-based at labeled doors) as specified in the following finish schedule:

HARDWARE ITEM	BHMA FINISH AND BASE MATERIAL
1. Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
2. Butt Hinges: Interior or Ferrous	652 (US26D - Satin Chromium on Steel)
3. Continuous Hinges	630 (US32D - Satin Stainless Steel)
4. Flush Bolts	626 (US26D - Satin Chromium)
5. Exit Devices	626 (US26D - Satin Chromium)
6. Locks and Latches	626 (US26D - Satin Chromium)
7. Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
8. Coordinators	600 (Prime painted or mill alum.)
9. Closers	689 (Powder Coat Aluminum)
10. Protective Plates	630 (US32D - Satin Stainless Steel)
11. Overhead Stops	630 (US32D - Satin Stainless Steel)
12. Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
13. Thresholds	719 (Mill Aluminum)
14. Weather-strip, Sweeps Drip Caps (wood and hollow metal doors)	Aluminum Anodized
15. Weather-strip, Sweeps Drip Caps (aluminum doors)	Match finish of aluminum doors.
16. Magnetic Holders	689 (Powder Coat Aluminum)
17. Magnetic Locks	628 (US28)
18. Miscellaneous	626 (US26D - Satin Chromium)

2.15 KEYING

A. Acceptable manufacturers and respective catalog numbers:

	Schlage	Corbin
1. Everest	29	Access

B. Provide all locks and cylinders utilizing a patented keyway to prevent manufacturing and distribution of aftermarket key blanks by anyone other than factory authorized dealers.

C. All locks under this section shall be keyed as directed by the owner to a new Restricted Patented Grand Master Key System.

D. Keying shall be by lock manufacturer where permanent records shall be kept.

E. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.

F. Furnish a total of 10 construction keys. Furnish a total of 2 construction control keys.

G. Furnish a minimum of 2 permanent control keys. Actual number to be determined by owner during keying meeting.

H. Master keys, control keys to be delivered by registered mail to the owner. Change keys shall be delivered in a set up key cabinet. Construction keys shall be delivered to the contractor.

2.16 KEY CABINETS

A. Acceptable manufacturers and respective catalog numbers:

	Lund	Key Control	Telkee
1.	1200-1205 AA	M228-2480	RWC-AWC

B. Furnish 1 each model 1200 or 1205 AA key cabinet with a capacity 1.5 times the number of key sets.

C. Provide one key cabinet with at least one hook for each key set, plus additional hooks for 50% expansion.

D. Furnish key cabinet complete with cam lock, permanent key tags, and change key cards.

E. Hardware supplier shall prepare all key change index records, tag all keys and place permanent file keys in cabinet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, installer shall examine door frame installation to ensure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

3.2 INSTALLATION

A. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.

B. Shim doors as required to maintain proper operating clearance between door and frame.

C. Install all hardware in accordance with the approved hardware schedule and manufacturer’s instructions for installation and adjustment.

D. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Provide blocking or reinforcement for all hardware mounted to drywall construction, including wall mounted door stops and holders.

F. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.

G. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.

H. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute (TDH-007-20).

I. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.

J. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

K. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.

L. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.

M. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.

N. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.

O. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.

P. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.

Q. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.

R. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.

S. Adjust spring power of door closers to the minimum force required to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to ensure opening force does not to exceed 5 lbs.

T. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.

U. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel arm door closers, exit devices, etc., as required to accommodate weatherstripping.

V. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.

W. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water-resistant seal.

X. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.3 FIELD QUALITY CONTROL

A. After installation has been completed, the hardware supplier and manufacturers representative for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware representative shall submit a list of all hardware that has not been installed correctly.

B. After installation has been completed, the hardware supplier and manufacturers representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

3.4 ADJUSTMENT AND CLEANING

A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication recommended by the manufacturer.

B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

3.5 HARDWARE SCHEDULE

A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

Group 1: Exterior Garage Doors. 100A 100B 108A
Butts: 2 pair
Latchset: passage function, F-75
Lock: Deadbolt Lock with keypad deadbolt
Closer with stop
Weatherstrip
Threshold

Group 2: Exterior Community Doors. 105 109
Butts: 2 pair
Panic Device; night latch function (with keypad opening if possible), ANSI F08
Exterior Trim: key outside locks/unlocks door handle trim
Closer with stop
Weatherstrip
Threshold

Group 3: Storage Rooms. 101 102 107
Butts: 1 1/2 pair
Lockset: Latchset storage room function, keyed, ANSI 86
Overhead stop

Group 4: Storage Rooms (Pair of Doors) 112
Butts: 1 1/2 pair
Active Leaf: Latchset; storage room function, keyed, ANSI 86
Inactive Leaf: surface floor and head bolts, flush bolt.

Group 5: Office. 110
Butts: 1 1/2 pair
Latchset: Office room function, keyed, F82
Wall stop

Group 6: Toilet Rooms. 106 108 103
Butts: 1 1/2 pair
Latchset: Privacy function, thumb turn used/not used indicator, F76
Wall stop

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 – Hollow Metal Doors and Frames: Glazing.

B. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished by storefront manufacturer; shall meet state Energy Compliances.

1.03 REFERENCE STANDARDS

A. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

C. ASTM C1036 - Standard Specification for Flat Glass; 2021.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

E. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

F. GANA (GM) - GANA Glazing Manual; 2022.

G. GANA (SM) - GANA Sealant Manual; 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

B. All glazing to meet energy code requirements.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, and special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLASS MATERIALS

A. Float Glass Manufacturers:

1. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.

2. Guardian Industries Corporation: www.guardian.com.
3. Pilkington North America Inc: www.pilkington.com/na.
4. PPG Industries, Inc: www.ppgideascapes.com.
5. Visteon Glass Systems: www.visteon.com/floatglass.
6. Viracon.
7. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Float Glass: Provide float glass based glazing unless noted otherwise.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
3. Tinted Types: ASTM C1036, Class 2 - Tinted, color and performance characteristics as indicated.
4. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

C. Clear Float Glass: Clear, annealed.
1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
2. Comply with ASTM C 1048, Condition A uncoated, Type I, transparent flat, Class 1, Quality q3 glazing select.
3. 1/4 inch thick.

D. Safety Glass: Clear; fully tempered with horizontal tempering.
1. Comply with ASTM C 1048, Condition A uncoated, Type I, transparent flat, Class 1, Quality q3 glazing select.
2. Comply with ANSI Z97.1.
3. 1/4 inch thick, interior glazing.

2.02 SEALED INSULATING GLASS UNITS

A. Manufacturers:
1. Any of the manufacturers specified for float glass.
2. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Sealed Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Edge Spacers: Aluminum, bent and soldered corners.
3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
4. Purge interpane space with dry hermetic air.

C. Insulated Glass Units: Double pane with glass to elastomer edge seal.
1. Outer pane of 1/4 inch glass, inner pane of 1/4 inch glass
2. Place reflective coating on No. 3 surface within the unit.
3. Comply with ASTM E 774 and E 773, Class CBA.
4. Purge interpane space with dry hermetic air.
5. Total unit thickness of 1 inch.

D. Tempered Insulated Glass Units: Double pane with glass to elastomer edge seal.
1. Outer pane of 1/4 inch tempered glass, inner pane of 1/4 inch tempered glass.
2. Place reflective coating on No. 3 surface within the unit.
3. Comply with ASTM E 774 and E 773, Class CBA.
4. Purge interpane space with dry hermetic air.
5. Total unit thickness of 1 inch.

2.03 GLAZING COMPOUNDS

A. Manufacturers:
1. Dow Corning Corp: www.dowcorning.com.
2. GE Plastics: www.geplastics.com.
3. Pecora Corporation: www.pecora.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.04 GLAZING ACCESSORIES

A. Manufacturers:
   1. Norton Performance Plastics Corp.
   2. Pecora Corporation: www.pecora.com.
   3. Tremco, Inc: www.tremcosealants.com.
   4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

C. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self-adhesive on one face.

D. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.

E. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I.

F. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.
   1. Place glazing tape on glazing pane of unit with tape flush with sight line.

F. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

G. Fill gap between glazing and stop with silicone type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.

H. Apply cap bead of silicone type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.04 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.

E. Fill gaps between pane and applied stop with silicone type sealant to depth equal to bite on glazing, to uniform and level line.

F. Trim protruding tape edge.

3.05 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Cementitious backing board.

F. Gypsum wallboard.

G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire rated walls.

B. Section 07 90 05 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2022.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

K. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.

L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

M. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.

N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

Q. ASTM E413 - Classification for Rating Sound Insulation; 2022.

R. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2024.

S. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2024.

T. ICC (IBC) - International Building Code.

U. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Partitions: UL listed assembly No. U419; 1 hour rating or as shown on drawings.
   2. Fire Rated Shaft Walls: UL listed assembly No. U419; 1 hour rating or as shown on drawings.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
   5. Furring: "Z" shaped sections, minimum depth of 2 inches.
      a. Contractors Option: Alternate "Z" Shaped Section: EcoStud, 100% recycled plastic studs as manufactured by Superior Polymer, phone 906-337-3355.

B. Metal Framing: Drywall and Plaster Ceilings:
   1. Chicago Metallic Corporation - System 640 and fire Front 650.
   2. USG - Drywall Suspension System Flat for Ceilings, rated and non-rated one hour.
   3. Armstrong - Quickstix Drywall Ceiling Framing.

C. Shaft Wall Studs and Accessories: N/A.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.

3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
4. Deflection and Firestop Track:
    a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
    b. Products:
        1) FireTrak Corporation; Posi Klip.
        2) Metal-Lite, Inc.; The System.
5. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. CertainTeed Corporation: www.certainteed.com.
2. Lafarge North America Inc: www.lafargenorthamerica.com.
3. National Gypsum Company: www.nationalgypsum.com.
4. USG Corporation: www.usg.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
3. Thickness:
    a. Vertical Surfaces: 5/8 inch or as shown on drawings.
    b. Ceilings: 5/8 inch or as shown on drawings.
4. Paper-Faced Products:
    a. CertainTeed Corporation; ProRoc Brand Gypsum Board.
    b. Lafarge North America Inc; Regular Drywall and Firecheck Type X and Type C.
    c. National Gypsum Company; Gold Bond Brand Gypsum Wallboard.
    d. USG Corporation; Sheetrock Brand Gypsum Panels.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

C. Impact Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
4. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M.
5. Type: Fire resistance rated Type X, UL or WH listed.
6. Thickness: 5/8 inch or as shown on drawings.
7. Edges: Tapered.
8. Products:
    a. National Gypsum Company; Gold Bond Hi-Impact Brand XP Wallboard.
    b. USG Corporation; Fiberock Brand Panels--VHI Abuse-Resistant.
    c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Type: Regular and Type X, in locations indicated.
5. Type X Thickness: 5/8 inch.

6. Regular Board Thickness: 5/8 inch or as shown on drawings.
7. Edges: Tapered.
8. Products: Basis of design is DensArmor Plus (office, toilet rooms, storage, mechanical). See drawings.
    a. CertainTeed Corporation; ProRoc Brand Moisture Resistant Gypsum Board ("Greenboard").
    b. Georgia-Pacific Gypsum; DensShield Tile Backer.
    c. Lafarge North America Inc; Watercheck ("Greenboard").
    d. National Gypsum Company; Gold Bond Brand XP Gypsum Board.
    e. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.
    f. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: as required in inches.

B. Acoustic Insulation: 1; preformed glass fiber, friction fit type, unfaced.
1. Owens Corning - Noise Barrier Batts
2. Manville - Sound Control Batts
3. Certainteed - Sound Control Batts
4. Guardian Fiberglass, Inc. - Sound Control Batts

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

D. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board. Acoustical sealant shall be as manufactured by one of the following or approved equal:
1. Ohio Sealants Inc. - Sound Sealant Rubber Base
2. Pecora - Acoustical Sealant
3. Tremco -Acoustical Sealant

E. Water-Resistive Barrier: As specified in Section 07 25 00.

F. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Ready-mixed vinyl-based joint compound.
4. Powder-type vinyl-based joint compound.
5. Chemical hardening type compound for use in mold resistant systems.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

I. Resilient Furring Channels: 1/2 inch deep Galvanized steel, Dietrich RC Deluxe.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center.
1. Extend partition framing to structure where indicated and to ceiling in other locations.

2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

D. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
   1. Orientation: Vertical.
   2. Spacing: As indicated.

E. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

F. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/360.
   2. Main runners shall be installed 48" on center, and be directly suspended by not less than 12 gage galvanized steel wire spaced 48" on center along the furring runners. Hanger wires shall be wrapped tightly with at least 3 full turns.
   3. Furring main runners shall be interconnected by furring cross tees 48" long spaced 16" on center and also 8" from the ends of each gypsum drywall panel. Cross tees shall also be installed adjacent to all recessed light fixtures on each side not supported by a furring runner. Pay special attention to the type of lay-in light fixture and direction in which they are installed.
   4. Wall track shall be installed wherever suspension components meet vertical surfaces, and the suspension component ends shall be butt cut to fit into the wall track.
   5. Studs: Space studs at 16 inches (400 mm) on center.
      a. Extend stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
      b. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
   6. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

G. "Z" Wall Furring: Install at masonry walls scheduled to receive gypsum wallboard. Furring shall be installed vertically with the 3/4 inch flange to the masonry and anchored to the masonry with appropriate fasteners 24" on center maximum. Install furring 16" on center. Install insulation progressively as furring installation proceeds.

H. Blocking: Install blocking for support of plumbing fixtures, wall cabinets, toilet accessories, and hardware. Bolt or screw steel channels to studs.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

4. Bottom of Partitions: Apply a round bead of sealant at each side stud track before setting gypsum board. Set gypsum board into sealant to form complete contact with adjacent materials.
5. Top and Sides of Partitions Abutting Existing Construction or Non-acoustical New Construction - After gypsum board is installed apply acoustical sealant to provide full contact with adjacent existing surfaces at each side of the partition.
6. Cut Outs - Backs of electrical boxes, pipes, ducts, and other equipment penetrating the wall surface shall be buttered with sealant and perimeter edges of all items sealed with sealant.

3.05 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
2. Partition, furring or column fireproofing abuts a structural element (except floor) or dissimilar wall or ceiling.
3. Ceiling or soffit abuts a structural element, dissimilar wall or partition or other vertical penetration.
4. Construction changes within the plane of partition or ceiling.
5. Ceiling dimensions exceed fifty feet in either direction with perimeter relief, thirty feet without relief.
6. Where wings of "L", "U" and "T" shaped ceiling areas are joined.
7. Where gypsum board systems abut dissimilar materials, gypsum board shall be isolated by installing a casing bead within a 1/4" of the dissimilar material and sealing the joint with either acoustical sealant as specified above for sound insulated partitions or caulking as specified under Section 07 90 05.
8. Ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners. Window openings shall be treated similar to doors with joint extending to the floor as well as the ceiling. Control joints in gypsum board to gypsum board configurations shall be formed using expansion joint formers as specified above. Joints shall be caulked with sound sealant or caulking as specified in Section 07 90 05 as appropriate to the condition.
9. Control joints in fire rated construction shall be formed with double studs and expansion joint former and backed with safing insulation as specified under Section 07 84 00.

B. Corner Beads: Install at external corners, using longest practical lengths.

3.07 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: All walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
      a. Regardless of schedule all walls to receive level 4 finish, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.08 TOLERANCES

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

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 09 26 00 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2019 (Reapproved 2025).

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

E. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components and acoustical units.

1.06 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels Type: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. Size: 24 x 24 inches (600 x 600 mm).
   2. Thickness: 3/4 inches (19 mm).
   3. Composition: Wet felted.
   4. Light Reflectance: 85 percent, determined as specified in ASTM E1264.
   5. NRC Range: 70 to 70, determined as specified in ASTM E1264.
   6. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E1264.

7. Edge: Reveal edge.
8. Surface Color: White.
9. Surface Pattern: Fine textured.
10. Product: Eclipse ClimaPlus item #76775 by USG.
11. Product: Cirrus item# 584 by Armstrong
12. Product: Cahmere item# CM-454 by CertainTeed
13. Suspension System: Exposed grid Type.

D. Acoustical Panels Type: Washable Gypsum Board Panel, ASTM E1264 Type XX, with the following characteristics:
1. Size: 24 x 24 inches (600 x 600 mm).
2. Thickness: 1/2 inches (12 mm).
3. Light Reflectance: 77 percent, determined as specified in ASTM E1264.
4. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E1264.
5. Edge: Square.
6. Surface Color: White.
7. Surface Pattern: Washable Vinyl.
8. Product: Sheetrock lay in ceiling panel ClimaPlus item# 3260by USG.
9. Product: Gold Bond Building Products - Gridstone 2 x 2.
10. Product: Vinylrock item# 1142-CRF-1 by CertainTeed
11. Suspension System: Exposed grid Type.

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
1. Same as for acoustical units.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems - General: ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Exposed Steel Suspension System Type: Formed steel, commercial quality cold rolled; intermediate-duty.
1. Profile: Tee; 15/16 inch (24 mm) wide face.
2. Construction: Double web.
3. Finish: White painted.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Furnish and install ceiling hold down clips for all lay-in ceilings that are installed in Vestibules or within twenty feet of an exterior door

D. Ceiling holddown clips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

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

C. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

F. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.

G. Do not eccentrically load system or induce rotation of runners.

H. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

G. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

D. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2019.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, installation adhesives and accessories, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plan.

D. Selection Samples: Submit manufacturers complete set of color samples for Architect's initial selection.

E. Verification from the flooring installer, in writing, on his letterhead, indicating that he has reviewed the concrete moisture content testing reports, or has conducted his own moisture content tests and accepts the moisture levels present within the concrete slab as acceptable for the installation of the products being furnished.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.06 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness, and:
   1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   2. Size: 12 x 12 inch (305 x 305 mm).
   3. Thickness: 0.125 inch (3.2 mm).

4. Pattern: Marbleized with standard finish selections.
5. Manufacturers:
    a. Armstrong World Industries, Inc; Product Imperial Texture Standard Excelon: www.armstrong.com.
    b. Mannington Mills, Inc; Product Essentials: www.mannington.com.
    c. Tarkett Inc; Product Expressions: www.tarkett.com.
    d. Substitutions: Not permitted.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
    1. Height: 6 inch, or as noted.
    2. Thickness: 0.125 inch (3.2 mm) thick.
    3. Finish: Satin with standard selections.
    4. Accessories: Premolded external corners and end stops.
    5. Manufacturers:
        a. Burke Flooring: www.burkemercer.com.
        b. Johnsonite, Inc: www.johnsonite.com.
        c. Roppe Corp: www.roppe.com.
        d. VPI.
        e. Armstrong
        f. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Subfloor Filler: Cement based; type recommended by adhesive material manufacturer. No gypsum based fillers are allowed.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Metal.

D. Filler for Sheet Vinyl Coved Base: Plastic.

E. Cap for Sheet Vinyl Coved Base: Vinyl

F. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive resilient flooring.

C. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
    1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

E. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

F. Verify that concrete sub-floor surfaces are ready for resilient flooring installation by reviewing testing report for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
    1. Installer shall verify in writing that he has reviewed the test results and is satisfied that the installation can proceed.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
   1. Sub-floor filler used on concrete slab on grade construction shall be cement based.
   2. No Gypsum based sub-floor fillers are allowed.

B. Prohibit traffic until filler is cured.

C. Clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

C. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Before installation of flooring, secure metal strips with stainless steel screws.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.05 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

C. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's instructions.

C. Clean, seal, and wax resilient flooring products in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 67 00
FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.

B. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.

B. ASTM D905 - Standard Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading; 2008 (reapproved 2021).

C. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser; 2019.

D. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

F. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

G. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples: Submit two samples, 6 x 6 inch in size illustrating color and pattern for each floor material for selection by Architect.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing work of this section approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

1.06 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:
   1. Tnemec; www.tnemec.com.
   2. Ultra Durable Technologies: UltraSpartic System with Ultra HTS No. 1: www.ultradt.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Fluid-Applied Flooring (FAF-01): Modified polyamine epoxy; color as indicated on drawings.
   1. Self-Leveling Primer Coat(s): Modified polyamine epoxy.
   2. System Thickness: 14 to 20 mils, nominal, when dry.
   3. Aggregate: Vinyl flakes.
   4. Texture: Slip resistant with glass bead grit.
   5. Sheen: Reduced gloss.
   6. Color: Custom as indicated.
   7. Products:
      a. Basis of Design Product: Tnemec; 224 Deco-Fleck with series 211 glass beads and series 248 EverThane reduced gloss top: www.tnemec.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fluid-Applied Flooring (FAF-02A, FAF-02B, FAF-02C, FAF-02D): Modified polyamine epoxy; color as indicated on drawings.
   1. Self-Leveling Primer Coat(s): Modified polyamine epoxy.
   2. System Thickness: 14 to 20 mils, nominal, when dry.
   3. Aggregate: Vinyl flakes.
   4. Texture: Smooth.
   5. Sheen: Reduced gloss.
   6. Color: Custom as indicated.
   7. Products:
      a. Basis of Design Product: Tnemec; SS 224 Deco-Fleck with Series 248 EverThane reduced gloss top coat: www.tnemec.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Fluid Applied Flooring (FAF-03): Polyurethane Modified Concrete; color to be selected from manufacturer's standard offering.
   1. Aggregate / Broadcast Coat: quartz bead, for slip resistance.
   2. System Thickness: 3/16" - 1/4" nominal when dry.
   3. Sheen: Reduced Gloss
   4. Products: 242 Ultra Tread S
      a. Basis of Design Product: Tnemec; Series 242 Ultra-Tread S Urethane with Quartz Broadcast and Series 246 Ultra-Tread Glaze Topcoat.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Base Caps: Brass, with projecting base of 1/8 inch.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by flooring materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

D. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - STRIPS

A. Accurately saw cut substrate to install divider strips.

B. Install terminating cap strip at top of base; attach securely to wall substrate.

3.04 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness indicated.

C. Finish to smooth level surface.

D. Cove at vertical surfaces.

3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until cured.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically so indicated.
   6. Ceramic and other tiles.
   7. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   8. Exterior insulation and finish system (EIFS).
   9. Glass.
   10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

C. GreenSeal GS-11 - Paints and Coatings; 2013.

D. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

E. SSPC (PM2) - Steel Structures Painting Manual, Vol. 2, Systems and Specifications; Society for Protective Coatings; 1995, Seventh Edition.

1.04 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Product Data: Provide data on all finishing products, including VOC content.

E. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on gypsum board.

F. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon of each color; store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years' experience.

1.07 ADMINISTRATIVE REQUIREMENTS

A. Inclusion of VOC and Green Label Requirements to meet compliance of MFHA.

B. See requirements of Enterprise Green Communities Criteria 6.1 for required VOC levels for applicable products.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints: Provide Zero VOC latex paints for each manufacturer.
   1. Base Manufacturer: Sherwin Williams (SW) - ProMar 200 Zero - VOC Mixture.
   2. Glidden Professional, a product of PPG Architectural Coatings: www.gliddenprofessional.com.
   3. Benjamin Moore & Co: www.benjaminmoore.com.
   4. Pittsburgh Paints
   5. Pratt & Lambert.
   6. Diamond Vogel

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each coating material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the criteria 6.1 in relation to the MFHA standards required and the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Non-flat: 50 g/L, maximum.
         3) Floor: 100 g/L.
         4) Anti-corrosive: 250 g/L
      c. Architectural coatings VOC limits of State in which the project is located and the requirements of Enterprise Green Communities Criteria.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Chemical Content: The following compounds are prohibited:
   1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Flammability: Comply with applicable code for surface burning characteristics.

F. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint ME-OP-2L - Exterior Ferrous Metals, Primed, Latex, 2 Coat:
   1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
   2. Semi-gloss: Two coats of latex enamel; SW DMT Acrylic Semi-gloss Coating.

2.04 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3L - Interior Wood, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer, SW PrepRite Classic Latex Primer.
   2. Flat: Two coats of latex enamel, SW Pro-Mar 200 Interior Latex Flat.

B. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:
   1. Filler coat (for open grained wood only).
   2. One coat of stain; SW Wood Classics Oil Stain.

3. One coat sealer; SW Wood Classics Sanding Sealer.
4. Satin: Two coats of varnish; SW Wood Classics Polyurethane.

C. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat.
1. Touch-up with latex primer.
2. Semi-gloss: Two coats of latex enamel; SW DMT Acrylic Semi-gloss Coating B66-2100.

D. Paint GI-OP-3L - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat, WALLS:
1. One coat of Latex primer sealer, SW Interior Latex Primer.
2. Eggshell: Two coats of latex enamel; SW Sherscrub Supreme Latex Eggshell.

E. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat, CEILINGS:
1. One coat of Latex primer sealer, SW Interior Latex Primer.
2. Flat: Two coats of latex enamel-acrylic; SW ProMar 400 Latex Flat.

F. Paint GI-OP-3EP - Gypsum Board/Plaster, Epoxy, 3 Coat, WALLS & CEILINGS.
1. One coat of SW Waterbased Tile-Clad Primer.
2. Two coats of water based epoxy SW Epo-Plex Multi-Mil Water Based Epoxy (B71-100 Series).

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: N/A.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted as applicable: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

K. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

L. Exterior Wood to Receive Transparent Finish as applicable: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

M. Glue-Laminated Beams: N/A.

N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Sand wood and metal surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

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

3.05 SCHEDULE - SURFACES TO BE FINISHED

A. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted.
   2. Fire rating labels, equipment serial number and capacity labels.

B. Paint the surfaces described below under Schedule - Paint Systems.

C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
   2. Paint shop-primed items occurring in finished areas.
   3. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
   4. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

3.06 SCHEDULE - PAINT SYSTEMS

A. Gypsum Board: Finish all surfaces exposed to view.
   1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
   2. Interior Walls: GI-OP-3L, Eggshell.

B. Wood: Finish all surfaces exposed to view, touch-up as necessary.
   1. Interior Paneling & Trim: WI-TR-VS, gloss.

C. Steel Frames: Finish all surfaces exposed to view; MI-OP-2L, semi-gloss.

D. Steel Fabrications: Finish all surfaces exposed to view.
   1. Exterior: ME-OP-2L, semi-gloss; finish all surfaces, including concealed surfaces, before installation.
   2. Interior: MI-OP-2L, semi-gloss.

END OF SECTION

SECTION 10 14 19
CAST LETTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast Aluminum Letters.

1.02 RELATED SECTIONS

A. Section 13 34 19 – Pre-Engineered Metal Building: Related.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate Copy, Letter Size, Font, and Finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Matthews International Corporation

B. Metal Arts.

C. Gemini Incorporated

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Copy: 20 inch high or as shown on drawings, Copy to be determined; assume twenty five (25) letters.

B. Font: Roman; Upper and Lower Case.

C. Finish: Clear Anodize with a polished face.

D. Mounting: Projected spacer mounting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions, in location shown on drawings.

B. Furnish template for mounting drilling pattern.

END OF SECTION

SECTION 10 14 23
INTERIOR SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior signage of the following types:
   1. ADA compliant interior signage

1.02 REFERENCES

A. ANSI/ICC A117.1 - Accessible and Useable Buildings and Facilities.

B. ATBCB ADAAG - Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG); U.S. Architectural Transportation Barriers Compliance Board.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature.

C. Shop Drawings: List sign styles, lettering, locations and dimensions of each interior sign.

D. Verification Samples: Two full size samples, representing type, style and color specified including method of attachment.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of ANSI/ICC A117.1 and ADAAG.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect products upon receipt. Store products in manufacturer's packaging until ready for installation.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Takeform Signs; Representative: Tim Healy & Associates. Contact: Patrick Healy, Email: phealy@timhealyandassociates.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 INTERIOR SIGNS

A. ADA-Compliant Interior Signage:
   1. Style A: Door Identification
      a. Collection: Your Turn using Fusion construction as manufactured by Takeform.
      b. Size: 4” h x 9.75” w
      c. Provide for single line of text
      d. Lettering Style: TBD, upper case.
      e. Braille: Grade 2 Braille, placed directly below last line of letters or numbers.
      f. Performance: Non-static, fire-retardant, and self-extinguishing.
      g. Text Color: Black C0101
      h. Sign Layer 1 (bottom layer) Material: Laminate, Color TBD
      i. Sign Layer 2 (top layer) Material: Laminate, Color TBD
      j. Copy: *Final copy schedule TBD*
      k. Quantity: 1. Refer to signage schedule on architectural drawings.
   2. Style C2: Restroom Identification
      a. Collection: Your Turn using Fusion construction as manufactured by Takeform.
      b. Size: 9.75” h x 9.75” w
      c. Provide for single line of text
      d. Pictogram: Men & Women

e. Lettering Style: TBD, upper case.
f. Braille: Grade 2 Braille, placed directly below last line of letters or numbers.
g. Performance: Non-static, fire-retardant, and self-extinguishing.
h. Text Color: Color TBD
i. Pictogram Color: Color TBD
j. Sign Layer 1 (bottom layer) Material: Laminate, Color TBD
k. Sign Layer 2 (top layer) Material: Laminate, Color TBD
l. Copy: RESTROOM
m. Quantity: 1. Refer to signage schedule on architectural drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine installation areas to ensure that conditions are suitable for installation.

B. Examine signage for defects prior to installation. Do not install damaged signage.

3.02 PREPARATION

A. Verify mounting heights and locations for interior signage will comply with referenced standards.

B. Clean mounting locations of dirt, dust, grease or similar conditions that would prevent proper installation.

3.03 INSTALLATION

A. Install signs level, plumb, without distortion, and in proper relationship with adjacent surfaces using manufacturer's recommended standard mounting system.
   1. Mounting: Mount with vinyl foam tape.

B. Remove adhesive from exposed sign surfaces as recommended by manufacturer.

C. Standard Frame Height is 36 inches.

D. Clean signs after installation as recommended by manufacturer.

E. Replace damaged products before Substantial Completion.

3.04 INTERIOR SIGNAGE SCHEDULE

A. It will be the responsibility of the **signage vendor** to produce and coordinate the text schedules, signage location plans & verify the final quantities with the Owner and Architect.

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms, and utility rooms.

B. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 – Gypsum Board Assemblies: Related.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.

F. ASTM C1036 - Standard Specification for Flat Glass 2016.

G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

H. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products listed are made by Bobrick.

B. Other Acceptable Manufacturers:
   1. A & J Washroom Accessories Inc: www.ajwashroom.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269, Type 304 or 316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Adhesive: Contact type, waterproof.

G. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.

H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

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

2.04 TOILET ROOM ACCESSORIES

A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, satin finished cast aluminum brackets, eccentric-shaped plastic spindle for 1/2 revolution delivery designed to prevent theft of tissue roll.
   1. Product: B-2740 manufactured by Bobrick.

B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 400-C Fold minimum.
   2. Product: B-262 manufactured by Bobrick.

C. Soap Dispenser: Liquid soap dispenser, deck-mounted on vanity, with polyethylene container concealed below deck; piston and 4 inch (100 mm) spout of stainless steel with bright polished finish; chrome-plated deck escutcheon.
   1. Minimum Capacity: 34 ounces.
   2. Product: B-822 manufactured by Bobrick.

D. Mirrors: Stainless steel framed, 6 mm thick float glass mirror.
   1. Size: As shown on drawings.
   2. Frame: 1-2 inch (___ mm) channel shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and non-absorptive filler material.
   4. Product: B-165 standard sizes as noted on drawings manufactured by Bobrick.

E. Grab Bars: Stainless steel, nonslip grasping surface finish.

F. Grab Bars: Stainless steel, 1-1/2 inches (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches (38 mm) clearance between wall and inside of grab bar.
   1. Length and configuration: As indicated on drawings.
   2. Product: B-6806 manufactured by Bobrick.

G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Product: B-254 surface mount manufactured by Bobrick.

2.05 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch (6 mm) diameter.
   2. Hooks: 2, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
   3. Mop/broom holders: 3 spring-loaded rubber cam holders at shelf front.
   4. Length: 30 inches.
   5. Product: B-224 manufactured by Bobrick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers.

1.03 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions.

C. Product Data: Provide extinguisher operational features.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co : www.larsensmfg.com.
   3. Nystom
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS & ACCESSORIES

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Dry Chemical Type Fire Extinguishers: Cast steel tank, with pressure gage.
   1. Class A B:C.
   2. Size 10.
   3. Finish: Baked enamel, Red color.

B. Knoxbox
   1. the Bemidji, MN zip code
   2. 3200 series

2.03 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.
   1. Sized to accommodate accessories.
   2. Trim: 2-1/2 inch rolled edge.
   3. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.

D. Door Glazing: Tempered Glass, clear, 1/8 inch thick . Set in resilient channel gasket glazing.

E. Finish of Cabinet Exterior Trim and Door: Aluminum Anodized to Clear color.

F. Finish of Cabinet Interior: White enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Knox Box as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 24 inches from floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

3.03 SCHEDULES

A. F.E. = Fire Extinguisher with wall bracket.

B. F.E.C. = Fire Extinguisher with semi-recessed cabinet.

C. 1 – Semi-recessed cabinet.

3 – Wall mounted.

END OF SECTION

SECTION 12 24 13
WINDOW SHADE SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manual window shades and accessories for sun/glare/heat control.

1.02 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

C. GREENGUARD Environmental Institute Gold.

D. US Green Building Council.

E. ANSI/WCMA A100.1-2018

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog data, product descriptions, installation instructions, detail sheets, and specifications for each type system specified.

C. Samples for Selection: Manufacturer's color chart or sample set and one sample shade of each type specified. Supplied samples shall be complete with all required components, mounting and associated hardware.

D. Shop Drawings: Prepared specifically for this project; show dimensions and interface with other products.
   1. Room schedule including field-verified dimensions of each opening to receive window shade systems.
   2. Indicate System Series, operator, fabric selection, and mounting type.
   3. Indicate control type and location of control in relation to shade edge.
   4. Installation instructions.
   5. Warranty.

1.04 QUALITY ASSURANCE

A. Installer: Approved by manufacturer.

B. Supplier: Manufacturer, subsidiary or licensed agent shall be approved to supply the products specified, and to honor any claims against product presented in accordance with warranty.

C. Uniformity: Provide product of only one manufacturer for entire project.

D. Mock-up: Provide (1) mock-up shade for each roller shade type/assembly specified.

E. Field verification measurements are required.

F. Verify mounting conditions and dimensions, coordinate sill and jamb depths with shade mounting location above. Shades shall fall within the depth of the sills and jamb.

G. Coordinate locations of chains against jambs at all locations possible.

H. Electric shade motors shall comply with UL standards. Copy of compliance available for submission upon request.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original cartons.

B. Individually package and mark shades with room number and opening number.

C. Inspect the materials upon delivery to assure that specified products have been received.

D. Store and handle shades to prevent damage to fabrics, finishes, and operators prior to installation.

1.06 WARRANTY

A. Lifetime Limited Warranty. Fabrics warranted for 5 years. Specific product warranties available from manufacturer or its authorized agent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manual Shades: Specifications have been developed based on Draper FlexShades. Manually roll-down operated Roller Shades.

B. Other approved manufacturers as listed:
   1. MechoShade; www.mechoshade.com
   2. Hunter Douglas Inc; www.hunterdouglas.com.
   3. Graber, division of Springs Window Fashions; www.graberblinds.com
   4. Substitutions: Other manufacturers may be considered.

2.02 MANUFACTURED UNITS—MANUAL OPERATION

A. Manual Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hem bars, hardware and accessories; fully factory-assembled.

B. Fabrics:
   1. Sun Control Shades: Architect/Owner's choice of the manufacturer's standard GREENGUARD certified, NFPA 701, 3% openness, woven, bacterial and fungal resistance: ASTM E2180 and ASTM G21, width as required for SEAMLESS production, minimum of 5 color selections

C. Control System: Clutch Operated: Engineered heavy-duty chain drive pulley operating system consisting of metal clutch housing and tube bearing plug. Lift torque enhancement provided by geared clutch when required by manufacturing standards. Utilization of adjustment-free continuous qualified T304 stainless steel ball chain with 110 lbs breaking strength for precise control, smooth operation and ensuring a uniform look. Chain tensioners shall be provided as recommended by the manufacturer. Components will be maintenance free from adjustments or lubrication for trouble-free operation.

D. Roller Tube: Circular-shaped aluminum tube, extruded from alloy and temper 6063 T-6. Up to 1.5" or 2"outside diameter extruded tube to have a .063" wall thickness (2.5" outside diameter to have a .079" wall thickness). Heavily reinforced with up to six internal ribs providing additional tensile strength and allows for secure placement of clutch & end plug.

E. Tube Bearing Plug: Reinforced idler assembly containing spring loaded end plug provides for a secure installation and removal of shade.

F. Bottom Bar: Extruded aluminum weight in a Sealed Pocket Hem Bar.

G. Ball Stop / Auto Stop: A ball stop or auto stop will be used for top and bottom limit setting.

H. FASCIA: L shape removable aluminum extrusion valance that attaches to brackets and conceals roller shade. Color TBD.

I. CHAINS SHALL BE PROVIDED WITH A BEAD CHAIN TENSION DEVICE TO FIX THE BOTTOM OF THE CHAIN TO EITHER THE SILL OR JAMB TO PREVENT THE CHAINS FROM SWINGING LOOSE.

J. Mounting Brackets: Manufacturer's standard bracket constructed of extruded aluminum to support full weight of shade with bracket & screw hole covers to provide uniform look. Integrated leveling device for enhanced level adjustment of overall shade shall be provided as recommended by the manufacturer. Locking mechanism on bracket adapter provides for a secure installation and removal of the shade.

K. All shades inside jamb mount installation.

L. Locations: As indicated on architectural plans.

2.04 FABRICATION

A. Shade measurements shall be accurate to within + 1/8” or as recommended in writing by manufacturer.

B. Shades shall not be manufactured until verification measurement are taken and submittals are reviewed and approved by the Architect/Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install window shade systems in accordance with manufacturer's instructions and these specifications.

B. Assume responsibility for all field dimensions and mounting surfaces.
   1. Shade measurements shall be accurate to within + 1/8” or per manufacturer.

C. Adjust window shade systems for proper operation.

D. Clean finish installation and adjacent surfaces of dirt and finger marks. Leave work area clean and free of debris.

E. Install chain fix brackets in locations that allow smooth and uninhibited operation of the shade without disruption to adjacent shades.

3.02 DEMONSTRATION

A. Demonstrate operation method and instruct owner’s personnel in the proper operation and maintenance of the roller shades.

END OF SECTION

SECTION 13 34 19
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufacturer-engineered, shop-fabricated structural steel building frame package.

B. Metal wall and roof panels.

1.02 RELATED REQUIREMENTS

A. Section 07 21 17 - Pre-Engineered Building Insulation; Silvercote system.

B. Section 07 21 19 - Foamed-In-Place Insulation.

C. Section 07 42 14 – Insulated Metal Wall Panels: Related.

D. Section 08 11 13 - Hollow Metal Doors and Frames.

E. Section 08 36 13 – Sectional Doors.

F. Section 08 43 13 – Aluminum-Framed Storefronts.

1.03 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings; 2022.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

G. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2019.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

J. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

K. ASTM C991 - Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings; 2023.

L. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink); 2020.

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

Q. MBMA (MBSM) - Metal Building Systems Manual; 2019.

R. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

S. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 DESIGN REQUIREMENTS

A. Design members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.

B. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on profiles, component dimensions, fasteners.

C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

D. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.

E. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.
   1. Per Pre-Engineered Metal Building Providers:
      a. Follow recommendations of the MBMA (Metal Building Manufacturers Association). Contractor to utilize company erection process.

F. Project Record Documents: Record actual locations of concealed components and utilities.

1.06 QUALITY ASSURANCE

A. Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this Work.
   1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
   2. Conform to applicable code for submission of design calculations as required for acquiring permits.
   3. Cooperate with regulatory agency or authority and provide data as requested.

B. Perform work in accordance with AISC 360 - Specification for Structural Steel Buildings.

C. Perform welding in accordance with AWS D1.1.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Erector Qualifications: Company specializing in performing the work of this section approved by manufacturer.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.08 DEFINITIONS

A. Metal Building System: A building system that will employ:
   1. Either a continuous or simple-span ‘Z’ or ‘C’-shaped cold-formed purlins or open-web steel joists for support of the roof cladding.
   2. Either a continuous or simple-span ‘Z’ or ‘C’-shaped cold-formed girts or open-web steel joists for support of the steel wall cladding.
   3. Three-plate, built-up rigid space frames and/or cold-formed ‘C’ or hot-rolled I-shaped post-and-beam framing to support the roof and wall secondary members.
   4. All systems (cladding, roof and wall secondary, lateral primary framing, and longitudinal bracing) work together to provide resistance to vertical and lateral loading demands.

B. Gable Symmetrical: A continuous frame building with the ridge in the center of the building, consisting of tapered or straight columns and tapered or straight rafters. The sidewall girts may be continuous (by-passing the columns) or simple span (inset in the column line). The rafters may or may not have interior columns.

C. Gable Asymmetrical: A continuous frame building with an off-center ridge, consisting of tapered or straight columns and tapered or straight rafters. The eave height and roof slope may differ on each side of the ridge. The sidewall girts may be continuous (by-passing the columns) or simple span (flush in the column line). The rafters may or may not have interior columns.

D. Single-Slope: A continuous frame building which does not contain a ridge, but consists of one continuous slope from side to side. The building consists of straight or tapered columns and tapered or straight rafters. The sidewall girts may be continuous (by-passing the columns) or simple span (flush in the column line). The rafters may or may not have interior columns.

E. Lean-To (LTO): A building extension, which does not contain a ridge, but consists of one continuous slope from side to side. These units usually have the same roof slope and girt design as the building to which they are attached and supported by.

F. Roof Slope: Pitch expressed as inches of rise for each 12" of horizontal run.

G. Building Width: Measured from outside to outside of sidewall secondary structural member (girt).

H. Building Eave Height: A nominal dimension measured from the finished floor to top flange of eave strut.

I. Building Length: Measured from outside to outside of endwall secondary structural member.

J. Auxiliary Loads: Dynamic loads induced by cranes, conveyors, or other material handling systems.

K. Collateral Loads: The weight of any non-moving equipment or material, such as ceilings, electrical or mechanical equipment, sprinkler systems, plumbing, or ceilings.

L. Dead Load: The actual weight of the building system (as provided by the metal building supplier) supported by a given member.

M. Floor Live Loads: Loads induced on a floor system by occupants of a building and their furniture, equipment, etc.

N. Roof Live Loads: Loads produced by maintenance activities, rain, erection activities, and other movable or moving loads but not including wind, snow, seismic, crane, or dead loads.

O. Roof Snow Loads: Gravity load induced by the weight of snow or ice on the roof, assumed to act on the horizontal projection of the roof.

P. Seismic Loads: Loads acting in any direction on a structural system due to the action of an earthquake.

Q. Wind Loads: The loads on a structure induced by the forces of wind blowing from any horizontal direction.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five-year period after Date of Substantial Completion.

C. Provide five-year manufacturer warranty for building.

1.09 DESIGN REQUIRENMENTS

A. The building manufacturer will use standards, specifications, recommendations, findings and/or interpretations of professionally-recognized groups such as AISC, AISI, AWS, ASTM, CSA, CWB, MBMA, Federal Specifications, and unpublished research by MBMA as the basis for establishing design, drafting, fabrication, and quality criteria, practices, and tolerances. The Manufacturer's design, drafting, fabrication and quality criteria, practices, and tolerances shall govern, unless specifically countermanded by the contract documents.

B. Design structural mill sections and built-up plate sections in accordance with:
   1. (US) code-appropriate edition of AISC's "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", ANSI/AISC 360 ASD method.
   2. (Canada) CSA S16, “Design of Steel Structures”, latest edition.

C. Cold-Formed steel structural members and panels will generally be designed in accordance with "Specifications for the Design of Cold-Formed Steel Structural Members", 2007 Edition, ANSI/AISI S-100-07 or CAN CSA S136-07.

D. Design weldments per the following:
   1. Structural Welding
      a. (US) Design per AWS D1.1, “Structural Welding Code – Steel”, Latest Edition.
      b. (Canada) Design per CWB W59, “Welded Steel Construction (Metal Arc Welding)”, Latest Edition.
   2. Cold-Formed Welding
      a. (US) Design per AWS D1.3, “Structural Welding Code – Sheet Steel”, Latest Edition.
      b. (Canada) Design per CWB W59, “Welded Steel Construction (Metal Arc Welding)”, Latest Edition.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Buildings: Butler-Pre-Engineered Metal Building. Classic systems.

B. Substitutions: Not accepted.

2.02 METAL BUILDING

A. Rigid Frame with Interior Columns.

B. Primary Framing: Rigid frame of rafter beams and columns, intermediate columns, braced end frames, and end wall columns, and wind bracing.

C. Secondary Framing: Purlins, and other items detailed.

D. Wall System: Preformed metal panels of vertical profile, with flush-girt framing/anchorage assembly, and accessory components.

E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, and accessory components.

F. Roof Slope: See drawings.

2.03 MATERIALS - FRAMING

A. Structural Steel Members: ASTM A 572/A 572M, Grade 50.

B. Structural Tubing: ASTM A 500, Grade B cold-formed.

C. Plate or Bar Stock: ASTM A 529/A 529M, Grade 50.

D. Anchor Bolts: ASTM A307, galvanized to ASTM A153/A153M.

E. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M, Class C.

F. Welding Materials: Type required for materials being welded.

G. Finish process: Primary framing primer is water-based red or grey color, 1.0 mil. Secondary is SSPC-15 red with 0.5 mil on each side. Include applicable single one primer.
   1. General Industry Coatings by Sherwin Williams; Aquaspar 100 Red Oxide Primer.

H. Grout: ASTM C1107/C1107M, Non-shrink type, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 2400 psi (17 MPa) in two days and 7000 psi (48 MPa) in 28 days.

2.04 MATERIALS - WALLS AND ROOF

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, SS Grade 33/230, with G90/Z275 coating.

B. Joint Seal Gaskets: Manufacturer's standard type.

C. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.

D. Sealant: Manufacturer's standard type.

E. Roof Curbs: Insulated metal same as roofing, 1 inch thick, designed for imposed equipment loads, anchor fasteners to equipment, counterflashed to metal roof system.

F. Trim, Closure Pieces, Caps, Flashings, Fascias: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

G. Energy Saver FP™ (OSHA-compliant leading edge fall protection) roof system fabric installed under the roof secondary structure and supported by associated banding grid system. Unfaced glass mineral wool insulation installed between and above the purlins in varying thickness combinations to obtain the desired insulating values as required.

H. Roof: MR-24 standing seam roof system.

2.05 COMPONENTS

A. Doors and Frames: Specified in Section 08 11 13 & 08 43 13, provide structural framed openings and coordinate with thermal moisture protection values.

B. Gutters and Downspouts: Manufacturers standard, See drawings for sizes.

2.06 FABRICATION - FRAMING

A. Fabricate members in accordance with AISC Specification for plate, bar, tube, or rolled structural shapes.

B. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.

C. Provide framing for door openings.

2.07 FABRICATION - WALL AND ROOF PANELS

A. Siding: Minimum 26-gauge metal thickness, Revers roll, 1-1/2 inch deep, lapped edges fitted with continuous gaskets.

B. Roofing: Minimum 26-gauge metal thickness, Standing Seam profile, lapped edges fitted with continuous gaskets, galvalume finish.

C. Soffit Panels: Use standard PBR reverse profile.

D. Girts/Purlins: Rolled formed structural shape to receive siding, roofing sheet.

E. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles. Back brace mitered internal corners as required.

F. Expansion Joints: Same material and finish as adjacent material where exposed, manufacturer's standard brake formed type, of profile to suit system.

G. Flashings, Closure Pieces, Fascia, Infills, and Caps: Same material and finish as adjacent material, profile to suit system.

H. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

I. Liner panels: Butler Mod 36 Liner Panel: 22 Ga. Standard finish selections.

J. Wall panels: Panel 1 – Butler II, Color A, Panel 2 – Shadowall, Color B.

2.08 FINISHES

A. Framing Members: Clean, prepare, and shop prime with light gray. Do not prime surfaces to be field welded.

B. Exterior Surfaces of Wall Components and Accessories: Pre-coated enamel on steel of modified silicone finish, color as selected from manufacturer's standard range.

C. Interior Surfaces of Wall Components and Accessories: Pre-coated enamel on steel of modified silicone finish, color as selected from manufacturer's standard range.

D. Exterior Surfaces of Roof Components and Accessories: Galvalume coating on steel.

E. Interior Surfaces of Roof Components and Accessories: Pre-coated enamel on steel of modified silicone finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.02 ERECTION - FRAMING

A. Erect framing in accordance with AISC 360 - Specification for Structural Steel Buildings.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - WALL AND ROOF PANELS

A. Install in accordance with manufacturer's instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Fasten cladding system to structural supports, aligned level and plumb.

D. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing.

E. Provide expansion joints where indicated.

F. Use exposed fasteners.

G. Install insulation and vapor retarder.

H. Install sealant and gaskets to prevent weather penetration.

3.04 INSTALLATION - ACCESSORIES

A. Install structural door frames in accordance with manufacturer's instructions. Doors and Overhead doors to be installed by others.

3.05 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.

B. Siding and Roofing: 1/8 inch (3 mm) from true position.

END OF SECTION

SECTION 220500
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The provisions of This Section, Common Work Results for Plumbing, apply to all sections in Division 22.

C. All Sections of Division 22 are interrelated. When interpreting any direction, material, and method specified in any section of Division 22, consider it within the entirety of Work in Division 22.

1.02 SUMMARY

A. The intent of Division 22 Specifications and the accompanying Drawings is to provide a complete and workable facility with complete systems as shown, specified, and required by applicable codes. Include all work specified in Division 22 and shown on the accompanying Drawings, including appurtenances, connections, etc., in the finished job.

B. The Division 22 Specifications and the accompanying Drawings are complementary, and what is called for by one shall be as binding as if called for by both. Items shown in the drawings are not necessarily included in the specifications and vice versa. Specifications shall supersede drawings in case of conflict.

C. Imperative language is frequently used in Division 22 Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by the Contractor.

D. The Drawings that accompany the Division 22 Specifications are diagrammatic. They do not show every offset, bend, tee, or elbow that may be required to install work in the space provided and avoid conflicts. Offsets and transitions shall be assumed at a minimum at each duct crossing, structural penetrations through shear walls or beams, structural grids where ceiling heights are restricted, and at piping mains. Follow the Drawing as closely as is practical to do so and install additional bends, offsets, and elbows where required by local conditions from measurements taken at the Building, subject to approval, and without additional cost to the Owner. The right is reserved to make any reasonable changes in fixture location prior to roughing in without cost impact.

1.03 RELATED WORK

A. The General and Supplemental Conditions apply to this Division, including but not limited to:
   1. Drawings and specifications.
   2. Public ordinances, permits.
   3. Include payments and fees required by governing authorities for the work of this Division.

B. Division 1, General Requirements, applies to this Division.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. All products and equipment shall be prohibited from containing pentabrominated, octabrominated, and decabrominated diphenyl ethers. Where products or equipment within this specification contain these banned substances, provide complying products and equipment from approved manufacturers with equal performance characteristics.
   2. General: All work and materials shall conform to the local and State codes and all Federal, State, and other applicable laws and regulations.
   3. The contractor is responsible for obtaining and paying for all permits, licenses, and inspection certificates required in accordance with the provisions of Contract Documents.

B. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects, and in conformance with the Contract Documents.

C. Apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.

D. The entire plumbing system and apparatus shall operate at full capacity without objectionable noise or vibration.

E. All equipment shall be installed level and true. Housekeeping pads and curbs shall account for floor or roof slopes.

F. Materials and Equipment:
   1. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name along with other manufacturers.
   2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of the same manufacturer.
   3. Furnish all materials and equipment of size, make, type, and quality herein specified.
   4. Equipment scheduled by performance or model number shall be considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment, the contractor is responsible for all changes and costs that may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements or any other differences which impact the project.

G. Workmanship:
   1. General: All materials shall be installed in a neat and professional manner.
   2. Manufacturer’s Instructions: Follow the manufacturer’s directions where they cover points not specifically indicated. If they are in conflict with the Drawings and Division 22 Specifications, obtain clarification before starting work.

H. Cutting and Patching:
   1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division, including plastering, masonry work, concrete work, carpentry work, and painting, shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.
   2. Additional openings required in building construction shall be made by drilling or cutting. Use of a jackhammer is specifically prohibited.
   3. Fill holes that are cut oversized so that a tight fit is obtained around the sleeves passing through.
   4. Beams or columns shall not be pierced without permission of the Architect and then only as directed.
   5. All new or existing work cut or damaged shall be restored to its original condition. Where alterations disturb lawns, paving, walks, etc., the surfaces shall be repaired, refinished, and left in the condition existing prior to the commencement of work.

1.05 SUBMITTALS

A. Shop Drawings:

***** EDIT "ARCHITECT"*****

   1. Contract drawings indicate the general layout of the piping and various equipment items.
   2. Coordinate with other trades and field conditions.
   3. Prepare shop drawings for piping and equipment installations.
   4. Prepare new Shop Drawings by Contractor and not reproductions or tracings of Architect’s Drawings.
   5. Overlay drawings with shop drawings of other trades and check for conflicts.
   6. Drawings the same size as Architect’s Drawings with title block similar to Contract Drawings and identifying Architect’s Drawing number or any reference drawings.
   7. Fully dimensioned, including both plan and elevation dimensions.

8. Shop drawings cannot be used to make scope changes.
9. Prepare in [three-dimensional] [two-dimensional] format.
10. Shop drawings include but are not limited to:
    a. The plumbing site plan is drawn to the same scale as a site plan.
    b. Complete floor plans with plumbing to a minimum of 1/4-inch equals 1-foot scale.
    c. Plumbing in mechanical rooms to a minimum of 1/2-inch equals 1-foot scale.
    d. Sections of congested areas to a minimum of 1/2-inch equals 1-foot scale.
    e. Fabricated Equipment: Scale and drawing sizes to suit the contractor except equipment not less than 1/2-inch equals 1-foot scale.
    f. Superplot plans of above-ground work with a colored overlay of all trades including, but not limited to, HVAC piping, HVAC equipment, plumbing piping and equipment, sprinklers, lighting, lighting controls, cable tray, fire alarm devices, electrical power conduit, and ceiling system to a minimum of 1/2-inch equals 1-foot scale.
    g. Superplot plans of below-ground work with a colored overlay of all trades including, but not limited to, structural footings and foundation, HVAC piping, civil piping, plumbing piping, and power conduit to a minimum of 1/2-inch equals 1-foot scale.
    h. Beam penetration drawings indicate beam penetrations meeting the requirements indicated on the floor plans and on the structural drawings to a minimum of 1/4-inch equals 1-foot scale.
    i. Slab penetration drawings of HVAC, plumbing, sprinklers, lighting and electrical to a minimum of 1/4-inch equals 1-foot scale.
11. Submit shop drawings for review prior to beginning fabrication. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.

B. Product Data:
1. Submit product data for review on scheduled pieces of equipment, on equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include the manufacturer's detailed shop drawings, specifications, and data sheets. Data includes the following:
    a. Capacities
    b. RPM
    c. BHP
    d. Pressure Drop
    e. Design and Operating Pressures
    f. Temperatures
2. Manufacturer's abbreviations or codes are not acceptable.
3. List the name of the motor manufacturer and service factor for each piece of equipment.
4. Indicate equipment operating weights, including bases and weight distribution at support points.
5. In the case of equipment such as wiring devices, time switches, valves, etc., specified by a specific catalog number, a statement of conformance will suffice.

C. Submission requirements
1. Shop Drawings and Product Data:
    a. Refer to Division 01, General Requirements, for additional requirements related to submittals.
    b. Submit electronic copies of shop drawings and product data for Work of Division 22, Plumbing in PDF format with each item filed under a folder and labeled with its respective specification section number, article, and paragraph and mark, if applicable.
    c. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.

d. The bulk of the shop drawings and product data, except Controls and Instrumentation, are included with the original submittal. Controls and Instrumentation submittals may lag but are still complete when submitted. Partial submittals will not be accepted. Other stragglers submitted after the return of the original binder include a tab similar to that originally submitted. Upon receipt of the returned late submittal, insert them in the previously submitted binder.

1.06 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNER'S INSTRUCTIONS

A. Refer to Division 1 for additional requirements.

B. Submit electronic copies of the manufacturer's operation and maintenance instruction manuals and parts lists for each piece of equipment or item requiring servicing.

C. Submit data when the work is substantially complete, packaged separately, and clearly identified. Include the name and contact information for the location of source parts and service for each piece of equipment.

D. Clearly mark and label in each submittal the piece of equipment provided with the proper nameplate and model number identified. Provide wiring diagrams for all electrically powered equipment.

E. Instruct Owner thoroughly in the proper operation of equipment and systems in accordance with the manufacturer's instruction manuals. Operating instructions shall cover all phases of control.

1.07 WARRANTY

A. Provide a written guarantee covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.

B. Provide manufacturer's written warranties for material and equipment furnished under this Division, insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.

C. Correct warranty items promptly upon notification.

PART 2 PRODUCTS

1.01 ACCESS PANELS

A. Furnish under this Division as specified in another Division of work.

1.02 PIPE SLEEVES

A. Interior Wall and Floor Sleeves: 18 gauge galvanized steel or another pre-approved system.

B. Interior Wall and Floor Sleeves (fire rated): Fire-rated and water-tight system approved by the Authority Having Jurisdiction and Owners Insurance underwriter, with a rating equal to the floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size, and service.

C. Exterior Wall Sleeves: Cast iron.

D. On-Grade Floor Sleeves: Same as exterior wall sleeves.

E. Water Tight Sleeves: Combination steel pipe sleeves with water stop and anchor plate; Link Seal Model WS, mated with synthetic rubber links interlocked with bolts and nuts; Link Seal Model LS.

1.03 FLOOR, WALL, AND CEILING PLATES

A. Furnish stamped split-type plates as follows:
   1. Floor Plates: Cast brass, chromium plated.
   2. Wall and Ceiling Plates: Spun aluminum.

1.04 MACHINERY GUARDS

A. Furnish guards for protection on all rotating and moving parts of equipment. Provide guards for all metal fan drives and motor pulleys, regardless of whether they are enclosed in a metal cabinet.

B. Design guards so as not to restrict airflow at fan inlets, resulting in a reduced capacity.

C. Provide shaft holes in guards for easy use of tachometers at pulley centers. Guards shall be easily removable for pulley adjustment or removal and changing of belts.

D. All guards shall meet OSHA requirements, including back plates.

E. Provide inlet and outlet screens on all fans in plenums or where exposed to personnel.

1.05 ELECTRICAL EQUIPMENT

A. General: All equipment and installed work shall be as specified under Division 26, Electrical.

B. Coordinate with the electrical Drawings and electrical contractor for minimum electrical equipment bracing requirements based on the available interrupting current (AIC) rating at the bus of the panelboard or switchboard serving the piece of equipment. Provide equipment that meets the bracing requirement.

C. Motors – AC Induction:

1. Motors shall be furnished as an integral part of driven equipment. They shall be drip-proof induction type with ball bearings unless noted otherwise. Motors 1 HP and above shall be premium energy-efficient types, except for emergency equipment motors. Motors shall be built according to NEMA standards for the service intended. The motors shall be rated for the voltage specified, suitable for operation within the range of 10% above to 10% below the specified voltage.
2. Energy efficient motors shall be Baldor, Westinghouse, General Electric, or approved equal.
3. The motor shall meet the efficiency standards identified in the table below as determined using the IEEE Method B test at full load.

MINIMUM MOTOR EFFICIENCIES					
		RPM **IEEE 112B EFFICIENCY**			
HP	**KW**	**900**	**1200**	**1800**	**3600**
1	**0.75**	**--**	**82.5**	**85.5**	**80.0**
1.5	**1.15**	**--**	**86.5**	**86.5**	**85.5**
2	**1.53**	**--**	**87.5**	**86.5**	**86.5**
3	**2.3**	**84.0**	**89.5**	**89.5**	**88.5**
5	**3.8**	**85.5**	**89.5**	**89.5**	**89.5**
7.5	**5.6**	**87.5**	**91.7**	**91.7**	**91.0**
10	**7.5**	**88.5**	**91.7**	**91.7**	**91.7**
15	**7.5**	**88.5**	**91.7**	**92.4**	**91.7**
20	**15.9**	**90.2**	**92.4**	**93.0**	**92.4**
25	**18.8**	**91.0**	**93.0**	**93.6**	**93.0**
30	**22.5**	**91.0**	**93.6**	**94.1**	**93.0**
40	**30.0**	**91.7**	**94.1**	**94.5**	**93.6**
50	**37.5**	**92.4**	**94.1**	**94.5**	**94.1**
60	**45.0**	**93.0**	**94.5**	**95.0**	**94.1**
75	**56.3**	**93.0**	**95.0**	**95.4**	**94.5**
100	**75.0**	**93.0**	**95.4**	**95.4**	**95.0**
125	**93.8**	**94.5**	**95.4**	**95.4**	**95.4**
150	**112.5**	**94.5**	**95.8**	**95.8**	**95.4**

200	**150.0**	**94.5**	**95.8**	**96.2**	**95.8**
250	**187.5**	**94.5**	**95.1**	**96.2**	**95.1**
300	**225.0**	**94.5**	**95.3**	**96.2**	**95.3**
350	**225.0**	**94.5**	**95.3**	**96.2**	**95.3**
400	**300.0**	**94.5**	**95.4**	**96.2**	**95.4**
450	**337.5**	**94.5**	**95.5**	**96.2**	**95.5**
500	**375.0**	**94.5**	**95.6**	**96.2**	**95.6**

4. Refer to Equipment Schedules on the Drawings for motor horsepower, voltage, and phase.
5. Refer to individual product sections for additional motor requirements.
6. Motors shall have built-in thermal overload protection or be protected externally with separate thermal overload devices with low voltage release or lockout. Hermetically sealed motors shall have quick trip devices.
7. All motors controlled by variable frequency drives shall be inverter duty-rated and have Class F insulation or better. They shall also be able to withstand repeated voltage peaks of 1600 volts with rise times of 0.1 microseconds and greater in accordance with NEMA Standard MG1 Part 31.
8. Motors served from variable frequency drives shall be equipped with a shaft grounding system, which shall provide a path for current to flow between the shaft and motor frame. SGS or equal.
9. Motors located in environment air plenums not tied to air handling functions shall be totally enclosed type motors.

D. Motors – Electronic Commutation (EC):
1. Motors shall be furnished as an integral part of driven equipment.
2. Permanently lubricated with ball bearings unless noted otherwise.
3. Internal motor circuitry shall convert AC power supplied to the motor to DC power to operate the motor.
4. Motor shall be speed controllable down to 20% of full speed.
5. Motor efficiency shall be a minimum of 85% at all speeds.
6. Refer to Equipment Schedules on the Drawings for motor horsepower, voltage, and phase.
7. Refer to individual product sections for additional motor requirements.
8. Motors shall have built-in thermal overload protection or be protected externally with separate thermal overload devices with low voltage release or lockout. Hermetically sealed motors shall have quick trip devices.
9. Motors located in environment air plenums not tied to air handling functions shall be totally enclosed type motors.

E. Starters: Provided under Division 26, Electrical, suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.

F. Equipment Wiring: Interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless shown otherwise. This does not include the wiring of motors, starters, and controllers provided under Division 26, Electrical.

G. Control Wiring: All control wiring for plumbing equipment shall be provided herewith.

H. Codes: All electrical equipment and products shall bear the Underwriters label as required by governing codes and ordinances.

PART 3 EXECUTION

2.01 ACCESS PANELS

A. Install in accordance with the manufacturer’s recommendations, coordinated with architectural features.

B. Provide 2-hour fire-rated doors where required bearing the U.L. label.

C. Furnish 18x18-inch panels for ceilings and for access to equipment in soffits and shafts, and 12x12-inch for walls unless indicated otherwise.

D. Furnish where indicated and where required to access valves, trap primers, shock arresters, and other appurtenances requiring operation, service, or maintenance. Submit proposed locations for review prior to installation.

2.02 SLEEVES

A. Interior Floor and Wall Sleeves: Provide sleeves large enough to provide 3/4-inch clearances around pipe or ductwork. Where pipe or ductwork is insulated, insulation shall pass continuously through the sleeve with a 3/4-inch clearance between the insulation and the sleeve. Penetrations through the mechanical room and fan room floors shall be made watertight by packing with safing insulation and sealing with Tremco Dymeric Sealant or an approved system.

B. Sleeves Through Rated Floors and Walls: Similar to interior sleeves except install fire rated system approved by Authority Having Jurisdiction and Owners insurance underwriter, with a rating equal to the floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size, and service.

C. Exterior Wall Sleeves Below Grade: Provide water-tight sleeves. Install at pipes entering the building below grade and where shown. Adjust to provide a positive hydrostatic seal. Contractor shall be responsible for following manufacturer's procedure for installing and tightening seal. Secure sleeves against displacement.

D. On-Grade Floor Sleeves: These are the same as below-grade exterior wall sleeves, caulked from the inside.

E. Exterior Wall Sleeves Above Grade: Similar to interior wall sleeves except for caulk outside with Tremco Dymeric Sealant.

F. Layout work before concrete forming. Do all cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.

G. All floor sleeves shall maintain a water barrier by providing a water-tight seal, or they shall extend 1 inch above the finished floor except through mechanical equipment room floors and shafts where sleeves shall extend 2 inches above the finished floor level. Sleeves through the roof shall extend 8 inches above the roof. Wall sleeves shall be flush with the face of the wall unless otherwise indicated. Waste stacks using carriers shall have sleeves flush with the floor and sealed. Sleeves through planters shall extend 8 inches above the planter base.

H. Do not support pipes by resting pipe clamps on floor sleeves. Supplementary members shall be provided so pipes are floor-supported.

I. Special sleeves detailed on the drawings shall take precedence over this section.

2.03 CLEANING

A. General: Clean plumbing equipment, fixtures, and piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.

B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

C. Additional requirements are specified under specific Sections of this Division.

2.04 EQUIPMENT PROTECTION

A. Keep pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, fixtures, equipment, and apparatus against dirty water and chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment, or apparatus to original conditions or replace them at no cost to the Owner.

B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.

C. Cover or otherwise suitably protect equipment and materials stored on the job site.

2.05 ACCESSIBILITY

A. General: Locate valves, thermometers, cleanout fittings, and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.

B. Thermometers and Gauges: Install thermometers and gauges so as to be easily read from the floors, platforms and walkways.

2.06 FLOOR, WALL, AND CEILING PLATES

A. Install on piping and ductwork passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates shall completely cover the opening around the pipe.

B. Secure wall and ceiling plates to pipe, insulation, or structure.

C. Plates shall not penetrate insulation vapor barriers.

D. Plates are not required in mechanical rooms or unfinished spaces.

2.07 PAINTING

A. General: Coordinate painting of mechanical equipment and items with products and methods in conformance with the appropriate Division of Work, Painting. All exposed work under this division shall receive either a factory-painted finish or a field prime coat finish, except:
   1. Exposed copper piping.
   2. Aluminum jacketed outdoor insulated piping.

B. Equipment Rooms and Finished Areas:
   1. Insulation: Not painted.
   2. Hangers, Uninsulated Piping, Miscellaneous Ironwork, Structural Steel Stands, Uninsulated Tanks, and Equipment Bases: Paint one coat of black enamel.
   3. Steel Valve Bodies and Bonnets: One coat of black enamel.
   4. Brass Valve Bodies: Not painted.
   5. Equipment: One coat of grey machinery enamel. Do not paint nameplates.

C. Concealed Spaces (above ceilings, not visible):
   1. Insulation: Not painted.
   2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies, and Bonnets: Not painted.

D. Exterior Steel: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel.

E. Exterior Black Steel Pipe: Wire brush and apply two coats of rust-inhibiting primer and one coat of exterior enamel. Painting schemes shall comply with ANSI A13.1.

2.08 ADJUSTING AND CLEANING

A. Before operating any equipment or systems, make a thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.

B. Use particular care in lubricating bearings to avoid damage by over lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.

2.09 ELECTRICAL EQUIPMENT

A. Piping for plumbing systems not serving electrical space shall not be installed in any switchgear room, transformer vault, telephone room, or electric closet except as indicated.

B. Piping for plumbing systems shall not pass over switchboards or electrical panelboards. Where conflicts exist, bring them to the attention of the Architect.

2.10 EQUIPMENT CONNECTIONS

A. Make final connections to equipment specified in sections other than Division 22 of the specifications and Owner furnished equipment in accordance with the manufacturer's instructions and shop drawings furnished and as indicated.

B. Piping:
   1. Connections shall include hot and cold water, deionized water, distilled water, natural gas, medical gases, medical air and vacuum, dental air and vacuum, lab air and vacuum, sanitary waste and vent, lab waste and vent, and fuel oil.
   2. Provide valves and specialties as specified and as detailed on the drawings. Provide increasers, reducers, and any other fittings required for complete installation.
   3. All piping connections shall be independently supported to prevent undue strain on equipment.

END OF SECTION

SECTION 220516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. EJMA (STDS) - EJMA Standards; Tenth Edition.

B. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
   2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Samples: Submit two low pressure compensators 3/4 inch (20 mm) in size.

D. Design Data: Indicate selection calculations.

E. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

F. Maintenance Data: Include adjustment instructions.

G. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with UL (DIR) requirements.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturers:
   1. Flex-Weld, Inc; _____: www.kelcoind.com/#sle.
   2. The Metraflex Company: www.metraflex.com/#sle.
   3. Unisource Manufacturing, Inc; Series 411, Bronze Braided Flex Connectors: www.unisource-mfg.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Exterior Sleeve: Braided bronze.

C. Pressure Rating: ____ psi up to ___ inch (____ kPa up to ___ mm, DN).

D. Maximum Service Temperature: 450 degrees F (232 degrees C).

E. End Connections: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch (20 mm) on each side of installed center line.

H. Application: Copper piping.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.02 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, mounting and support details, and piping connections.

1.04 QUALITY ASSURANCE

A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Manufacturers:
   1. Flexicraft Industries
   2. Substitutions: See Section 016000 - Product Requirements.

B. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch (40 mm) angle set in silicon adhesive around the opening.
   4. Drilled Penetrations: Provide 1-1/2 inch (40 mm) angle ring or square set in silicone adhesive around the penetration.

C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

F. Pipe Passing Through Mechanical Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

H. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
1. Advance Products & Systems, LLC; Innerlynx.
2. Flexicraft Industries; PipeSeal.
3. Hilti.
4. Link-Seal.
5. Substitutions: See Section 016000 - Product Requirements.

B. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 m).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations:
1. Do not penetrate building structural members unless coordinated with the Structural Engineer.

F. Provide sleeves when penetrating . Seal pipe, including sleeve penetrations, to achieve fire resistance equivalent to the fire separation required.
1. Underground Piping: Caulk pipe sleeve watertight with mechanically expandable chloroprene inserts with bitumen-sealed metal components.

2. Aboveground Piping:
    a. Pack solid using mineral fiber complying with ASTM C592.
    b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with fire-stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into the building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field-assembled sleeve-seal system components in the annular space between the sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 220519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Positive displacement meters.

B. Flow meters.

C. Pressure gauges and pressure gauge taps.

D. Thermometers and thermometer wells.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi; 2004 (Reaffirmed 2017).

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2025).

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

E. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2024.

F. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2024.

G. AWWA C702 - Cold-Water Meters -- Compound Type; 2024.

H. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).

I. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide a list that indicates use, operating range, total range, and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

D. Operation and Maintenance Data:

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 POSITIVE DISPLACEMENT METERS (LIQUID)

A. Manufacturers:
   1. Dwyer Instruments, Inc
   2. FMC Technologies
   3. Venture Measurement, a Danaher Corporation Company
   4. Substitutions: See Section 016000 - Product Requirements.

B. AWWA C700, positive displacement disc type suitable for fluid with bronze case and cast iron frost-proof, breakaway bottom cap, hermetically sealed register, remote reading.

C. Meter: Brass body turbine meter with magnetic drive register.

2.02 LIQUID FLOW METERS

A. Manufacturers:

1. Dwyer Instruments, Inc.
2. Venture Measurement, a Danaher Corporation Company
3. McCrometer, Inc
4. Substitutions: See Section 016000 - Product Requirements.

B. Calibrated ASME MFC-3M venturi orifice plate and flanges with valved taps, chart for conversion of differential pressure readings to flow rate, with pressure gauge in case.

C. Annular element flow stations with meter set.
1. Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.

2.03 PRESSURE GAUGES

A. Manufacturers:
1. Dwyer Instruments, Inc.
2. Moeller Instrument Company, Inc.
3. Omega Engineering, Inc.
4. Weksler Glass Thermometer Corp
5. Substitutions: See Section 016000 - Product Requirements.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch (115 mm) diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi.

2.04 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).

B. Needle Valve: Brass, 1/4 inch (6 mm) NPT for minimum 150 psi (1034 kPa).

2.05 STEM TYPE THERMOMETERS

A. Manufacturers:
1. Dwyer Instruments, Inc.
2. Omega Engineering, Inc.
3. Weksler Glass Thermometer Corp
4. Substitutions: See Section 016000 - Product Requirements.

B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
1. Size: 9 inch (225 mm) scale.
2. Window: Clear Lexan.
3. Accuracy: 2 percent, per ASTM E77.
4. Calibration: Degrees F.

2.06 DIAL THERMOMETERS

A. Manufacturers:
1. Dwyer Instruments, Inc.
2. Omega Engineering, Inc.
3. Weksler Glass Thermometer Corp
4. Substitutions: See Section 016000 - Product Requirements.

B. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.

1. Size: 5 inch (125 mm) diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

2.07 TEST PLUGS

A. Test Plug: 1/4 inch (6 mm) or 1/2 inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F (93 degrees C).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

C. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

E. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION

SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.
B. General requirements.
C. Backwater valves.
D. Water pressure-reducing valves.
E. Balancing valves.
F. Water relief valves.
G. System specialties.
H. Specialty valves.
I. Ball valves.
J. Check valves.
K. Gate valves.
L. Globe valves.
M. Plug valves.

1.02 RELATED REQUIREMENTS

A. Section 220553 - Identification for Plumbing Piping and Equipment.
B. Section 220716 - Plumbing Equipment Insulation.
C. Section 220719 - Plumbing Piping Insulation.
D. Section 221005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. NPS: Nominal pipe size.
B. CWP: Cold working pressure.
C. EPDM: Ethylene propylene copolymer rubber.
D. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
E. NRS: Non-rising stem.
F. OS&Y: Outside screw and yoke.
G. PTFE: Polytetrafluoroethylene.
H. RS: Rising stem.
I. SWP: Steam working pressure.
J. TFE: Tetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
E. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2025.
F. ASME B31.9 - Building Services Piping; 2025.

G. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

H. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.

I. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017 (Reapproved 2025).

J. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.

K. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

L. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

M. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

N. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.

O. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

P. NSF 61 - Drinking Water System Components - Health Effects; 2024.

Q. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of the square plug valve head.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, Gate, or Plug.
   2. Throttling: Provide globe, angle, or ball.
   3. Swing Check (Pump Outlet):
      a. 2 NPS (50 DN) and Smaller: Bronze swing check valves with a disc.
      b. 2-1/2 NPS (65 DN) and Larger for Domestic Water: Iron swing check valves with metal seat.
      c. 2-1/2 NPS (65 DN) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

D. Domestic, Hot and Cold Water Valves:
   1. 2 NPS (50 DN) and Smaller:
      a. Bronze and Brass: Provide with solder-joint or threaded ends.
      b. Ball: One piece, full port, bronze or PEX type A with brass trim, lead-free.
      c. Bronze Swing Check: Class 125, bronze disc.
      d. Bronze Gate: Class 125, NRS.
      e. Bronze Globe: Class 125, bronze disc.
   2. 2-1/2 NPS (65 DN) and Larger:
      a. Iron, 2-1/2 NPS (65 DN) to 4 NPS (100 DN): Provide with threaded or flanged ends.

b. Iron Ball: Class 150, lead-free.
c. Iron Swing Check: Class 125, metal seats, lead-free.
d. Iron Gate: Class 125, OS&Y, lead-free.
e. Iron Globe: Class 125.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than the rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
1. Gear Actuator: Quarter-turn valves 8 NPS (200 DN) and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 NPS (150 DN) and smaller except plug valves.
4. Wrench: Plug valves with square heads.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: With 2 NPS (50 DN) stem extensions and the following features:
1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Solder Joint Connections: ASME B16.18.

F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.

G. Valve Materials for Potable Water: NSF 61 and NSF 372.

2.03 BRONZE BALL VALVES

A. One Piece, Reduced Port with Bronze Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 400 psig (2760 kPa).
3. CWP Rating: 600 psig (4140 kPa).
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Bronze.
8. Ball: Chrome plated brass.
9. Manufacturers:
a. Viega LLC
b. Apollo Valves
c. Nibco
d. Hammond
e. Milwaukee Valve
f. Substitutions: See Section 016000 - Product Requirements.

B. Two Piece, Standard Port with Bronze Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig (1035 kPa).
3. CWP Rating: 600 psig (4140 kPa).
4. Body: Bronze.

5. Ends: Threaded.
6. Seats: PTFE.

2.04 IRON BALL VALVES

A. Class 125, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72.
2. CWP Rating: 200 psig (1380 kPa).
3. Body: ASTM A536 Grade 65-45-12, ductile iron.
4. Ends: Flanged.
5. Seats: PTFE.
6. Operator: Lever, with locking handle.

2.05 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa).
1. Comply with MSS SP-80, Type 3.
2. Design: Horizontal flow.
3. Body: Bronze, ASTM B62.
4. Ends: Threaded as indicated.
5. Disc: Bronze.
6. Manufacturers:
a. Apollo Valves
b. Nibco
c. Hammond
d. MIilwaukee Valve.
e. Substitutions: See Section 016000 - Product Requirements.

2.06 IRON SWING CHECK VALVES

A. Class 125:
1. Comply with MSS SP-71, Type I.
2. CWP Rating: 200 psig (1380 kPa).
3. Design: Clear or full waterway.
4. Body: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged as indicated.
6. Trim: Composition.
7. Seat Ring and Disc Holder: Bronze.
8. Disc: PTFE.
9. Gasket: Asbestos free.
10. Manufacturers:
a. Apollo Valves
b. Nibco
c. Hammond
d. Milwaukee Valve
e. Flomatic Valves
f. Substitutions: See Section 016000 - Product Requirements.

2.07 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
1. Comply with MSS SP-71, Type I.
2. Description:
a. CWP Rating: 200 psig (1380 kPa).
b. Design: Clear or full waterway.
c. Body: ASTM A126, gray iron with bolted bonnet.
d. Ends: Flanged as indicated.
e. Trim: Bronze.

f. Gasket: Asbestos free.
g. Closer Control: Factory installed, exterior lever, and weight.

2.08 BRONZE GATE VALVES

A. Rising Stem (RS):
1. Comply with MSS SP-80, Type I.
2. Class 125: CWP Rating: 200 psig: (1380 kPa).
3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint joint.
5. Stem: Bronze.
6. Disc: Solid wedge; bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.
9. Manufacturers:
a. Apollo Valves
b. Nibco
c. Hammond
d. Milwaukee
e. Substitutions: See Section 016000 - Product Requirements.

2.09 IRON GATE VALVES

A. NRS or OS & Y:
1. Comply with MSS SP-70, Type I.
2. Class 125: CWP Rating: 200 psig: (1380 kPa).
3. Body: ASTM A126, gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.
8. Manufacturers:
a. Apollo Valves
b. Nibco
c. Hammond
d. Milwaukee
e. Substitutions: See Section 016000 - Product Requirements.

2.10 BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig: (1380 kPa).
1. Comply with MSS SP-80, Type 1.
2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
3. Ends: Threaded joint.
4. Stem: Bronze.
5. Disc: PTFE.
6. Packing: Asbestos free.
7. Handwheel: Malleable Iron.
8. Manufacturers:
a. Apollo Valves
b. Milwaukee
c. Hammond
d. Nibco
e. Substitutions: See Section 016000 - Product Requirements.

2.11 IRON GLOBE VALVES

A. Class 125: CWP Rating: 200 psig: (1380 kPa).

1. Comply with MSS SP-85, Type I.
2. Body: Gray iron; ASTM A126, with bolted bonnet.
3. Ends: Flanged.
4. Trim: Bronze.
5. Packing and Gasket: Asbestos free.
6. Operator: Handwheel or chainwheel.
7. Manufacturers:
    a. Apollo Valves
    b. Milwaukee
    c. Hammond
    d. Nibco
    e. Substitutions: See Section 016000 - Product Requirements.

2.12 BALANCING VALVES

A. Lead-Free Manual Calibrated:
    1. Bronze, Ametal (copper-alloy), or ductile iron body, brass globe or ball, differential pressure readout valves with integral checks, calibrated plate, and integral pointer.
    2. Suitable for tight shutoff, memory stops, threaded, grooved or soldered ends, 250 psi water, NSF/ANSI 61 compliant.
    3. Manufacturers:
        a. Bell & Gossett

2.13 SPECIALTY VALVES

A. Gas Cock:
    1. Forged brass body, hard chromium plated forged brass ball, with handle, rubber seats meeting ASTM D471, 175 psi WOG.
    2. Test the entire unit to latest version of ANSI Z21.15, AGA, and UL listed.

B. Emergency Gas Shutoff:
    1. Cast steel, normally closed, manually opened, electrically held open, automatic closing upon power interruption.
    2. Provide manual gas cock upstream of the emergency gas shut-off valve.

C. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, ¼-inch.

D. Drain Valves: Bronze globe valve or full port ball valve, garden hose end, cap, and chain 3/4-inch size.

E. Gas Pressure Regulator:
    1. 0-500 SCFH capacity at 0-14 inches outlet pressure.
    2. Body: Cast iron complying with ANSI 125-pound construction standard.
    3. Orifice: Aluminum
    4. Valve Seat: BUNA-N
    5. Diaphragm: BUNA-N
    6. Internal relief valve
        a. Vent limiting device
        b. Maxitrol 325 series
    7. Description: 501-3,000 SCFH capacity at 0-2 psig outlet pressure.
        a. Body: Cast iron complying with ANSI 125-pound construction standard.
        b. Orifice: Brass
        c. Valve Seat: BUNA-N
        d. Diaphragm: BUNA-N
        e. Internal relief valve
        f. Actaris B38 series
    8. Description: 3,001-10,000 SCFH capacity at 1-2 psig outlet pressure.
        a. Body: Ductile iron
        b. Orifice: Stainless steel

c. Valve Seat: Brass with vulcanized BUNA-N
d. Diaphragm: BUNA-N
e. External relief valve
f. Actaris RB1700 series

2.14 WATER PRESSURE-REDUCING VALVE

A. Manufacturers:
1. Amtrol Inc
2. Apollo Valves
3. Cla-Val Company
4. Flomatic Valve
5. Watts Regulator Company
6. Substitutions: See Section016000-Product Requirements.

B. Up to 2 Inches:
1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches
1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

D. Description:
1. Lead-free brass body.
2. Inlet Strainer
3. Water Tight Spring Cage Assembly
4. Minimum Working Pressure: 300 psi
5. Maximum working Temperature 160 degrees F
6. Adjustable Reduced Pressure Range: 25 psi – 75 psi
7. Watts LF223S

2.15 SYSTEM SPECIALTIES

A. Manual Air Vents: Coin type; Dole 9 or approved equal.

B. Pressure/Temperature Test Plug:
1. Manufacturers:
a. Peterson Engineering, Inc.
b. Universal Lancaster
c. Sisco
d. Trerice
2. Other Manufacturers: Submit substitution request.
3. General: 1/2-inch NPT fitting to receive either a temperature or pressure probe 1/8-inch O.D., fitted with a color-coded and marked cap with gasket.
4. Material: Solid brass with valve core of NORDEL.
5. Rating: Minimum 300 psig at 275 degrees F.
6. Gauges and Thermometers: Supply the Owner with two pressure gauge adapters with 1/8-inch OD probe and two five-inch stem pocket test thermometers 25 degrees F to 125 degrees F for chilled water, 40 degrees F to 240 degrees F for heating water.

2.16 RELIEF VALVES

A. Pressure:
1. Manufacturers:
a. Cla-Val Co
b. Henry Technologies
c. Watts Regulator Company
d. Substitutions: See Section016000-Product Requirements

2. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure:
   1. Manufacturers:
      a. Cla-Val Co
      b. Henry Technologies
      c. Watts Regulator Company
   2. Substitutions: See Section016000-Product Requirements.

C. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.17 STRAINERS

A. Manufacturers:
   1. General:
      a. Armstrong
      b. McAlear
      c. Sarco
      d. Steamflo
      e. Mueller
      f. R.P. & C. Company Titan Flow Control
   2. Grooved Coupling Systems:
      a. Gruvlok
      b. Victaulic
      c. Other Manufacturers: Submit substitution request.

B. Wye Pattern:
   1. Bronze: Bronze body, 250 psi, 1/16-inch perforated type 304 stainless screen.
   2. Ductile Iron: Ductile iron body, 300 psi, 1/16 or 1/8-inch 304 stainless steel screen.
   3. Cast Iron: Cast iron body, 125 psi, 1/16-inch perforated type 304 stainless screen.
   4. Cast Iron, High Pressure: Cast iron body, 250 psi, 1/16-inch perforated type 304 stainless screen.

C. Size 2 inches and Under:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

D. Size 1-1/2 inch to 4 inch:
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

E. Size 5 inches and Larger:
   1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.18 BACKWATER VALVE

A. Manufacturers:
   1. J.R. Smith
   2. Zurn
   3. Josam
   4. Other Manufacturers: Submit substitution request.

B. Description:
   1. J.R. Smith 7022Y cast iron backwater valve with threaded cover and no-hub connections.
   2. Model 7022S may be substituted for shallow bury applications where vault access is not required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that the valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm that the gasket material is suitable for the service, is of the correct size, and without defects that could compromise effectiveness.

D. Should the valve be determined to be defective, replace it with a new valve.

3.02 INSTALLATION

A. Manual Air Vents:
   1. Install at high points where automatic air vents are not used, where noted, and where required for proper venting of the system.
   2. Install in accordance with the manufacturer's recommendations.

B. Strainer:
   1. Applied Locations Plumbing:
      a. Bronze wye, in piping 2-inch and smaller; domestic water.
      b. Cast iron, in piping 2-1/2-inch and larger; domestic water.
      c. Cast iron, high-pressure wye, in piping 2-1/2-inch and larger; domestic water.

C. Backwater Valves:
   1. Install backwater within the vault indicated.
   2. If the vault is not indicated (shallow bury application), provide soil pipe extension to install ferrule and cover at the top and flush with the floor surface.

D. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

E. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

F. Install check valves where necessary to maintain direction of flow as follows:
   1. Swing Check: Install horizontal maintaining hinge pin level.

G. Provide chainwheels on operators for valves 4 NPS and larger where located 8 feet or more above the finished floor, terminating 5 feet above the finished floor.

END OF SECTION

SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping

B. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 220719 - Plumbing Piping Insulation

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2025.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

H. MFMA-4 - Metal Framing Standards Publication; 2004.

I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until the concrete has fully cured in accordance with applicable standards.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for all manufactured hangers, supports, hardware, etc.

C. Shop Drawings: Include details for fabricated hangers and supports.

D. Derating Calculations for Systems where such conditions exist: Indicate load ratings adjusted for applicable service conditions.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide hangers compatible with soft surface piping (including but not limited to plastic and copper pipe and fittings) and will not cut, scratch, or damage tubing during vibration and/or thermal expansion/contraction.
   3. Provide sufficient hangers and supports to prevent bowing of piping. (To be verified during filled operating conditions.)
   4. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   5. Where support and attachment component types and sizes are not indicated, select in accordance with the manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   7. Steel Components: Use corrosion-resistant materials suitable for the environment where they are installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Engineered Support Systems:
   1. The following support systems shall be designed and detailed and bear the seal of a professional engineer registered in the state having jurisdiction.
      a. Supports and seismic restraints for suspended piping and equipment.
      b. Support frames such as pipe racks or stanchions for piping and equipment that provide support from below.
      c. Equipment and piping support frame anchorage to supporting slab or structure.

C. Metal Channel (Strut) Framing Systems:
   1. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation
      b. Thomas & Betts Corporation
      c. Unistrut, a brand of Atkore International, Inc

d. Substitutions: See Section 016000 - Product Requirements.
e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
3. Comply with MFMA-4.
4. Channel Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm).
6. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.

D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch (13 mm) diameter.
   b. Piping up to 1 inch (27 mm) nominal: 1/4 inch (6 mm) diameter.
   c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch (10 mm) diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.

E. Thermal Insulated Pipe Supports:
1. General Construction and Requirements:
   a. Insulated pipe supports are to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch (12.7 mm to 762 mm) iron pipes.
2. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Moisture Vapor Transmission: 0.0071 perm inch (0.0092 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   c. Thickness: 60 mil (1.524 mm).

F. Pipe Supports:
1. Liquid Temperatures Up To 250 degrees F (121 degrees C):
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.

G. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. Riser Clamps:
1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. Provide pipe surface protection for riser clamp clamping surface.

I. Strut Clamps: Two-piece pipe clamp.

J. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

K. Pipe Hangers: For a given pipe run use hangers of the same type and material.

L. Intermediate Pipe Guides: Use pipe clamps with oversizes pipe sleeve that provides clearance around pipe.
1. Pipe Diameter 6 inches (150 mm) and Smaller: Provide a minimum clearance of 0.16 inch (4 mm).

M. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

N. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   4. Hollow Masonry: Use toggle bolts.
   5. Steel: Use beam clamps or welded threaded studs.
   6. Wood: Use wood lag screw anchors.
   7. Plastic and lead anchors are not permitted.
   8. Hammer-driven anchors and fasteners are not permitted.
   9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from the roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on a properly sized 3 inch (80 mm) high concrete pad constructed in accordance with applicable standards.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 220548
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

D. Vibration-isolated and/or seismically engineered roof curbs.

1.02 RELATED REQUIREMENTS

A. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification method for spring element load capacities.

D. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
   2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Field quality control test reports.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
   4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
   5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2 inch (50 mm) operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation: As indicated on drawings.

E. Piping Isolation:
   1. Provide vibration isolators for piping supports:
      a. Located within 50 feet (15.2 m) of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
      b. For piping over 2 inch (50 mm) located below or within 50 feet (15.2 m) of noise-sensitive areas indicated.
   2. Minimum Static Deflection:
      a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch (50 mm) deflection required.
      b. Remainder of Supports: 0.75 inch (19 mm) deflection unless otherwise indicated.
   3. Suspended Piping, Non-Seismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
   5. Floor-Mounted Piping, Non-Seismic Applications: Use open (unhoused) spring isolators.
   6. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
   7. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g. walls, floors) arranged to prevent vibration transmission to structure.

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
   1. Vibration-Isolated Equipment Support Bases:

a. Kinetics Noise Control, Inc.
b. Mason Industries
c. Vibration Eliminator Company, Inc.
d. Substitutions: See Section 016000 - Product Requirements.

2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration-Isolated Structural Steel Bases:
1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting equipment.

2.03 VIBRATION ISOLATORS

A. Manufacturers:
1. Vibration Isolators:
a. Kinetics Noise Control, Inc.
b. Mason Industries
c. Vibration Eliminator Company, Inc.
d. Substitutions: See Section 016000 - Product Requirements.

2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
a. Color code or otherwise identify springs to indicate load capacity.
b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.

C. Vibration Isolators for Non-Seismic Applications:
1. Resilient Material Isolator Pads:
a. Description: Single or multiple layer pads utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material.
b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch (6 mm) thickness.
c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Non-Seismic:
a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:
a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
b. Bottom Load Plate: Non-skid molded elastomeric isolator material or steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.
c. Furnished with an integral leveling device for positioning and securing supported equipment.
4. Housed Spring Isolators:

a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
b. Furnished with an integral leveling device for positioning and securing supported equipment.

5. Restrained Spring Isolators, Non-Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
6. Resilient Material Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g. neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

2.04 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A. Manufacturers:
   1. Vibration-Isolated and/or Seismically Engineered Roof Curbs:
      a. Kinetics Noise Control, Inc.
      b. Mason Industries
      c. Vibration Eliminator Company, Inc.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Source Limitations: Furnish vibration-isolated roof curbs and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. Vibration Isolation Curbs:
   1. Non-Seismic Curb Rail:
      a. Location: Between existing roof curb and rooftop equipment.
      b. Construction: Steel.
      c. Integral vibration isolation to comply with requirements of this section.
      d. Weather exposed components consist of corrosion resistant materials.
   2. Non-Seismic Curb:
      a. Location: Between structure and rooftop equipment.
      b. Construction: Aluminum.
      c. Integral vibration isolation to comply with requirements of this section.
      d. Weather exposed components consist of corrosion resistant materials.
   3. Seismic Curb:
      a. Location: Between structure and rooftop equipment.
      b. Construction: Steel.
      c. Integral vibration isolation to comply with requirements of this section.
      d. Snubbers consist of minimum 0.25 inch (6 mm) thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
      e. Weather exposed components consist of corrosion resistant materials.

C. Seismic Type Non-Isolated Curb and Fabricated Equipment Piers:
   1. Location: Between structure and rooftop equipment.
   2. Construction: Steel.
   3. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Vibration-Isolated Equipment Support Bases:
      a. Provide specified minimum clearance beneath base.
   2. Spring Isolators:
      a. Position equipment at operating height; provide temporary blocking as required.
      b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
      c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
   3. Clean debris from beneath vibration-isolated equipment that could cause short circuiting of isolation.
   4. Use elastomeric grommets for attachments where required to prevent short circuiting of isolation.
   5. Adjust isolators to be free of isolation short circuits during normal operation.
   6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Provide services of a manufacturer's authorized representative for vibration isolation systems to observe installation and assist in inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.

D. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify required clearance beneath vibration-isolated equipment support bases.
   3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers.

B. Pumps: Nameplates.

C. Small-sized Equipment: Tags.

D. Tanks: Nameplates.

E. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc.
   2. Kolbi Pipe Marker Co.
   3. Seton Identification Products
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch (6 mm).
   3. Background Color: Black.

2.03 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving
   2. Brady Corporation
   3. Brimar Industries, Inc.
   4. Craftmark Pipe Markers
   5. Kolbi Pipe Marker Co.
   6. Seton Identification Products
   7. Substitutions: See Section 016000 - Product Requirements.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers
4. Kolbi Pipe Marker Co.
5. MIFAB, Inc.
6. Seton Identification Products
7. Substitutions: See Section 016000 - Product Requirements.

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

F. Color code as follows:
1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
2. Fire Quenching Fluids: Red with white letters.
3. Toxic and Corrosive Fluids: Orange with black letters.
4. Flammable Fluids: Yellow with black letters.
5. Combustible Fluids: Brown with white letters.
6. Compressed Air: Blue with white letters.

2.05 CEILING TACKS

A. Manufacturers:
1. Craftmark Pipe Markers
2. Substitutions: See Section 016000 - Product Requirements.

B. Description: Steel with 1/2 inch diameter color-coded head.

C. Color code as follows:
1. Isolation Valves: Green.
2. Balancing Valves: Blue.
3. Plumbing Pumps: Red.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.

F. Use tags on piping surface 3/4 inch (20 mm) diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification so as not to exceed 20 feet (6 m) on straight runs, including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Locate ceiling tacks to locate valves above lay-in panel ceilings. Locate it in the corner of the panel closest to the equipment.

END OF SECTION

SECTION 220716
PLUMBING EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible glass fiber insulation.

1.02 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

D. ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks; 2025.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE GLASS FIBER INSULATION

A. Insulation: ASTM C553; flexible, noncombustible.
   1. K (Ksi) Value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

B. Insulation: ASTM C1393; pipe and tank, end grain adhered to jacket.
   1. K (Ksi) Value: ASTM C177, 0.27 at 75 degrees F (0.034 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   1. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

E. For fiberglass insulated equipment containing fluids below ambient temperature, provide vapor barrier jackets, factory-applied or field-applied, and finish with glass cloth and vapor barrier adhesive.

F. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

G. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Cold Water Storage Tanks:
      a. Glass Fiber, Flexible Insulation: 1 inches thick.

END OF SECTION

SECTION 220719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Pipe acoustical wrap.

C. Jackets and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2024).

D. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2024).

E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

F. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

H. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 REGULATORY REQUIREMENTS

A. Insulating products are prohibited from containing pentabrominated, octabrominated, and decabrominated diphenyl ethers. Where products within this specification contain these banned substances, complying products from approved manufacturers with equal performance characteristics are provided.

B. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

C. Energy Codes: Local Building and Energy Codes govern where insulation performance requirements for thickness exceed the thickness specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation
   2. Johns Manville Corporation
   3. Knauf Insulation
   4. Owens Corning Corporation
   5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation into the atmosphere.
   1. K (Ksi) Value: ASTM C177, 0.23 at 75 degrees F (0.034 at 24 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

F. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

G. Insulating Cement: ASTM C449.

2.02 HYDROUS CALCIUM SILICATE

A. Manufacturers:
   1. Johns Manville Corporation
   2. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos-free, gold color.
   1. K (Ksi) Value: 0.40 at 300 degrees F (0.057 at 149 degrees C) when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
   3. Density: 15 lb/cu ft (240 kg/cu m).

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc
   2. Armacell LLC; AP Armaflex
   3. K-Flex USA LLC; Insul-Tube
   4. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use of molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 PIPE ACOUSTICAL WRAP

A. Barrier
   1. Nominal density of 2 pounds per square foot vinyl noise barrier with reinforced foil facing on one side

2. Minimum thermal conductivity value of 0.29 and a rated service temperature range of -20 degrees F to 220 degrees F.

B. Decoupling Layer:
1. 1-inch thick acoustical fiberglass quilted with a non-porous scrim facing.

C. Composite Material:
1. Fabricated to include a nominal 6-inch wide barrier overlap tab extending beyond the quilted fiberglass to facilitate a leak-tight seal around field joints.

D. Performance:
1. Minimum STC rating of 29 when tested in accordance with ASTM E90 and E413.
2. A flame spread index of less than 25 and a smoke-development index of less than 50 when tested in accordance with ASTM E84 or UL 723.

E. Accessories for securely mounting the Acoustical pipe and duct lagging
1. Foil lag tape
2. Stick pins
3. Welding pins
4. Banding

2.05 JACKETS

A. PVC Plastic.
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F (Minus 18 degrees C).
b. Maximum Service Temperature: 150 degrees F (66 degrees C).
c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil (0.25 mm).
e. Connections: Brush on welding adhesive.
2. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016 inch (0.40 mm) sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
4. Fittings: 0.016 inch (0.4 mm) thick die-shaped fitting covers with a factory-attached protective liner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate the entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

F. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Calcium Silicate Insulation:
   1. Secure with 18-gauge wire embedded into insulation.
   2. Cover with a continuous vapor barrier jacket.

I. Elastomeric Insulation:

J. Slit full length and snap around the pipe.
   1. Make cuts perpendicular to the insulating surface, leaving no cut section exposed.
   2. Do not stretch insulation to cover joints or fittings.
   3. Seal joints in elastomeric insulation with adhesive.
   4. Exterior insulation is painted with two coats of specified paint in accordance with the manufacturer's instructions and encased in a metal jacket.
   5. Sealing joints with tape will not be allowed.

K. Inserts and Shields:
   1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

L. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

M. Exterior Applications: Provide a vapor barrier jacket. Insulate fittings, joints, and valves with insulation of material and thickness such as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on the bottom side of horizontal piping.

N. Heat-Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. The size is large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on the bottom side of horizontal piping.

O. Elastomeric insulation is not allowed over heat trace cable.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Supply:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: Less than 1-1/4 inch.
            (a) Thickness: 1.0 inch.
         2) Pipe Size Range: 1-1/2 inch and larger.
            (a) Thickness: 1.5 inch.
      b. Flexible Elastomeric Cellular Insulation:
         1) Pipe Size Range: Less than 1-1/4 inch.
            (a) Thickness: 1.0 inch.

2. Domestic Hot Water Recirculation:
    a. Glass Fiber Insulation:
        1) Pipe Size Range: Less than 1-1/4 inch.
            (a) Thickness: 1.0 inch
        2) Pipe Size Range: 1-1/2 inch and larger.
            (a) Thickness: 1.5 inch.
3. Domestic Cold Water:
    a. Flexible Elastomeric Cellular Insulation:
        1) Pipe Size Range: Less than 1-1/4 inch.
            (a) Thickness: 1.0 inch.
    b. Glass Fiber Insulation:
        1) Pipe Size Range: Less than 1-1/4 inch.
            (a) Thickness: 0.5 inch.
        2) Pipe Size Range: 1-1/2 to 6 inch.
            (a) Thickness: 1.0 inch.
4. Traps and trap priming lines (in unheated spaces):
    a. Glass Fiber Insulation:
        1) Thickness: 1 inch
        2) Insulate over heat tape/trace.

END OF SECTION

SECTION 221005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Natural gas.
   4. Flanges, unions, and couplings.
   5. Pipe hangers and supports.

1.02 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.

B. Section 099113 - Exterior Painting.

C. Section 099123 - Interior Painting.

D. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.

E. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

F. Section 220553 - Identification for Plumbing Piping and Equipment.

G. Section 220719 - Plumbing Piping Insulation.

H. Section 330110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

D. ASME B31.1 - Power Piping; 2024.

E. ASME B31.9 - Building Services Piping; 2025.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

I. ASTM B32 - Standard Specification for Solder Metal; 2020.

J. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2025.

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

L. ASTM B813 - Standard Specification for Water Flushable Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2024.

M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

N. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2022.

O. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2025.

P. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020 (Reapproved 2024).

Q. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe; 2024.

R. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2024.

S. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2025.

T. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).

U. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).

V. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

W. AWWA C651 - Disinfecting Water Mains; 2023.

X. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

Y. NSF 61 - Drinking Water System Components - Health Effects; 2024.

Z. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product data on mechanical couplings and related components.

C. Test Reports and Certificates: Submit certificates of inspections and pipe tests to the owner.

D. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

E. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Provide chlorination of domestic cold and hot water piping in accordance with County and State health requirements.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Pipe Cleaning: If pipe gets plugged or should foaming of water systems occur, disconnect piping, reclean, and reconnect without additional expense to the Owner.

E. Correct damages to the building or systems resulting from failure to properly clean the system without additional expense to the Owner.

F. Products with a wetted surface installed in potable water systems UL classified in accordance with ANSI / NSF-61 for Drinking Water System components, ANSI/NSF-14 for Plastic Piping System Components, and certified to the low lead requirements of NSF-372.

G. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. ABS Pipe: ASTM D2661.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. ABS Pipe: ASTM D2661.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

B. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

B. Polyethylene (PE) Pipe: ASTM D2239.
   1. Fittings: ASTM D2609, PE.
   2. Joints: Mechanical with stainless steel clamp.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
   4. Size: All Sizes.
      a. Manufacturers:
         1) Apollo Valves
         2) Grinnell Products
         3) Viega LLC
         4) Substitutions: See Section 016000 - Product Requirements.

2.06 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type.
   2. Joints: ASME B31.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.

2.07 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Carbon Steel Pipe.

1. Fittings: ASME B16.3, malleable iron.
2. Joints: Threaded and Coupled with pipe sealant.
3. Size: All sizes.

2.08 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If the type of hanger or support for a particular situation is not indicated, select the appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to the structure or trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
   6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
      a. Bases: High density polypropylene.
      b. Base Sizes: As required, distribute the load sufficiently to prevent indentation of the roofing assembly.
      c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
      e. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to the top of the roofing.
      f. Manufacturers:
         1) PHP Systems/Design: www.phpsd.com.
         2) Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 EXCAVATION AND BACKFILL

A. General:
   1. Perform necessary excavation and backfill required for the installation of mechanical work in accordance with Division 02, Existing Conditions
   2. Repair pipelines or other work damaged during excavation and backfilling.

B. Excavation:
   1. Excavate trenches to the necessary depth and width, removing rocks, roots, and stumps.
   2. Include additional excavation to facilitate utility crossovers, additional offsets, etc.
   3. Excavation material is unclassified. The width of the trench is adequate for the proper installation of piping.
   4. Widen the trench if it is not wide enough for a proper installation.

C. Bedding:
   1. Cast iron, steel, and copper piping full bedded on sand.
   2. Place a minimum 4-inch deep layer on the leveled trench bottom for this purpose.

3. Remove the sand to the necessary depth for piping bells and couplings to maintain contact with the pipe on the sand for its entire length.
4. Lay other piping on a smooth, level trench bottom so that contact is made for its entire length.

D. Backfill:
1. Place in layers not exceeding 8 inches deep and compact to 95 percent of standard proctor maximum density at optimum moisture content.
2. Earth backfill is free of rocks over 2 inches in diameter and foreign matter.
3. Disposal of excess material as directed.
   a. Interior: Backfill under interior slabs, bank sand, or pea gravel.
   b. Exterior:
      1) Excavated material may be used outside of buildings at the Contractor's option.
      2) First 4 inches sand, and the final 12-inch layer of course soil.

3.04 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 220516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.
1. Coordinate size and location of access doors with Section 083100.

I. Install vent piping penetrating roofed areas to maintain the integrity of roof assembly.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Install valves with stems upright or horizontal, not inverted. Refer to Section 220523.

M. Install water piping to ASME B31.9.

N. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

O. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

P. Flexible couplings are to be used only when expansion, contraction, deflection, or noise and vibration are to be dampened, as detailed or specified.

Q. Gaskets shall be molded and produced by the coupling manufacturer and shall be suitable for the intended service.

R. Use strike protectors where piping has the potential to be struck and damaged with a screw or nail.

S. Sleeve pipes passing through partitions, walls, and floors.

T. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

U. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide sheet lead packing between hanger or support and piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   a. Painting of interior plumbing systems and components is specified in Section 099123.
   b. Painting of exterior plumbing systems and components is specified in Section 099113.

3.05 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install globe valves for throttling, bypass, or manual flow control services.

F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

G. Provide spring-loaded check valves on the discharge of water pumps.

3.06 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope. Piping may be sloped at 1/8 inch per foot slope where noted on plans and approved by authority having jurisdiction.

3.07 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 330110.58.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.08 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve.
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18 gage, 0.0478 inch (1.21 mm) galvanized sheet metal sleeve around service main to 6 inch (150 mm) above floor and 6 feet (1800 mm) minimum below grade. Size for minimum of 2 inches (50 mm) of loose batt insulation stuffing.

3.09 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
         1) Maximum Hanger Spacing: 6.5 ft (2 m).
         2) Hanger Rod Diameter: 3/8 inches (9 mm).
      b. Pipe Size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).
      c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 1/2 inch (13 mm).
      d. Pipe Size: 4 inches (100 mm) to 6 inches (150 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 5/8 inch (15 mm).
      e. Pipe Size: 8 inches (200 mm) to 12 inches (300 mm):
         1) Maximum hanger spacing: 14 ft (4.25 m).
         2) Hanger Rod Diameter: 7/8 inch (22 mm).
      f. Pipe Size: 14 inches and Over (350 mm and Over):
         1) Maximum Hanger Spacing: 20 ft (6 m).
         2) Hanger Rod Diameter: 1 inch (25 mm).
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft (1.8 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

SECTION 221006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hose bibbs.
D. Hydrants.
E. Backflow preventers.
F. Water hammer arrestors.
G. Sanitary waste interceptors.
H. Catch basins and manholes.
I. Fire-rated enclosures.
J. Trap primer / trap primer stations

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.
B. Section 223000 - Plumbing Equipment.
C. Section 224000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor Drains; 2022.
B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.
C. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.
D. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.
E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.
F. NSF 61 - Drinking Water System Components - Health Effects; 2024.
G. NSF 372 - Drinking Water System Components - Lead Content; 2024.
H. PDI-WH 201 - Water Hammer Arresters; 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
E. Operation Data: Indicate frequency of treatment required for interceptors.
F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
G. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, _____.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company
   2. Mifab
   3. LATICRETE International, Inc
   4. OMG Roofing Products
   5. Zurn Industries, LLC
   6. Substitutions: See Section 016000 - Product Requirements.

B. Floor Drain:
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.03 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company
   2. Mifab
   3. Zurn Industries, LLC
   4. Substitutions: See Section 016000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas:
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas (:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas:
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas:
   1. Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company
   2. Watts Regulator Company
   3. Zurn Industries, LLC:
   4. Mifab
   5. Woodford
   6. Substitutions: See Section 016000 - Product Requirements.

B. Interior Hose Bibbs:

1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

C. Interior Mixing Type Hose Bibbs:
1. Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with handwheels, and vacuum breaker in compliance with ASSE 1011.

2.05 HYDRANTS

A. Manufacturers:
1. Arrowhead Brass & Plumbing, LLC
2. Jay R. Smith Manufacturing Company
3. Zurn Industries, LLC
4. Woodford
5. Substitutions: See Section 016000 - Product Requirements.

B. Wall Hydrants:
1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.

2.06 BACKFLOW PREVENTERS

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
3. Zurn Industries, LLC: www.zurn.com.
4. Mifab/Beeco
5. Substitutions: See Section 016000 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.07 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
3. Zurn Industries, LLC: www.zurn.com.
4. Mifab
5. Substitutions: See Section 016000 - Product Requirements.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

2.08 SANITARY WASTE INTERCEPTORS

A. Manufacturers:
1. Schier Products Company: www.schierproducts.com.
2. Striem: www.striemco.com.
3. Canplas Industries: www.canplas/endura.com.
4. Jay R. Smith Manufacturing Company: www.jrsmith.com.
5. Zurn Industries, LLC: www.zurn.com.
6. Mifab
7. Substitutions: See Section 016000 - Product Requirements.

B. Flamible Liquid Interceptors:
    1. Construction:
        a. Material: Molded polyethylene.
        b. Rough-in: Fully recessed flush with floor (deep rough-in) with anchor flange.
        c. Accessories: Integral deep seal trap, removable integral flow control, adjustable draw-off assembly, sediment bucket.
        d. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.
            1) Cover shall be rated for pedestrian or automobile traffic as indicated on plans.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Install floor cleanouts at elevation to accommodate finished floor.

D. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

E. Pipe relief from backflow preventer to nearest drain.

F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or washing machine outlets.

SECTION 221123
DOMESTIC WATER PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Circulators.

1.02 REFERENCE STANDARDS

A. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NSF 61 - Drinking Water System Components - Health Effects; 2024.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide certified pump curve with duty point marked over pump and system operating conditions and NPSH curve and power requirement by pump tag.
   2. Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.

C. Shop Drawings: Include dimensions and performance data.

D. Test Reports: Plumbing fixture operational tests.

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Project Record Documents: Record actual locations of components.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rated capacity identified by permanently attached label.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 1-year manufacturer warranty for pumps except circulator type. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 CIRCULATORS

A. Manufacturers:
   1. Bell & Gossett, a Brand of Xylem, Inc: www.xylem.com/#sle.
   2. Grundfos Pumps Corporation; MAGNA 3: www.grundfos.com/#sle.
   3. Taco, Inc: www.tacocomfort.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Casing: Bronze with bronze cast impeller, and stainless steel rotor assembly.

C. Shaft: Alloy steel with integral thrust collar and two oil-lubricated bronze sleeve bearings.

D. Mechanical Seal: Carbon rotating against a stationary ceramic seat.

E. Pipe-End Connection: Union connection.

F. Maximum Discharge Pressure: 145 psi (1000 kPa).

G. Motor: 1,750 rpm, ECM duty with flexible coupling.

H. Service Temperature Range: Minus 30 to 250 degrees F (Minus 34.4 to 121.1 degrees C).

I. Controls: Provide aquastat set for high-temp cutoff, electric plug, and illuminated hand switch.

J. Accessories: Include inlet-outlet temperature and pressure gauges with 2-way isolation valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products with related fittings, and accessories according to manufacturer instructions.

B. Potable and Drinking Water Service: Provide NSF 61 certified; comply with ICC (IPC).

C. Electrical-Driven Pump Work:
   1. Provide electric-motor-driven equipment specified complete with local disconnect switch and control panel with starter, controls, safety devices, and related wiring.
   2. Provide automatic control and protective devices field-wired to interface-related devices required for specified operation.

D. Ensure that small pressure gauges are installed on both upstream and downstream ends.

E. Hot Water Service: Ensure that small pressure-temperature gauges are installed on both upstream and downstream ends.

F. Factory-Provided Pump Controls: Factory provided, tested for use.

G. ECM, VSD, or VFD Controlled Motors: Configure unit to operate within manufacturer-listed pump curve points unless factory set to do so. Then adjust to operate in automatic to maintain downstream pressure setpoint.

H. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are nonoverloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 221319
SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor drains.

B. Floor sinks.

C. Trench drains.

D. Cleanouts.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

B. Section 221323 - Sanitary Waste Interceptors.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor Drains; 2022.

B. ASME A112.6.7 - Sanitary Floor Sinks; 2022.

C. ASME A112.36.2 - Cleanouts; 2022.

D. DIN 19580 - Drainage Channels for Vehicular and Pedestrian Areas - Durability, Mass Per Unit Area and Evaluation of Conformity; 2010.

E. DIN EN 1433 - Drainage Channels for Vehicular and Pedestrian Areas - Classification, Design and Testing Requirements, Marking and Evaluation of Conformity; 2005.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on fabrication materials, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

C. Shop Drawings:
   1. Floor sinks: Provide drawings overlaid on latest published kitchen equipment plans showing dimensioned locations of floor sinks.
   2. Trench Drains: Provide plans or diagrams showing layout of individual trench drains and each network of trench drains. Indicate length and width of each trench drain. Show starting and ending inverts. Show sanitary waste piping connection points. Show installed accessories.

D. Manufacturer's Instructions: Provide for products listed below. Include instructions for handling, protection, examination, preparation, and installation.
   1. Trench drains.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Store plastic products protected from direct sunlight.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

2.02 FLOOR SINKS

2.03 TRENCH DRAINS

A. Polymer Concrete Trench Drains:
   1. Description: Trench drain system assembled from factory-fabricated, polymer concrete channel sections in standard lengths, with interlocking joints and integral grate support rails; includes tie-down anchors, end caps, outlet fittings, and grating.
   2. Channel Slope: Sloped at minimum of 0.5 percent.
   3. Channel Width: 12 inches (300 mm).
   4. Grate Support Rail: Factory-embedded in channel sections; provide in galvanized steel, stainless steel, or ductile iron.
   5. Grate: Manufacturer provided with manufacturer's snap-in or clip-in anchoring system to prevent rocking or slipping.
      a. Load Class, in Accordance With DIN 19580 or DIN EN 1433: Load Class E.
      b. Material: Ductile iron.
      c. Style: Slotted.
      d. Grate Locks: Provide manufacturer's vandal-resistant locking devices.
   6. Accessories:
      a. Bottom outlet fitting.

2.04 CLEANOUTS

A. Manufacturers:
   1. MIFAB, Inc: www.mifab.com/#sle.
   2. Zurn Industries, LLC: www.zurn.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Floor Cleanouts:
   1. Assembly: ASME A112.36.2.
   2. Body: Lacquered cast iron.
   3. Closure Plug: PVC or ABS, threaded, gastight and watertight.
   4. Top: Adjustable, with vandal-proof screws.
      a. Shape and Finish:
         1) All Locations, Unless Noted Otherwise: Round; nickel bronze.
         2) Warehouse: Heavy duty; round; cast iron, ductile iron, nickel bronze, or stainless steel.
   5. Accessories:
      a. Acid-resistant coating.
      b. Clamp ring and flange for floors with waterproofing membrane.

C. Wall Cleanouts:
   1. Assembly: ASME A112.36.2.
   2. Body: Tee type; body material to match surrounding pipe.
   3. Plug: PVC or ABS, threaded, gastight.
   4. Access Cover: Round, stainless steel wall access cover with vandal-proof screw.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify conditions are satisfactory for installation prior to starting work.

B. Verify floor sink locations are coordinated with latest published kitchen equipment plans and plumbing plans.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Maintain continuity of waterproofing membranes. Secure waterproofing membranes to drain clamping collars and bonding flanges.

C. Install drains so strainers and grates are level and are at design elevation.

D. Install floor sinks so grates are flush with finished floor unless noted otherwise or unless directed otherwise by adopted code.

E. Install trench drains and channel drains parallel and perpendicular to building lines, unless designated otherwise.

F. Install grates in trench drains so grates do not rock, slip, or shift.

G. Extend cleanouts to finished floor or wall surface. Ensure clearance at cleanout for rodding or jetting of drainage system.

H. Install floor cleanouts to allow for floor finishes.

I. Locate, provide, and install cleanouts in piping in accordance with adopted code.

3.03 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean debris from drains.

C. Clean grates and strainers prior to mm-dd-yyyy.

3.04 PROTECTION

A. Protect installed drains from accumulating dirt and debris through remainder of construction.

B. Protect installed products from damage due to subsequent construction operations.

END OF SECTION

SECTION 221500
GENERAL-SERVICE COMPRESSED-AIR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reciprocating air compressors.
B. System filters.
C. Aftercoolers.
D. Air dryers.
E. Air receivers.
F. Pipe and fittings.
G. Unions and couplings.
H. Pressure reducing stations.
I. Air outlets.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.
B. Section 220523 - General-Duty Valves for Plumbing Piping.
C. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
D. Section 220553 - Identification for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
C. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.
D. ASME B31.1 - Power Piping; 2024.
E. ASTM B32 - Standard Specification for Solder Metal; 2020.
F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
H. ASTM F3226/F3226M - Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems; 2019 (Reaffirmed 2024).
I. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections; 2022.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.
C. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.
D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, hoisting and setting requirements, starting procedures.
E. Operation Data: Submit for air compressor, air receiver, and accessories, aftercooler, refrigerated air dryer, and pressure reducing station.
F. Maintenance Data: Submit for air compressor, air receiver, and accessories, aftercooler, refrigerated air dryer, and pressure reducing station.
G. Project Record Documents: Record actual locations of equipment and components. Modify shop drawings to indicate final locations.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept air compressors, refrigerated air dryer on site in factory-fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

B. Protect piping and equipment from weather and construction traffic.

PART 2 PRODUCTS

2.01 RECIPROCATING AIR COMPRESSORS

A. Manufacturers:
   1. Flexilla
   2. Emax
   3. Substitutions: See Section 016000 - Product Requirements.

B. Type: Simplex air compressor system with fixed belt-driven mechanism.

C. Electrically driven, air-cooled compressor unit; factory-assembled with air intake, intake filters, after-cooler, oil separator, oil cooler, moisture separator with drain trap, oil charging valve, gauges, sight glasses, vibration isolators, controls, and safeties.

D. Mounting: Tank mounted.

E. Receiver Accumulator Tank: 80 gal (302.8 L), mount compressor on horizontal aligned tank.

F. Enclosure: Provide manufacturer's sound masking enclosure.

G. Controls:
   1. Indicators:
      a. Air temperature.
      b. Oil temperature.
      c. Hour meter.
      d. Air discharge pressure.
      e. Sump pressure.
      f. Air intake filter loading.
      g. Anti-recycle timer.
      h. Phase loss/reversal monitor.
   2. Pushbutton or Handswitch: Start/stop and load/unload functions.
   3. Electronic Touchscreen Controller:
      a. Include digital versions of of listed operators and indicators.
      b. Include built-in logic to track usage, optimize load, and diagnose system.

H. Electrical:
   1. 7.5 hp (____ kW) at 230-VAC, 50 to 60 hz, TEFC motor, soft starter controlled.
   2. Factory mount disconnect switch with terminal box with each circuit identified and spare spare to accommodate field-installed components. Ground each component to base of assembly.

2.02 SYSTEM FILTERS

A. Cartridge Number 1: Coalescing.

B. Location: Downstream of air compressor.

C. Flow Capacity: Match compressor rate.

2.03 AFTERCOOLERS

A. Construction: Removable tube nests of non-ferrous metal tubes and corrosion-resistant tube plates, safety valves, pressure gauge, moisture separator, moisture drain valve, water inlet piping with automatic water valve, automatic condensate trap and overflow piping with open funnel.

2.04 AIR DRYERS

A. Type: Self-contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, internal wiring and piping, and full refrigerant charge.

B. Air Connections: Inlet and outlet connections at same level, factory insulated.

2.05 PIPE AND FITTINGS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (Type A), drawn temper.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, solder, Grade Sn95.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (Type A), drawn temper.
   1. Mechanical Press Sealed Fittings: ASME B16.51, ASTM F3226/F3226M, or IAPMO/ANSI/CAN Z1117, with EPDM or HNBR seals.
   2. Joints: Mechanically pressed.

2.06 UNIONS AND COUPLINGS

A. Unions:

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

C. Flexible Connector: Neoprene with brass threaded connectors.

2.07 PRESSURE REDUCING STATIONS

A. Pressure Reducing Station: Consisting of automatic reducing valve and bypass and low pressure side relief valve and gauge. Provide oil separator where indicated.

B. Valve Capacity: Reduce pressure from 200 psi (1379 kPa) to 30 psi (207 kPa), adjustable upwards from reduced pressure.

2.08 AIR OUTLETS

A. Quick Connector: 3/8 inch (10 mm) brass, snap-on connector with self closing valve, Style A.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install compressor unit on concrete housekeeping pad. See Section 033000.

C. Install compressor unit on vibration isolators. Level and bolt in place. See Section 220548.

D. Make air cock and drain connection on horizontal casing.

E. Install line size gate valve and check valve on compressor discharge. See Section 220523.

F. Install replaceable cartridge type filter silencer of adequate capacity for each compressor.

G. Place shut off valve on water inlet to aftercooler. Pipe drain to floor drain. See Section 220523.

H. Connect condensate drains to nearest floor drain.

I. Install valved bypass around air dryer. Factory insulate inlet and outlet connections. See Section 220523.

J. Install valved drip connections at low points of piping system. See Section 220523.

K. Install takeoffs to outlets from top of main, with shut off valve after takeoff. Slope takeoff piping to outlets.

L. Install compressed air couplings, female quick connectors, and pressure gauges where outlets are indicated.

M. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

N. Identify piping system and components. See Section 220553.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

C. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

D. Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION

SECTION 223000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tankless gas-fired water heaters.

B. Water Heaters:
   1. Tankless gas fired.

C. Diaphragm-type compression tanks.

D. In-line circulator pumps.

E. Temperature mixing valves.

F. Condensate removal pumps.

1.02 REFERENCE STANDARDS

A. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2019 (Reaffirmed 2024).

B. ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous; 2019 (Reaffirmed 2024).

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2025, with Errata .

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data:
   1. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on materials of fabrication, assembly of components, dimensions, weights, capabilities, performance, electrical characteristics, location and sizes of connections, service and access locations, and manufacturer-provided and field-installed accessories.

C. Manufacturer's qualification statement.

D. Project Record Documents: Record actual locations of components.

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:
   1. Water Heaters: NSF approved.
   2. Gas Water Heaters: ANSI Z21.10.1 and ANSI Z21.10.3.
   3. Water Tanks: ASME labeled to ASME BPVC-VIII-1.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:
   1. Intellihot
   2. A.O. Smith Water Products Co.
   3. Bradford White
   4. Bock Water Heaters, Inc.
   5. Rheem Manufacturing Company
   6. Lochinvar
   7. Eemax
   8. Substitutions: See Section 016000 - Product Requirements.

B. Tankless Gas-Fired Water Heaters:
   1. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
   2. Water Inlet Pressure: From 30 psi (207 kPa) to 150 psi (1034 kPa).
   3. Type: Automatic, natural gas-fired.
   4. Heater Type: Self-contained, wall-mounted unit capable of handling listed capacity, air intake valve, condensate solenoid drain valve, water-inlet strainer, removable thermally-insulated front panel, blower access cover, and threaded water, gas, and condensate pipe-end connections.
   5. Burner-Heat Exchanger: 316L stainless steel assembly with single flue passage, flue baffle, and draft hood; thermally insulated and encased in corrosion-resistant steel jacket; baked-on enamel finish.
   6. Safeties: Provide internal safeties for vent side, water flow, flame detection, fan speed, electrical load, and thermal load.
   7. Controls: Color touchscreen interface for internal controls and built-in gas pressure regulator; temperature range adjustable from 100 to 185 degrees F (37.7 to 85 degrees C) using safety pilot and thermocouple.
   8. Accessories: Provide cold water inlet expansion tank, hot water recirculation pump, inlet ball valve, outlet ball valve, outlet ASME-ratred temperature-pressure relief valve, and pipe-mounted thermometers.
   9. Electrical Load: 120 VAC, single phase.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig (860 kPa), with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig (80 kPa).

2.03 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
   1. Armstrong Fluid Technology; _____: www.armstrongfluidtechnology.com/#sle.
   2. Grundfos
   3. Bell & Gossett, a brand of Xylem, Inc; _____: www.bellgossett.com/#sle.
   4. Sterling SIHI GmbH; _____: www.sterlingsihi.com/#sle.

B. Casing: Bronze, rated for 125 psig (860 kPa) working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B. Coordinate with plumbing piping and related fuel piping and electrical work to achieve operating system.

C. Water Heaters/Boilers:

3.02 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Domestic Hot Water Storage Tanks:
   1. Provide steel pipe support, independent of building structural framing members.
   2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

C. Pumps:
   1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
   2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches (100 mm) and over.
   3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

SECTION 224000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush valve water closets.

B. Bidets.

C. Waterless urinals.

D. Wall hung urinals.

E. Lavatories.

F. Wall-hung, solid surface, multistation lavatory units.

G. Wall-hung, multistation wash fountains.

H. Sinks.

I. Supply stops.

J. Under-lavatory pipe supply covers.

K. Mop sinks.

L. Service sinks.

1.02 RELATED REQUIREMENTS

A. Section 221119 - Domestic Water Piping Specialties.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

C. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

D. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

E. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2024.

F. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.

G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.

H. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2024.

I. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.

J. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

K. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. NSF 61 - Drinking Water System Components - Health Effects; 2024.

N. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.04 QUALITY ASSURANCE

A. Water Closets: Maximum Performance (MaP) score of no less than 800

B. Faucets: Certify to NSF/ANSI 61 and California AB1953

C. Electric Water Coolers and Drinking Fountains: Certified to NSF/ANSI 61 and California AB1953

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes for each item specified.
   1. For electrically powered fixtures, include electrical characteristics.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

E. Operating and Maintenance Data:
   1. Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on-site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide drinking water system components certified as complying with NSF 61 and NSF 372.

B. ADA: Where indicated to be ADA-compliant, provide fixtures complying with ADA Standards and ICC A117.1.

C. See the Fixture Schedule on Plumbing plans for the Basis of the Design manufacturer and model.

D. Fixture types (Faucets, water closets, and lavatories) shall be the products of the same manufacturer.

E. Safety covers over exposed waste and supply piping at ADA-accessible fixtures shall be LAV-GUARD by TRUEBRO or equivalent.

F. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, and lavatory faucets.

G. Maximum Fixture Supply Pressure: 80 psi (550 kPa) unless stated otherwise.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Perform work in accordance with local health department regulations.

2.03 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
   1. Bowl: ASME A112.19.2; 16.5 inches (420 mm) high with elongated rim.
   2. Flush Valve: Exposed (top spud).
   3. Flush Operation: Sensor operated.
   4. Handle Height: 44 inches (1117 mm) or less.
   5. Inlet Size: 1-1/2 inches (38 mm).
   6. Trapway Outlet: 4 inch (100 mm, DN).

7. Color: White.
8. Manufacturers:
    a. Kohler Company
    b. Substitutions: See Section 016000 - Product Requirements.

B. Flush Valves:
1. Manual Operated: Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.
    a. Supplied Volume Capacity: 1.28 gal per flush.
    b. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.
2. Manufacturers:
    a. Kohler Company
    b. Substitutions: See Section 016000 - Product Requirements.

C. Toilet Seats:
1. Manufacturers:
    a. Kohler Company
    b. Substitutions: See Section 016000 - Product Requirements.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.

D. Water Closet Carriers:
1. Manufacturers:
    a. J.R. Smith
    b. JOSAM Company
    c. Zurn Industries, Inc
    d. Substitutions: See Section 016000 - Product Requirements.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.04 LAVATORIES

A. Manufacturers:
1. Kohler Company
2. Substitutions: See Section 016000 - Product Requirements.

B. Wall-Hung Basin:
1. Vitreous China, Grade A: ASME A112.19.2; white, rectangular commercial-grade sink with predrilled holes, rear-center drain, front overflow, and hanger. Size as indicated on drawings with 4-inch (100 mm) centerset spacing.
2. Carrier:
    a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.
    b. Manufacturers:
        1) Jay R. Smith MFG. Co; _____: www.jrsmith.com/#sle.
        2) JOSAM Company; _____: www.josam.com/#sle.
        3) Zurn Industries, LLC; Z1231: www.zurn.com/#sle.
        4) Substitutions: See Section 016000 - Product Requirements.

C. Supply Faucet:
1. Deck Mounted Faucet Manufacturers:
2. ASME A112.18.1; chrome plated combination supply fitting with open grid strainer, water economy aerator with maximum flow of 0.5 gpm (1.9 L/min), indexed handles.
3. Finish to be approved by architect
4. Two-Lever Handle, Gooseneck Spout, Supply Faucet: ASME A112.18.1; deck-mount, ceramic cartridge disc valve, and maximum flow of 0.5 gpm, low-flow (1.9 L/min, low-flow).

D. Supply Faucet Manufacturers:
1. Kohler Company

2. Substitutions: See Section 016000 - Product Requirements.

E. Accessories:
1. Chrome plated 17 gage, 0.0538 inch (1.37 mm) brass P-trap with clean-out plug and arm with escutcheon.
2. Wheel handle stops.
3. Rigid supplies.

2.05 SINKS

A. Manufacturers:
1. Kohler Company
2. Substitutions: See Section 016000 - Product Requirements.

B. Single Compartment Bowl
1. ASME A112.19.3; outside dimensions, 18 gauge, 0.050 inch (1.27 mm) thick, type 304 stainless steel, self-rimming and undercoated, with ledge back drilled for trim.
2. Drain: 1-1/2 inch (38 mm) chromed brass.

C. Faucets:
1. Manufacturers:
a. Kohler Company: www.kohler.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.
2. Single Handle Faucet with Three-Function Pulldown Spray Head:
a. Minimum Spout Height: 8 inch (203.2 mm).
b. Minimum Spout Reach: 8-1/4 inch (209.6 mm).
c. Type: Deck-mount, swivel faucet with mounting plate.
d. Spray Functions: Stream, full spray and pause at 1.5 gpm (_____ L/min), maximum.
e. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
f. Materials: Ceramic disc-cartridge valve on brass body.
g. Finish to be approved by the architect.

D. Accessories: Provide braided water supply lines, slip-joint p-trap, and stainless steel basket strainer.

2.06 SUPPLY STOPS

A. Description: ASME A112.18.1, quarter-turn full-port brass ball valve.

B. Operation: Handwheel or T-handle.

C. Finish: Polished chrome.

D. End Connections: Provide supply stops with end connections to match rough-in piping.

E. Maximum Working Pressure: 125 psi (8.6 bar).

F. Working Temperature Range: 33 to 160 degrees F (0.5 to 71 degrees C).

2.07 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
1. Plumberex Specialty Products, Inc
2. Truebro
3. McGuire
4. Substitutions: See Section 016000 - Product Requirements.

B. General:
1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks per ADA Standards.
2. Adhesives, sewing threads and two-ply laminated materials are prohibited.
3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.

4. Construction: 1/8 inch (3.2 mm) PVC with antimicrobial, antifungal and UV-resistant properties.
    a. Provide one-piece injected molded design with internal bridge at top of J-bend to prevent separating.
    b. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
    c. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
    d. Comply with ICC A117.1.
5. Color: High gloss white.
6. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

2.08 BOTTLE FILLER

A. Drinking Fountain Manufacturers:
    1. Elkay
    2. Haws Corporation
    3. Oasis
    4. Substitutions: See Section016000-Product Requirements.

B. Water Cooler: Elkay ezH20 electric, mechanically refrigerated; surface mounted; stainless steel top; stainless steel body; elevated anti-squirt bubbler with stream guard; automatic stream regulator; push-button; mounting bracket; integral air-cooled condenser; and stainless steel grille.
    1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
    2. Electrical: 115 V, 60 Hertz compressor, 6-foot cord, and plug for connection to electric wiring system including grounding connector.

2.09 MOP SINKS

A. Manufacturers:
    1. E.L. Mustee & Sons, Inc
    2. Substitutions: See Section 016000 - Product Requirements.

B. Material: Fiberglass

C. Grid Strainer: Stainless steel; integral; removable.

D. Dimensions: As indicated on drawings.

2.10 SERVICE SINKS

A. Manufacturers:
    1. E.L. Mustee & Sons, Inc
    2. Substitutions: See Section 016000 - Product Requirements.

B. Wall-Mount, Single-Bowl, Laundry Sink: _____, white finished, plastic-molded bowl, 19 gal (_____ L) capacity with integral-molded drain and stopper. Size as indicated on drawings.

C. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Two-Lever Handle Service Faucet:
    1. Type: Wall-mount spout faucet with union inlets and mounting plate.
    2. Spray Type: Full stream spray at 1.8 gpm (6.8 L/min), maximum.
    3. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
    4. Materials: Ceramic disc cartridge valve on brass body with polished chrome finish.

E. Accessories:
    1. 5 feet (1.5 m) of 1/2 inch (13 mm) diameter plain end reinforced plastic hose.
    2. Hose clamp hanger.
    3. Mop hanger.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify walls, floors, and finishes are prepared and ready for installation of fixtures.

B. Verify rough-ins for field connections match sizes and locations shown on drawings.

C. Verify electric power is available and of the correct characteristics.

D. Review casework and countertop shop drawings. Confirm locations and sizes of fixtures and openings before rough-in and installation.

E. Verify casework and countertops are prepared and ready for installation of fixtures.

3.02 PLUMBING FIXTURES

A. Install products in accordance with manufacturer's instructions.

B. Provide plumbing fixture trim where applicable on fixtures, including but not limited to supply stops, traps, support rims, flush valves, and vacuum breakers.

C. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

D. Provide rough-in and final piping connection to fixtures in accordance with minimum sizes indicated in the fixture rough-in schedule for particular fixtures. Carefully review all construction documents to ensure that all fixtures are provided with the necessary services for a complete operating system.

E. Secure fixtures in place.

F. Install rigid or flexible supplies to fixtures. Provide supply stops, reducers, and escutcheons.

G. Install wall-mounted fixtures, trim, and accessories at heights indicated on drawings.

H. Install new batteries in battery-powered fixtures at time of Date of Substantial Completion.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Repair or replace damaged or defective products.

D. Test fixtures after installation to verify operation. Correct deficiencies.

E. Install and secure fixtures in place with wall supports and bolts.

F. Solidly attach water closets to the floor with through bolts or lag screws. Lead flashing is not intended to hold the fixture in place.

G. Americans with Disabilities Act:
   1. Those fixtures indicated by ADA are to comply with and be installed in accordance with the Americans with Disabilities Act Guidelines (ADAAG). Where applicable building code requirements are more stringent than ADAAG guidelines, building code requirements followed.
   2. Water Closets:
      a. The mounting height of the ADA water closet is 17 inches to 19 inches from floor to top of the toilet seat.
      b. Mount flush valve for ADA water closets on the wide side of the enclosure.
   3. Lavatories:
      a. Mounting height of ADA lavatories at a maximum height of 34 inches from floor to rim.
      b. Provide insulation kits on exposed hot water and waste piping beneath ADA lavatories.
   4. Sinks: Provide insulation kits on exposed hot water and waste piping beneath ADA sinks.
   5. Urinals: Mounting height of ADA water closet at a maximum height of 17-inches from floor to top rim.

H. Fixture Mounting Heights: Fixtures standard rough-in catalogued heights unless shown otherwise on the Architectural Drawings.

I. Water Supplies: When both hot and cold water to a fixture is required, connect the hot on the left and the cold on the right.

J. Floor Mounted Supports and Chair Carriers:
   1. Secure floor-mounted supports and chair carriers to the slab with a minimum of 1/2-inch bolts.
   2. Install supports and carriers per the manufacturer's installation instructions.

K. Lavatories, Urinals, and Water Closets with Hard-Wired Electronic Sensors:
   1. Install sensors, wiring, and piping as recommended by the manufacturer.
   2. Provide vandal-proof screws on wiring boxes for lavatories and sensor boxes.
   3. Mount the lavatory wiring box on the bottom of the countertop for total concealment. Coordinate with Division 26 for plug-in transformer and receptacle locations.
   4. Provide one 24V transformer for any combination of 10 water closets or urinals installed side by side, and one transformer for every 6 lavatories installed side by side.

L. Lavatories:
   1. Public Toilet Room: Grid strainers.
   2. Private Toilet Room: Pop-up waste assemblies.
   3. Those lavatories indicated as ADA are ADA compatible. Coordinate with the Architect to verify if all wall-hung lavatories are to be installed at ADA height.

M. Floor Drain and Floor Sinks:
   1. Set-top flush with the finished floor.
   2. Provide flashing clamps for all drain bodies installed on floors provided with waterproof membranes.

N. Cleanout:
   1. Where shown or required.
   2. Cover set flush with finished surface.

O. Water Hammer Arresters: Provide where shown and where recommended by the Plumbing Drainage Institute (PDI).

P. Water Coolers and Drinking Fountains:
   1. Water-bearing materials comply with the Safe Drinking Water Act of 1986 and the Lead Contamination Control Act of 1988. The waterway system of the unit is manufactured of copper components and other completely lead-free materials.
   2. Water cooler refrigerants will be non-CFC.
   3. Provide fixture manufacturer's wall mounting plate or floor-mounted support for all wall-hung water coolers or drinking fountains.

Q. Mixing Valves: Provide piping connections per the manufacturer's installation instructions.

3.04 PRIMING VALVES

A. All floor drains, floor sinks, and similar traps are primed. Use minimum 3/8-inch type K annealed copper tubing. The primer line is to be continuous without joints.

B. Where priming valves are installed in finished rooms, concealed in walls, and provide access panels.

C. Coordinate locations of electronic trap primer stations with the electrical contractor for 120V service.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean plumbing fixtures to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

END OF SECTION

SECTION 224500
EMERGENCY PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Eyewash equipment.

1.02 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014, with Editorial Revision (2020).

B. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

C. ASSE 1071 - Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment; 2012 (Reaffirmed 2021).

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.

PART 2 PRODUCTS

2.01 EYEWASH EQUIPMENT

A. Manufacturers:
   1. Encon Safety Products, Inc: www.enconsafety.com/#sle.
   2. Guardian Equipment: www.gesafety.com/#sle.
   3. Haws Corporation: www.hawsco.com/#sle.
   4. Hughes a company of Justrite Group: www.hughers-safety-showers.com/#sle.
   5. Justrite Manufacturing Company, LLC: www.justrite.com/#sle.
   6. Speakman Company: www.speakman.com/#sle.
   7. Sysbel: www.sysbelmfg.com/#sle.
   8. Substitutions: See Section 016000 - Product Requirements.

B. ANSI Z358.1, wall-mounted bowl with dual eye-spray head assembly.

C. Product Certification: UL (DIR).

D. Thermostatic Mixing Valve: ASSE 1071, manufacturer furnished, sized for maximum flow rate of eyewash.

E. Tepid Supply Water Temperature: Set to 85 degrees F (29 degrees C).

F. Water Supply Connection Size: 1/2 inch (12.7 mm).

G. Water Discharge Flow Rate: Minimum, 0.4 gpm (1.5 Lpm) for 15 minutes.

H. Pipe and Fittings Material: Epoxy coated galvanized steel.

I. Valve: Full flow, self close, quick to open using wide-handle manual hand operator.

J. Drain: Built-into the bowl assembly with 1-1/4 inch (3.2 cm) female outlet.

K. Accessories:
   1. Bowl Cover: Valve-operated stainless steel hinged assembly.
   2. Signage: ANSI Z535.2, emergency eye wash safety equipment.
   3. Shut Off Valve: Provide upstream full flow ball valve with detached operating handle.
   4. Alarm: NEMA EN 10250, Type 1 audio-visual station with amber colored lamp, reset switch, and 100 db, 100 ft (30.5 m) horn.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fixtures and accessories are of the correct type and size prior to installation.

B. Verify that deck, wall and floor finishes are prepared and ready for fixture installation.

3.02 INSTALLATION

A. Install fixtures and fittings in accordance with the manufacturer's instructions.

B. Adjust water flow rates to comply with manufacturer's rating of the fixture.

C. Place remote-activated thermostatically actuated bleed valve behind wall or buried below frost line.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.04 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.05 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

END OF SECTION

SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe-sleeve seals.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 230553 - Identification for HVAC Piping and Equipment: Piping identification.

C. Section 230716 - HVAC Equipment Insulation.

D. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. FM (AG) - FM Approval Guide; Current Edition.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch (40 mm) angle set in silicon adhesive around opening.

B. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Modular Mechanical Sleeve-Seal:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Glass-reinforced plastic pressure end plates.

B. Sealing Compounds:
   1. Provide packing and sealing compound to fill pipe to sleeve thickness.
   2. Combined packing and seal compound is to match partition fire-resistance hourly rating.

C. Pipe Sleeve Material:
   1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
   2. Masonry Structures: Sheet metal or fiber.

D. Wall Sleeve: PVC material with waterstop collar, and nailer end-caps.

E. Sleeve-Forming Disk: Non-conductive plastic-based material, 3 inch (76.2 mm) thick.

F. Pipeline-Casing Seals:
   1. End Seals: 1/8 inch (3.1 mm), pull-on type, rubber or synthetic rubber based.

PART 3 EXECUTION

3.01 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, partitions, and _____. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.02 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2025.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

M. FM (AG) - FM Approval Guide; Current Edition.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

O. UL (DIR) - Online Certifications Directory; Current Edition.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets.

1.03 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Strut Channel or Bracket Material:
2. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.

D. Cable Hanging System Kits:
1. Provide cable-wire in bulk or precut lengths with respective cable hangers as required to hold minimum weight of 120 lb (54.4 kg).
2. Accessories: Provide brackets, clip or c-clip hangers, covers, and y-hook hangers.

E. Thermal Insulated Pipe Supports:
1. General Requirements:
    a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
    b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
    c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch (15 to 750 mm, DN) iron pipes.
    d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
    a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
    b. Moisture Vapor Transmission: 0.0071 perm inch (0.0092 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
    c. Thickness: 60 mil (1.524 mm).

F. Pipe Hangers:
1. Split Ring Hangers:
    a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
    b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
    c. Provide hanger rod and nuts of the same type and material for a given pipe run.
    d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
2. Band Hangers, Adjustable:
    a. MSS SP-58 Type 7 or 9, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
3. J-Hangers, Adjustable:
    a. MSS SP-58 Type 5, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
4. Swivel Ring Hangers, Adjustable:
    a. MSS SP-58 Type 10, epoxy-painted, zinc-colored.

b. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
c. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.

5. Clevis Hangers, Adjustable:
a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
b. Light-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
c. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.

G. Pipe Shields for Insulated Piping:
1. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
d. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
e. Maximum Service Temperature: 178 degrees F (81 degrees C).
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

H. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

3.02 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

1.02 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

END OF SECTION

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Stencils.

E. Pipe markers.

F. Ceiling tacks.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags.

C. Dampers: Ceiling tacks, where located above lay-in ceiling.

D. Piping: Tags.

E. Pumps: Nameplates.

F. Small-sized Equipment: Tags.

G. Tanks: Nameplates.

H. Thermostats: Nameplates.

I. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch (6 mm).

C. Background Color: Black.

D. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.

2.05 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil, 0.004 inch (0.10 mm) thick, manufactured for direct burial service.

E. Color code as follows:
1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
2. Compressed Air: Blue with white letters.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

B. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.

F. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 230800 - Commissioning of HVAC.

C. Section 250500 - Common Work Results for Integrated Automation.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024, with Errata (2025).

C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit to the Commissioning Provider.
   3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   5. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
      g. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Terminal flow calibration (for each terminal type).
         2) Diffuser proportioning.
         3) Branch/submain proportioning.

4) Total flow calculations.
5) Rechecking.
6) Diversity issues.

h. Details of how TOTAL flow will be determined; for example:
1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

i. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.

j. Confirmation of understanding of the outside air ventilation criteria under all conditions.

k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

l. Method of checking building static and exhaust fan and/or relief damper capacity.

m. Methods for making coil or other system plant capacity measurements, if specified.

n. False loading of systems to complete TAB work, if specified.

o. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least twice a week to the Commissioning Provider.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit to the Commissioning Provider within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Include the following on the title page of each report:
a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Report date.

F. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place.
   15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING

A. See Sections 019113 - General Commissioning Requirements and 230800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Water side systems.

D. Furnish to the Commissioning Provider, upon request, any data gathered but not shown in the final TAB report.

E. In the presence of the Commissioning Provider, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
   2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
   3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.09 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. High Efficiency Condensing Boilers.
   3. Gas Fired Unit Heaters
   4. Small Capacity Split Systems
   5. Air Coils.
   6. Air Handling Units.
   7. Fans.
   8. Air Filters.
   9. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.

B. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.
   5. Service.
   6. Design flow rate, pressure drop, BHP.
   7. Actual flow rate, pressure drop, BHP.
   8. Discharge pressure.

9. Suction pressure.

C. Combustion Equipment:
   1. Boiler manufacturer.
   2. Model number.
   3. Serial number.
   4. Firing rate.
   5. Gas flow rate.
   6. Heat input.
   7. Percent combustion efficiency.
   8. Heat output.

D. Cooling Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Entering air DB temperature, design and actual.
   7. Entering air WB temperature, design and actual.
   8. Leaving air DB temperature, design and actual.
   9. Leaving air WB temperature, design and actual.

E. Heating Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Water flow, design and actual.
   7. Water pressure drop, design and actual.
   8. Entering water temperature, design and actual.
   9. Leaving water temperature, design and actual.
   10. Entering air temperature, design and actual.
   11. Leaving air temperature, design and actual.
   12. Air pressure drop, design and actual.

F. Electric Duct Heaters:
   1. Manufacturer.
   2. Identification/number.
   3. Location.
   4. Model number.
   5. Design kW.
   6. Number of stages.
   7. Phase, voltage, amperage.
   8. Test voltage (each phase).
   9. Test amperage (each phase).
   10. Air flow, specified and actual.
   11. Temperature rise, specified and actual.

G. Air Moving Equipment:
   1. Location.
   2. Manufacturer.
   3. Air flow, specified and actual.
   4. Return air flow, specified and actual.
   5. Outside air flow, specified and actual.

6. Total static pressure (total external), specified and actual.
7. Discharge pressure.

H. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Return air temperature.

I. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Number of Belts/Make/Size.
8. Fan RPM.

J. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Design air flow.
6. Test (final) air flow.
7. Percent of design air flow.

K. Sound Level Reports:
1. Location.
2. Octave bands - equipment off.
3. Octave bands - equipment on.

END OF SECTION

SECTION 230713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

F. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2025.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

L. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

M. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Current Edition, Including All Revisions.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   2. Johns Manville:
   3. JP Lamborn Co; Thermal Sleeve MT:
   4. Knauf Insulation; Atmosphere Duct Wrap:
   5. Manson Insulation, a company of Knauf Insulation; Alley Wrap B: www.imanson.com/#sle.
   6. Owens Corning Corporation: www.ocbuildingspec.com.
   7. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K (Ksi) value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1,200 degrees F (649 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Indoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter (1.29 mm diameter).

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   2. Johns Manville:
   3. Knauf Insulation:
   4. Manson Insulation, a company of Knauf Insulation; AK Board: www.imanson.com/#sle.
   5. Owens Corning Corporation
   6. CertainTeed Corporation:
   7. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible.
   1. K (Ksi) Value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Maximum Density: 8.0 pcf (128 kg/cu m).

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA; AEROFLEX Breathe-EZ: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us.
   3. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com.
   4. Substitutions: See Section 016000 - Product Requirements

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 180 degrees F (82 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETING AND ACCESSORIES

A. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square (2.45 kg/sq m).

C. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch (0.41 mm) with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch (0.40 mm) sheet.
   3. Finish: Smooth.
   4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   5. Fittings: 0.016 inch (0.40 mm) thick die-shaped fitting covers with factory-attached protective liner.
   6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.
   7. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

D. Plain Foil Tape:
   1. Aluminum foil with pressure-sensitive adhesive on paper release liner.

E. UL181 Tape for Rigid and Flexible Ductwork:
   1. Comply with UL 181A for rigid ductwork.
   2. Comply with UL 181B for flexible ductwork.
   3. Aluminum foil coated with pressure-sensitive adhesive on paper release liner.
   4. Foil tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.

5. Finish: Printed with UL Listing for identification.

2.06 DUCT LINER

A. Manufacturers:
   1. Aeroflex USA; AEROFLEX Breathe-EZ: www.aeroflexusa.com/#sle.
   2. Armacell LLC; AP Coilflex:
   3. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   4. Ductmate Industries, Inc, a DMI Company:
   5. Johns Manville:
   6. Knauf Insulation; Performance+ Duct Liner: www.knaufinsulation.com/#sle.
   7. Manson Insulation, a company of Knauf Insulation; Akousti-Liner: www.imanson.com/#sle.
   8. Knauf Insulation:
   9. Owens Corning Corporation:
   10. CertainTeed Corporation:
   11. Substitutions: See Section 016000 - Product Requirements.

B. Note: Choose the liner type - Elastomeric Foam, Glass Fiber, or Phenolic Foam.

C. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 180 degrees F (82 degrees C).
   3. Fungal Resistance: No growth when tested according to ASTM G21.
   4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F (0.045 at 24 degrees C).
   5. Minimum Noise Reduction Coefficients:
      a. 1/2 inch (13 mm) Thickness: 0.30.
      b. 1 inch (25 mm) Thickness: 0.40.
      c. 1-1/2 inches (40 mm) Thickness: 0.50.
      d. 2 inch (50 mm) Thickness: 0.60.
   6. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm (50.8 m/s) when tested in accordance with ASTM C1071.
   7. Connection: Waterproof vapor barrier adhesive.

D. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

E. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
   1. Fungal Resistance: No growth when tested according to ASTM G21.
   2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F (0.045 at 24 degrees C).
   3. Service Temperature: Up to 250 degrees F (121 degrees C).
   4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm (25.4 m/s), minimum.
   5. Minimum Noise Reduction Coefficients:
      a. 1/2 inch (13 mm) Thickness: 0.30.
      b. 1 inch (25 mm) Thickness: 0.45.
      c. 1-1/2 inches (40 mm) Thickness: 0.60.
      d. 2 inch (50 mm) Thickness: 0.70.

F. Adhesive: Waterproof, fire-retardant type, ASTM C916.

G. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor) ((below 3 meters above finished floor)): Finish with canvas jacket sized for finish painting.

F. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct and Plenum Liner Application:
   1. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   2. Seal and smooth joints. Seal and coat transverse joints.
   3. Seal liner surface penetrations with adhesive.
   4. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

END OF SECTION

SECTION 230719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 232113 - Hydronic Piping: Placement of hangers and hanger inserts.

C. Section 232300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2026.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

F. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2025.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Inspect for damage prior to acceptance.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

A. Manufacturers:
   1. CertainTeed Corporation.
   2. Johns Manville Corporation.
   3. Knauf Insulation.
   4. Manson Insulation, a company of Knauf Insulation; Alley-K Pipe Insulation: www.imanson.com/#sle.
   5. Owens Corning Corporation.
   6. Owens Corning Corporation; VaporWick Pipe Insulation: www.owenscorning.com/en-us/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K (Ksi) Value: ASTM C177, 0.23 at 75 degrees F (0.034 at 24 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 650 degrees F (343 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

E. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/(Pa s m)).

F. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA; AEROFLEX Self-Seal: www.aeroflexusa.com/#sle.
   2. Armacell LLC; AP ArmaFlex: www.armacell.us/#sle.
   3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.04 JACKETING AND ACCESSORIES

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation.
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (minus 18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/(Pa s m)), maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch (0.25 mm).
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.

2.05 ACCESSORIES

A. General Requirements:
   1. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
   2. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
   3. Supply materials that are asbestos free.

B. Corrosion Inhibitors:
   1. Corrosion Control Gel:
      a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested and inspected before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

H. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with PVC jacket and fitting covers.

L. Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil, 0.001 inch (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

END OF SECTION

SECTION 230800
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Provider (CxP) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Ductwork and accessories.
   5. Vibration control devices.
   6. Variable frequency drives.
   7. Special Ventilation:
      a. Specialty fans.
   8. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 017900 - Demonstration and Training: Scope and procedures for Owner personnel training.

C. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

D. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

E. Section 230913 - Instrumentation and Control Devices for HVAC.

F. Section 230923 - Direct-Digital Control System for HVAC.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - Application of the Commissioning Process to New HVAC&R Systems; 2025.

1.04 SUBMITTALS

A. Updated Submittals: Keep Commisioning Provider (CxP) informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.

2. List of devices.
3. Step-by-step procedures for testing each controller after installation, including:
    a. Process of verifying proper hardware and wiring installation.
    b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
    c. Process of performing operational checks of each controlled component.
    d. Plan and process for calibrating valve and damper actuators and all sensors.
    e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with CxP and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Provider.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
    a. Floor.
    b. Room number.
    c. Room name.
    d. Air handler unit ID.
    e. Reference drawing number.
    f. Air terminal unit tag ID.
    g. Heating and/or cooling valve tag ID.
    h. Minimum air flow rate.
    i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.

d. Controller and/or module data.
e. Thermostats and timers.
f. Sensors and DP switches.
g. Valves and valve actuators.
h. Dampers and damper actuators.
i. Program setups (software program printouts).

E. Project Record Documents: See Section 017800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 017900, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 017900 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with CxP in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by CxP.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by CxP; update the schedule as appropriate.

D. Notify CxP when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction, notify ahead of time and be proactive in seeing that CxP has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.
1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by CxP for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.
   1. With full pressure in the system, command valve closed.
   2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup, and component Functional Tests of the system completed and approved by CxP prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by CxP.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.

2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to CxP during testing of controlled equipment; coordinate with commissioning of equipment.
1. Setpoint changing features and functions.
2. Sensor calibrations.

G. Demonstrate to CxP:
1. That all specified functions and features are set up, debugged and fully operable.
2. That scheduling features are fully functional and setup, including holidays.
3. That all graphic screens and value readouts are completed.
4. Correct date and time setting in central computer.
5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Provider for review; make changes recommended by Commissioning Provider.

D. Commissioning Provider will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 017900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to CxP during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct Owner's personnel for minimum ____ hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of ____ hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer's facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of ____ hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.
      e. Point database entry and modifications.
   3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of ____ hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 231123
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.

1.02 REFERENCE STANDARDS

A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.

B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

D. ASME B31.1 - Power Piping; 2024.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

G. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.02 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.

B. Flanges for Pipe Size Over 1 Inch (25 mm):
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

2.04 BALL VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Grinnell Products: www.grinnell.com/#sle.
   3. Milwaukee Valve Company: www.milwaukeevalve.com/#sle.
   4. Nibco, Inc: www.nibco.com/#sle.
   5. Viega LLC: www.viega.us/#sle.
   6. Uponor, Inc: www.uponorpro.com/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brassball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded ends with union.

2.05 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Manufacturers:
   1. Maxitrol Company: www.maxitrol.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

B. Compliance Requirements:
   1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
   2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

C. Materials in Contact With Gas:
   1. Housing: Aluminum, steel (free of non-ferrous metals).
   2. Seals and Diaphragms: NBR-based rubber.

D. Maximum Inlet Operating Pressure: 10 psi (68.9 kPa).
   1. Appliance Regulator: 10 psi (68.9 kPa).
   2. Line Pressure Regulator: 10 psi (68.9 kPa).

E. Maximum Body Pressure: 10 psi (1000 mbar).

F. Output Pressure Range: 1 inch wc (2.5 mbar) to 80 inch wc (200 mbar).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 083100.

G. Provide support for utility meters in accordance with requirements of utility companies.

H. Install valves with stems upright or horizontal, not inverted.

I. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

3.02 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. For Piping Serving Boilers:
   1. Provide and install line pressure regulator as specified by the equipment manufacturer.
   2. Verify fuel piping compliance with manuracturer's recommendations.

END OF SECTION

SECTION 232113
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water and glycol piping, buried.

C. Heating water piping, above grade.

D. Heating water and glycol piping, above grade.

E. Radiant heating piping system.

F. Pipe hangers and supports.

G. Unions, flanges, mechanical couplings, and dielectric connections.

H. Valves:
   1. Ball valves.
   2. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 230523 - General-Duty Valves for HVAC Piping.

B. Section 230548 - Vibration and Seismic Controls for HVAC.

C. Section 230553 - Identification for HVAC Piping and Equipment.

D. Section 230719 - HVAC Piping Insulation.

E. Section 232114 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.

D. ASME B31.9 - Building Services Piping; 2025.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

G. ASTM B32 - Standard Specification for Solder Metal; 2020.

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

J. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2025.

K. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2025.

L. ASTM F3226/F3226M - Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems; 2019 (Reaffirmed 2024).

M. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

N. AWS D10.12M/D10.12 - Guide for Welding Mild Steel Pipe; 2000.

O. DIN 4726 - Warm Water Surface Heating Systems and Radiator Connections - Plastics and Multilayer Piping Systems; 2024.

P. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

Q. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections; 2022.

R. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturers catalog information.
   3. Indicate valve data and ratings.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
      b. Use rigid joints unless otherwise indicated.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) gate valves with cap; pipe to nearest floor drain.
   2. For throttling, bypass, or manual flow control services, use ball valves.
   3. For shut-off and to isolate parts of systems or vertical risers, use ball valves.

2.02 HEATING WATER AND GLYCOL PIPING, BURIED

A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. Manufacturers:
      a. Uponor, Inc; Wirsbo hePEX:
   2. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.000044 grains per cu ft/day (0.10 mg per cu m/day) at 104 degrees F (40 degrees C) in accordance with DIN 4726.

2.03 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D10.12M/D10.12 welded.
   2. Mechanical Press Sealed Fittings: ASTM F3226/F3226M, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (Type B), drawn temper, using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
      a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
      b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
   2. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.
      a. Manufacturers:
         1) Apollo Valves; _____: www.apollovalves.com/#sle.
         2) NIBCO INC; Press System: www.nibco.com/#sle.
         3) Substitutions: See Section 016000 - Product Requirements.

2.04 RADIANT HEATING PIPING

A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. Manufacturers:
      a. Uponor, Inc; _____: www.uponorpro.com/#sle.
   2. Fittings: Brass and copper.
   3. Joints: Mechanical compression fittings.
   4. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.000044 grains per cu ft/day (0.10 mg per cu m/day) at 104 degrees F (40 degrees C) in accordance with DIN 4726.

2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Greater: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches (50 mm, DN) and Less:
   1. Ferrous Piping: 150 psi (1034 kPa) brass or malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches (50 mm, DN) and Greater:
   1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
   2. Copper Piping: Bronze.

2.07 BALL VALVES

A. Manufacturers:
   1. Apollo Valves; _____: www.apollovalves.com/#sle.
   2. Victaulic Company; _____: www.victaulic.com/#sle.

B. Up To and Including 2 Inches (50 mm):

1. Bronze one piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends with union.

C. Over 2 Inches (50 mm):
   1. Ductile iron body, chrome plated stainless steel ball, teflon, Virgin TFE, or _____ seat and stuffing box seals, lever handle, gear operated, or _____, flanged ends, rated to 800 psi (5515 kPa).

2.08 SWING CHECK VALVES

A. Manufacturers:
   1. Anvil International; _____: www.anvilintl.com/#sle.
   2. Apollo Valves; _____: www.apollovalves.com/#sle.

B. Up To and Including 2 Inches (50 mm):
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

2.09 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Anvil International; _____: www.anvilintl.com/#sle.
   2. Shurjoint Piping Products, Inc; _____: www.shurjoint.com/#sle.
   3. Victaulic Company; _____: www.victaulic.com/#sle.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer, or threaded lug ends.

END OF SECTION

SECTION 232114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Pump connectors.

F. Pressure-temperature test plugs.

G. Balancing valves.

H. Automatic flow control valves.

I. Flow meters.

J. Relief valves.

K. Glycol system.

1.02 RELATED REQUIREMENTS

A. Section 221119 - Domestic Water Piping Specialties: Backflow preventers.

B. Section 232113 - Hydronic Piping.

C. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.

B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2025, with Errata .

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of flow controls.

E. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 EXPANSION TANKS

A. Manufacturers:

1. Amtrol Inc
2. Bell & Gossett, a brand of Xylem, Inc
3. Taco, Inc
4. Substitutions: See Section 016000 - Product Requirements.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, adjustable flexible EPDM diaphragm or bladder seal factory precharged to 12 psi (80 kPa), and steel support stand.

C. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced-pressure-principle backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.
1. See Section 221119 for backflow preventer specifications.

D. Accessories: Provide air-charging fitting, bulls eye sight glass, pressure gauge, and tank drain ball valve.

2.02 AIR VENTS

A. Manufacturers:
1. Armstrong International, Inc
2. Bell & Gossett, a brand of Xylem, Inc
3. Taco, Inc
4. Substitutions: See Section 016000 - Product Requirements.

B. Manual Air Vent: Short vertical sections of 2-inch (50 mm, DN) diameter pipe to form air chamber, with 1/8 inch (6 mm, DN) brass needle valve at top of chamber.

C. Float Air Vent:
1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Maximum Fluid Pressure: 150 psi (1,034 kPa).

E. Maximum Fluid Temperature: 250 degrees F (121.1 degrees C).

2.03 AIR SEPARATORS

A. Centrifugal Air Separators/Strainers:
1. Manufacturers:
a. Armstrong International, Inc
b. Bell & Gossett, a brand of Xylem, Inc
c. Taco, Inc
d. Substitutions: See Section 016000 - Product Requirements.
2. Primed steel body, tested and stamped in accordance with ASME BPVC-VIII-1 with integral bronze strainer, tangential flanged inlet and outlet connections, and internal stainless steel air collector tube.
3. Maximum Service Flow and Pressure: 16 gpm (60.6 Lpm) at 125 psi (860 kPa).
4. Accessories: Provide epoxy coating finish, removable strainer, and tank-bottom magnets.

2.04 STRAINERS

A. Size 2 inch (50 mm, DN) and Under:
1. Provide threaded, grooved, or sweat brass or iron body for up to 175 psi (1,200 kPa) working pressure, Y-pattern strainer with 1/32 inch (0.8 mm) stainless steel perforated screen.
2. Body Material by Fluid Service:
a. Cast Iron or Brass:
1) Liquids: Up to 400 psi at 150 degrees F (2,758 kPa at 65.6 degrees C).

B. Size 2-1/2 inch (65 mm, DN) to 4 inch (100 mm, DN):

1. Provide flanged iron body for up to 175 psi (1,200 kPa) working pressure, up to 250 degrees F (121.1 degrees C) working temperature, Y-pattern strainer with 1/16 inch (1.6 mm) or 3/64 inch (1.2 mm) stainless steel perforated screen.
2. Body Material by Fluid Service:
    a. Cast Iron:
        1) Liquids: Up to 200 psi at 150 degrees F (1,379 kPa at 65.6 degrees C).

C. Basket-Type, Size 1 to 30 inch (25 to 750 mm, DN) for Liquid Service:
1. Flanged carbon steel body with 1/8 inch (3.2 mm) stainless steel perforated basket screen, bottom drain and capped air vent.
2. Fluid Service: Up to 285 psi at 100 degrees F (1,965 kPa at 37.8 degrees C).

2.05 PUMP CONNECTORS

A. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
1. Maximum Operating Service: 150 psi (1030 kPa) at 120 degrees F (49 degrees C).
2. End Connections: Same as specified for pipe jointing.
3. Provide necessary accessories including, but not limited to, swivel joints.

2.06 PRESSURE-TEMPERATURE TEST PLUGS

A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F (93 degrees C).

B. Application: Use extended length plugs to clear insulated piping.

2.07 BALANCING VALVES

A. Size 2 inch (50 mm, DN) and Smaller:
1. Provide ball style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and threaded, soldered, or sweat connections.
2. Metal construction materials consist of bronze or brass.
3. Non-metal construction materials consist of Teflon or EPDM.

B. Size 2-1/2 inch (65 mm, DN) and Larger:
1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
2. Valve body construction materials consist of cast iron or carbon steel.
3. Internal components construction materials consist of Teflon, EPDM, or engineered resin.

2.08 AUTOMATIC FLOW CONTROL VALVES

A. Construction:
1. Brass, bronze, or iron body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
2. Built-in lug-type outlet butterfly valve with 2-position handle.

B. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi (13.7 kPa).

C. Control Mechanism: Provide stainless steel or nickel-plated, brass piston or regulator cup, operating against stainless steel helical or wave formed spring or elastomeric diaphragm and polyphenylsulfone orifice plate.

2.09 FLOW METERS

A. Direct reading with insert pitot tube, threaded coupling, for 150 psi (1034 kPa) working pressure, maximum 240 degrees F (115 degrees C), 5 percent accuracy.

B. Cast iron, wafer type, orifice insert flow meter for 250 psi (1720 kPa) working pressure, with read-out valves equipped with integral check valves with gasketed caps.

2.10 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.11 GLYCOL SYSTEM

A. Pump System:
   1. Storage: 30 gal (113.6 L) polypropylene tank with bolt-removable hinged solid cover and enamel coated carbon steel tank-stand.
   2. Pump:
      a. Thermally protected 1/4 hp (0.2 kW) motor at 115 to 120 VAC, single phase rated for indoor service.
      b. Maximum Service Operation: 100 psi (689 kPa) at 85 degrees F (29 degrees C).
   3. Mechanical Accessories: System isolation valves, strainer, and pressure gauges.
   4. Control Panel:
      a. Fused single-point system connection rated at 115 to 120 VAC, single phase.
      b. Interface: Hand switches with indicating lights for ON, FAULT, and LOW LEVEL.
      c. Pressure Switch: Panel-mounted and prewired for 10 psi (69 kPa) cut-in and 40 psi (276 kPa) cut-out, adjustable.
      d. Low Level Cut-Off Switch: Prewired to shut-down unit upon activation. Tank-side mounted.
      e. High Level Cut-Off Float Switch: Prewired to shut-down unit upon activation. Tank-side mounted.
      f. Auxiliary Dry Contacts: Low level, high level, and fault/alarm for remote monitoring.
      g. Alarm: Audio-visual device with panel-mounted silencing switch to activate upon system fault or alarm with audio pressure level rated for 90 dB.
   5. Pressure Relief Valve: System-mounted brass valve tubed from pump discharge side into tank with adjustable setpoint between 20 psi (138 kPa) and 150 psi (1,034 kPa).

B. Glycol Solution:
   1. Water-based solution mix containing 35 and 50 percent propylene glycol by volume required for cooling or heating system operating temperature range.
   2. Cooling or heating System Operating Temperature Range: Between freezing and boiling points of 3 and 220 degees F (minus 16.1 and 104.4 degees C) at 14.7 psia (101.4 kPa).

C. Mixing Tank: 55 gallon (205 L) steel drum with fittings suitable for filling and hand pump for charging, rubber hose for connection of hand pump to system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties and equipment in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blowdown connection.

F. Provide pump suction fitting on suction side of base-mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

G. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

H. Support pump fittings with floor-mounted pipe and flange supports.

I. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

J. Pipe relief valve outlet to nearest floor drain.

K. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

L. Clean and flush glycol system before adding glycol solution, see Section 232500.

M. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at 12 psi (80 kPa).

N. Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

SECTION 232123
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Circulators.

1.02 RELATED REQUIREMENTS

A. Section 230513 - Common Motor Requirements for HVAC Equipment.

B. Section 230548 - Vibration and Seismic Controls for HVAC.

C. Section 230719 - HVAC Piping Insulation.

D. Section 230934 - Variable-Frequency Motor Controllers for HVAC.

E. Section 232113 - Hydronic Piping.

F. Section 232114 - Hydronic Specialties.

G. Section 253500 - Integrated Automation Instrumentation and Terminal Devices for HVAC.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

D. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Fluid Technology, Inc

B. Bell & Gossett, a Xylem Inc. brand

C. Grundfos Pumps Corporation: www.grundfos.com/#sle.

D. Taco Comfort Solutions, Inc.; www.tacocomfort.com/#sle

E. Substitutions: See Section 016000 - Product Requirements.

2.02 GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Electrical Requirements:
   1. Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.
   2. Variable Frequency Drives (VFDs): Provide in accordance with Section 230934, except for integral-VFDs.
   3. Enclosures: Provide unspecified product(s) required to fit motor:

2.03 CIRCULATORS

A. Factory-assembled and -tested, wet-rotor pump. Pump and motor to form an integral unit with bearings lubricated by the pumped liquid.

B. Casing: Cast iron, with flanged pump connections.

C. Impeller: 304 Stainless Steel keyed to shaft.

D. Bearings: Metal-impregnated carbon.

E. Shaft: Stainless steel with bronze sleeve, integral thrust collar.

F. Seal: Mechanical seal, 225 degrees F (107 degrees C) maximum continuous duty temperature.

G. Electrical:
   1. Motor: ECM type.
   2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Check, align, and certify alignment of base-mounted pumps prior to start-up.

H. Controls Human-Machine Interface (HMI): HVAC operator terminal; see Section 253500.

END OF SECTION

SECTION 232300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Engineered wall seals and insulation protection.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Addendum (2025).

B. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2024, with Addendum (2025).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

D. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2024.

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

F. ASME B31.9 - Building Services Piping; 2025.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

J. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

L. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

M. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

1.03 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.

D. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use service valves on each branch selector port to indoor equipment.

E. Strainers:
   1. Use line size strainer upstream of each automatic valve.

2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.

F. Pressure Relief Valves: Use on ASME receivers and pipe to outdoors.

G. Filter-Driers:
1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
2. Use a filter-drier on suction line just ahead of compressor.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

2.02 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch (22 mm) OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
1. Fittings: ASME B16.26 cast copper.
2. Joints: Flared.

C. Pipe Supports and Anchors:
1. Provide hangers and supports that comply with MSS SP-58.
a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
3. Vertical Support: Steel riser clamp.
4. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
5. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
6. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
7. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
e. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to top of roofing.

2.03 REFRIGERANT

A. Refrigerant: R454B and R32.

2.04 ENGINEERED WALL SEALS AND INSULATION PROTECTION

A. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
   1. Outlet Cover Color: Gray.

B. Insulation Protection System: Mechanical line insulation and PVC cover.
   1. PVC Insulation Cover Color: Black with full-length velcro fastener.
   2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
   3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
   4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

3.02 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi (1380 kPa). Perform final tests at 27 inches (92 kPa) vacuum and 200 psi (1380 kPa) using halide torch. Test to no leakage.

END OF SECTION

SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.02 RELATED REQUIREMENTS

A. Section 230130.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

B. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

G. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

1.05 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 233319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc (500 Pa) of galvanized steel.
   2. Flexible Duct (Fabric and wire): Plus or minus 1/2 in-wc (125 Pa); see Section 233700.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:

F. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

G. Low Pressure Supply: 3 inch w.g. (___ Pa) positive pressure class, galvanized steel.

H. Return and Relief: 2 inch w.g. (___ Pa) positive/negative pressure class, galvanized steel.

I. General Exhaust: 2 inch w.g. (___ Pa) positive/negative pressure class, galvanized steel.

J. Outside Air Intake: 2 inch w.g. (500 Pa) pressure class, galvanized steel.

K. Transfer Air and Sound Boots: 1/2 inch w.g. (125 Pa) pressure class, acoustically lined galvanized sheet metal.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, per manufacturer's guidelines.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Flexible Ducts: Connect to metal ducts with adhesive plus sheet metal screws.

G. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

H. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Use double nuts and lock washers on threaded rod supports.

K. Provide three (3) duct diameters minimum and/or (12) duct diameters maximum of straight duct prior to terminal units.

L. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

M. Set plenum doors at 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.

N. At exterior wall louvers, seal duct to louver frame and install blank-out panels. Ductwork connection at louver box shall extend up at a minimum of 30 degrees to prevent water infiltration into ductwork. This low point in the louver box shall be sealed water tight.

O. Provide paint grip spiral ductwork in exposed ceiling installations.

3.02 CLEANING

A. Clean thoroughly each duct system. See Section 230130.51.

B. Clean thoroughly each duct system. See Section 230130.51.

C. Provide duct cleaning and disinfecting on all existing ductwork.

D. Provide video and pictures of duct before and after cleaning with summarized report detailing procedures and results.

END OF SECTION

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Duct access doors.

D. Duct test holes.

E. Flexible duct connectors.

F. Volume control dampers.

G. Low leakage (Class 1A) control dampers.

H. Miscellaneous Products:
   1. Fire-rated enclosures.
   2. Internal strut end plugs.
   3. Duct opening closure film.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 233100 - HVAC Ducts and Casings.

C. Section 233600 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

E. Project Record Drawings: Record actual locations of access doors and test holes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Carlisle HVAC Products
   2. Elgen Manufacturing, Inc:
   3. Krueger-HVAC, Division of Air System Components:
   4. Ruskin Company
   5. Titus HVAC, a brand of Johnson Controls
   6. Substitutions: See Section 016000 - Product Requirements.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc
   2. Nailor Industries, Inc
   3. Ruskin Company
   4. Substitutions: See Section 016000 - Product Requirements.

B. Gravity Backdraft Dampers, Size 18 by 18 inches (450 by 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ductmate Industries, Inc, a DMI Company:
   2. Elgen Manufacturing, Inc:
   3. Lloyd Industries, Inc:
   4. MKT Metal Manufacturing:
   5. Nailor Industries, Inc:
   6. Ruskin Company:
   7. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric:
   2. Ductmate Industries, Inc, a DMI Company:
   3. Elgen Manufacturing, Inc:
   4. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

D. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.87 lbs per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.

E. Maximum Installed Length: 14 inch (356 mm).

2.06 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc:
   2. Elgen Manufacturing Company, Inc; _____:
   3. MKT Metal Manufacturing
   4. Nailor Industries, Inc

5. Ruskin Company
6. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers:
1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
2. Blade: 24 gauge, 0.0239 inch (0.61 mm), minimum.

D. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches (200 by 1825 mm). Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
1. Blade: 18 gauge, 0.0478 inch (1.21 mm), minimum.

E. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

2.07 LOW LEAKAGE (CLASS 1A) CONTROL DAMPERS

A. Manufacturers:
1. Ruskin Company: www.ruskin.com.
2. Substitutions: See Section 016000 - Product Requirements.

B. Maximum Leakage Allowed: 4 cfm/sq ft at 1 in-wc (15.2 L/sec/sq m at 0.25 kPa).

2.08 MISCELLANEOUS PRODUCTS

A. Fire-Rated Enclosures:
1. Provide as required to preserve fire resistance rating of building elements.

B. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.

C. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
1. Thickness: 2 mils (0.6 mm).
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch (200 by 200 mm) size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch (100 by 100 mm) size access door for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

G. For fans developing static pressures of 5.0 inches (1250 Pa) and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 233423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling exhaust fans.

B. Inline centrifugal fans and blowers.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2025.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2025.

E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate fan roof curbs and service utilities installation according to fan size.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panasonic

B. Greenheck Fan Corporation

C. Loren Cook Company:

D. Twin City Fan & Blower

E. Substitutions: See Section 016000 - Product Requirements.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: Comply with AMCA 204.

B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

D. Fabrication: Comply with AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 CEILING EXHAUST FANS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resiliently mounted motor, gravity backdraft damper in discharge.

B. Grille: Molded white plastic.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 INLINE CENTRIFUGAL FANS AND BLOWERS

A. Centrifugal Fan Unit: Direct driven, with galvanized steel housing lined with acoustic insulation, resiliently-mounted and electronically commutated motor (E with variable speed control.

B. Forward Curved or Mixed Flow Blower:
   1. Direct-driven, resiliently mounted motor, heavy-duty ball bearings, galvanized steel housing for indoor service, and removable service panels.
   2. Accessories: Provide external vibration isolator spring.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm gets reached with sheaves set at mid-position; fan shaft with self-aligning prelubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:

C. Provide and install motorized back draft dampers on fans 300 cfm or greater.

D. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

SECTION 233516
ENGINE EXHAUST SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Centrifugal fans.

B. Ductwork and duct accessories.

C. Exhaust system accessories.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC: Vibration isolators.

B. Section 230913 - Instrumentation and Control Devices for HVAC: Carbon monoxide detectors.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2025.

C. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2025.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

F. SMACNA (ROUND) - Round Industrial Duct Construction Standards; 2013.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers literature and data sheets indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.
   1. Provide fan curves with specified operating point clearly plotted.
   2. Submit sound power levels for both fan inlet and outlet at rated capacity.

C. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, and locations and sizes of field connections.

D. Manufacturer's Installation Instructions: Include assembly and installation instructions.

E. Operation and Maintenance Data: Include instructions for fan lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Fan Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

B. Fan Fabrication: Comply with AMCA 99.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Monoxivent:

B. Fume-a-vent

C. Substitutions: See Section 016000 - Product Requirements.

2.02 CENTRIFUGAL FANS

A. Wheel and Inlet: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

B. Housing: Heavy gauge steel, spot welded with inlet bell and shaped cut-off, factory finished with enamel or prime coat.

C. Motors and Drives:
   1. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball bearings or roller bearings.
   2. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.

2.03 DUCTWORK AND DUCT ACCESSORIES

A. Materials:
   1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Ductwork:
   1. Fabricate and support in accordance with:
   2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
   3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

C. Flexible Connectors: UL-listed, fire-retardant, polyethylene-impregnated fabric, minimum density 20 oz per sq yd (0.68 kg per sq m), approximately 2 inches (50 mm) wide, crimped into metal edging strip.

2.04 EXHAUST SYSTEM ACCESSORIES

A. Tail Pipe Adapters: Rubber formed to tapered cone with spring clip attachment, adapter size 6 inch (150 mm), for connection to 2-1/2 inch (65 mm) diameter hose.

B. Flexible Exhaust Hose: Heat resistant neoprene coated fabric spring steel wire reinforced, rated for duty to 260 degrees F (125 degrees C) and 20 inches WG (5 kPa) positive or negative.

C. Flexible Exhaust Hose: Galvanized steel, 28 gauge, 0.0149 inch (0.38 mm).

D. Exhaust Hose Reel: Motor operated reel with direct-mounted override switch on motor. The reel to consist of 16-gauge, cold rolled steel cylinder with internal aluminum flexible pipe, zinc plated steel stand, two steel springs, brake mechanism, hose stop, hose guide and 16 feet (5 meters) of 2-1/2-inch (65 mm) diameter hose.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install fans with resilient mounting and flexible electrical leads. See Section 230548 and Section 260583.

C. Install flexible connections at fan inlet and discharge. Ensure metal bands of connectors are parallel with minimum 1-inch (25 mm) flex between ductwork and fan while running.

D. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION

SECTION 233700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:
   1. Perforated ceiling diffusers.

B. Rectangular ceiling diffusers.

C. Registers/grilles:
   1. Ceiling-mounted, egg crate exhaust and return register/grilles.
   2. Ceiling-mounted, exhaust and return register/grilles.
   3. Ceiling-mounted, supply register/grilles.

D. Duct-mounted supply and return registers/louvers.

E. Louvers:

F. Goosenecks.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Price Industries:

B. Titus, a brand of Air Distribution Technologies:

C. Substitutions: See Section 016000 - Product Requirements.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide diffuser to discharge air in pattern with sectorizing baffles where indicated.

B. Connections: Round.

C. Frame: Provide type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As selected by Architect from manufacturer's standard range.

F. Accessories: Provide radial opposed blade, butterfly, and combination splitter volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating

rod extension, anti-smudging device, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.

2.03 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with fully adjustable pattern and removable face.

B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with steel frame and baked enamel finish.

D. Color: As selected by Architect from manufacturer's standard range.

E. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.04 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS

A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and dual cover flanges to lay flush on duct surface regardless of diameter. Performance to match manufacturer's catalog data.

B. Material: 22 gauge, 0.0299 inch (0.76 mm).
   1. Provide crossing spiral fitting-body of matching duct diameter.

C. Color: As indicated on drawings.

2.05 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Construction: Made of aluminum extrusions with factory enamel finish.

D. Color: As indicated on drawings.

2.06 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gauge, 0.0359 inch (0.91 mm) minimum frames and 22 gauge, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gauge, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated on the drawings.

2.07 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: As indicated on the drawings.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

F. Accessories: Provide integral gang and face operated opposed blade damper, 2 inch filter frame (50 mm), plaster frame, square mesh insect screen, square mesh debris screen, prescored molded fiberglass back, and 45 degree angled eggcrate or other similar provisions for visual blocking such as angled louver or 90 degree duct elbow.

2.08 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, vertical face, single deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gauge, 0.0359 inch (0.91 mm) minimum frames and 22 gauge, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gauge, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated on the drawings.

2.09 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with two-way deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions with factory clear lacquer finish.

D. Color: As indicated on the drawings.

2.10 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: As indicated on the drawings.

2.11 LOUVERS

A. Manufacturers:
   1. Ruskin Company
   2. Greenheck
   3. Substitutions: See Section 016000 - Product Requirements.

B. Type: 6 inch (150 mm) deep frame with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch (13 mm) square mesh screen over intake or exhaust end.

C. Color: As indicated on the drawings.

2.12 GOOSENECKS

A. Fabricate in accordance with of minimum 18 gauge, 0.0598 inch (1.21 mm) galvanized steel.

B. Mount on minimum 12 inch (300 mm) high curb base where size exceeds 9 by 9 inch (230 by 230 mm).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black, see Section 099123.

3.02 CLOSEOUT ACTIVITIES

A. Demonstrate operational system to Owner's representative.

B. Instruct Owner's representative to maintain system and use occupant controls or interfaces, as required.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION

SECTION 235216
CONDENSING BOILERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured units.

B. Boiler construction.

C. Boiler trim.

D. Fuel burning system.

E. Factory installed controls.

1.02 RELATED REQUIREMENTS

A. Section 230913 - Instrumentation and Control Devices for HVAC.

B. Section 232114 - Hydronic Specialties.

C. Section 232123 - Hydronic Pumps.

D. Section 235100 - Breechings, Chimneys, and Stacks.

E. Section 251500 - Integrated Automation Software.

F. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.

B. ANSI Z21.13 - American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers; 2022.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2025).

E. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2025, with Errata.

F. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); Current Edition.

G. NFPA 54 - National Fuel Gas Code; 2024.

H. SCAQMD 1146.1 - Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters; 1990, with Amendment (2018).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.

C. Manufacturer's Installation Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Natural Gas, Propane, or Combination Natural Gas/Propane for Indoor Applications:
   1. LAARS Heating Systems Company
   2. Lochinvar LLC
   3. Rinnai America Corporation
   4. The Fulton Companies

2.02 MANUFACTURED UNITS

A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.

B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.

2.03 BOILER CONSTRUCTION

A. Comply with the minimum requirements of ASME BPVC-IV and ANSI Z21.13 for construction of boilers.

B. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE Std 90.1 I-P.

C. Required Directory Listings:
   1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.
   2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at www.nationalboard.org.

D. Heat Exchanger: Construct with materials that are impervious to corrosion where subject to contact with corrosive condensables.

E. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection.

F. Insulate casing with insulation material, protected and covered by heavy-gauge metal jacket.

G. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic, powder coated, painted, or weather-proofed finish.

2.04 BOILER TRIM

A. ASME rated pressure relief valve.

B. Flow switch.

C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.

D. Temperature and pressure gauge.

E. Pressure Switches:
   1. High gas pressure.
   2. Low gas pressure.
   3. Air pressure.

F. Manual reset high limit.

G. Boiler Pump (where required by boiler design):
   1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.
   2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.
   3. Pump time delay.

2.05 FUEL BURNING SYSTEM

A. Provide forced draft automatic burner or pulse combustion, integral to boiler, designed to burn natural gas, and maintain fuel-air ratios automatically.
   1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor.
   2. Forced Draft Design: Mixes combustion air and gas to achieve 96 percent combustion efficiency.

B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.

C. Emission of Oxides of Nitrogen Requirements: Comply with SCAQMD 1146.1 for natural gas fired system, as applicable.

D. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe.

2.06 FACTORY INSTALLED CONTROLS

A. Option for internal or external (0-10) VDC control.

B. Temperature Controls:
   1. Automatic reset type to control fuel burning system on-off and firing rate to maintain temperature.
   2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.
   3. Low-fire start time delay relay.

C. Electronic PI setpoint/modulation control system.

D. Microprocessor-based, fuel/air mixing controls.

E. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.
   1. External Point Mapping: Provide mapping table for each parameter included in the local visual interface with software-toggle flag to allow reduced mapping of available points.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.

C. Coordinate factory installed controls with Section 230913.

D. Pipe relief valves to nearest floor drain.

E. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

F. Install primary boiler pump in accordance with Section 232123.

G. Provide piping connection and accessories in accordance with Section 232114.

H. Provide for connection to electrical service in accordance with Section 260583.

I. Connect vent combustion generated fumes to breeching, chimney or exhaust stack; see Section 235100.

J. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote front-end interface; see Section 251500.

3.02 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.

END OF SECTION

SECTION 235533
FUEL-FIRED UNIT HEATERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gas fired unit heaters.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 235100 - Breechings, Chimneys, and Stacks.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2022, with Errata (2025).

C. NFPA 54 - National Fuel Gas Code; 2024.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

E. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2024.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.01 GAS FIRED UNIT HEATERS

A. Manufacturers:
   1. Modine Manufacturing Company
   2. Sterling HVAC/Mestek Technology, Inc
   3. Reznor/Thomas & Betts Corporation
   4. Substitutions: See Section 016000 - Product Requirements.

B. Unit Heaters: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:
   1. Heating: Natural gas fired.
   2. Discharge Louvers: Individually adjustable horizontal and vertical louvers to match cabinet finish.

C. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

D. Supply Fan: Propeller type with direct drive, variable pitch motor pulley.

E. Heat Exchanger: Aluminized steel welded construction.

F. Gas Burner:
   1. Atmospheric type with adjustable combustion air supply.
   2. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
   3. Electronic pilot ignition, with electric spark igniter.

G. Gas Burner Safety Controls:
   1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
   2. Vent Safety Shutoff Sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

H. Operating Controls:
   1. Room Thermostat: Cycles burner to maintain room temperature setting.

I. Performance:
   1. Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1 I-P; seasonal efficiency to ASHRAE Std 103.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available.

C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

A. Install in accordance with NFPA 90A.

B. Install gas fired units in accordance with NFPA 54 and applicable codes.

C. Provide vent connections in accordance with NFPA 211. Refer to Section 235100.

D. Install unit heaters with vibration isolation. Refer to Section 230548.

E. Provide connection to electrical power systems; refer to Section 260583.

END OF SECTION

SECTION 237223
PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Energy recovery units.

B. Casing.

C. Fans.

D. Filters.

E. Dampers.

F. Vibration isolation.

1.02 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C. AHRI 1060 (I-P) - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment; 2023.

D. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2025.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.

C. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.

D. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements for additional provisions.

PART 2 PRODUCTS

2.01 ENERGY RECOVERY UNITS

A. Energy Recovery Units: Provide stationary core air-to-air exchanger; prefabricated packaged system designed by manufacturer.
   1. Provide unit with a AHRI 1060 (I-P) compliant air-to-air exchanger.
   2. Access: Hinged and/or screwed access panels on front.
   3. Lifting holes at the unit base.
   4. Framing: Welded extruded aluminum tubular frame capable of supporting components and casings.
   5. Permanent name plate listing manufacturer mounted inside door near electrical panel.

B. Energy Recovery Units for Spot Ventilation or Whole House Ventilation: Prefabricated packaged system designed by manufacturer with exchange capillary core.
   1. Access: Hinged and/or screwed access panels on front.
   2. Suspension brackets at the unit base.
   3. Framing: Galvanized steel body.

4. Provide a ceiling grille or access panel.
5. Provide with MERV 8 filters on supply and exhaust air ducts.
6. Provide exterior wall cap.
7. Permanent name plate listing manufacturer mounted inside door near electrical panel.

2.02 CASING

A. Wall, Floor, and Roof Panels:
   1. Panels: Removable.
   2. Construction: 1 inch (25 mm) thick, double wall box construction, with formed edges of exterior wall overlapping formed edges of interior wall.
   3. Aluminum is standard. Factory-painted aluminized steel is an economic alternative when the higher corrosion resistance of aluminum is not required.
   4. Exterior Wall: Galvanized steel sheet.
      a. 0.040 inches (1 mm) thick aluminum.
   5. Interior Wall: Galvanized sheet metal.
      a. 22 gauge, 0.0299 inch (0.76 mm) galvanized sheet metal.
   6. Insulation:
      a. 1/2 inch (13 mm) insulated fiberglass.
      b. Panel Cores: Mineral wool board.
      c. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
      d. Smoke Developed Index (SDI): 50, maximum, when tested in accordance with ASTM E84 or UL 723.
   7. Coating: Polyurethane enamel.

B. Access Panels: Provide access to components through a large, tightly sealed and easily removable panel.

C. Doors:
   1. Construct doors of same construction and thickness as wall panels.
   2. Height: 80 inches (2032 mm).

D. Duct Connection Collars: 0.08 inches (2 mm) aluminum, continuously welded.

2.03 FANS

A. Provide separate fans for exhaust and supply blowers.

B. Fans:
   1. Individually driven with a dedicated motor.
   2. AMCA-rated.

C. Housings: 12 gauge, 0.1046 inch (2.66 mm) aluminized steel with plenums integral to general housing and constructed to Class 1 fan standards.

D. Motors:
   1. Motors: Open drip proof.
   2. Efficiency: Premium.
   3. Speed: Variable
   4. Control: ECM
   5. Fan Motor: UL listed and labeled.

2.04 FILTERS

A. Exhaust and Fresh Air Streams: MERV 7 filters constructed to meet ASHRAE Std 52.2.

2.05 DAMPERS

A. Exhaust Back-Draft Damper: Factory installed, galvanized steel.
   1. High performance, backdraft dampers suitable for application in HVAC systems with velocities to 3000 fpm (914 m/min).
   2. Louvers, Dampers, and Shutters: AMCA 500-D and AMCA 500-L.

3. Damper Capacity: Demonstrate damper capacity to withstand HVAC system operating conditions.
4. Fabrication:
    a. Frame: 20 gauge, 0.0359 inch (0.91 mm), 3 inch (76 mm) roll formed galvanized steel channel with rear flange, prepunched mounting holes, and welded corner clips for maximum rigidity.
    b. Blades:
        1) Style: Single-piece, overlap frame.
        2) Material: Roll formed 28 gauge, 0.0149-inch (0.38 mm) galvanized steel.
        3) Width: Maximum 6 inches (152 mm).

B. Return Air Damper:
1. Factory installed, adjustable volume control, opposed blade damper for regulating airflow, based on external static pressure.
2. Return Air Damper: Structural hat channels, reinforced at corners.
3. Roll-formed Frames: Structurally superior to 13 gauge, 0.0897 inch (2.28 mm) U-channel frames.
4. Blades: Single skin, 16 gauge, 0.0598 inch (1.52 mm).

C. Motorized Dampers: Provide motorized dampers at outside air inlet, exhaust air outlet, and supply air outlet.
1. Type: Motorized two position parallel blade damper with blade seals.
2. Motorized Damper: Roll-formed structural hat channels, reinforced at the corners,
3. Blades: Single skin, 16 gauge, 0.0598 inch (1.52 mm).

D. Motorized Louvers:
1. Type: Motorized two position parallel blade louver with drainable blades, blade seals, and jamb seals
2. Adjustable louver:
    a. Fabrication: Mullion style.
        1) Frame:
            (a) Material: Extruded aluminum, Alloy 6063-T5.
        2) Blades:
            (a) Style: Horizontal, adjustable, drainable.
            (b) Material: Formed aluminum, Alloy 6063-T5.

2.06 VIBRATION ISOLATION

A. Vibration Isolation: Provide whole unit vibration isolation with the energy recovery unit assembly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

3.02 INSTALLATION

A. Provide openings for suitable ductwork connection.

3.03 SYSTEM STARTUP

A. Provide services of manufacturer's authorized representative to provide start up of unit.

3.04 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION

SECTION 238126.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Air cooled condensing units.

C. Indoor air handling (fan and coil) units for ducted systems.

D. Indoor air handling (fan and coil) units for ductless systems.

E. Controls.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Mounting pad for outdoor unit.

B. Section 233100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

F. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. LG

B. Daikin

C. Mitsubishi / Trane

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.

2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Horizontal.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.

C. Air Filters: 1 inch (25 mm) thick urethane, washable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

2.04 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturer: System manufacturer.

2.05 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Refrigerant: R454B or R32.
   2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
   3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.

B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high-pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

D. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

E. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig (1965 kPa) and off when pressure drops below 140 psig (965 kPa) for operation to -10 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION

SECTION 238410
ELECTRIC HEATING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric Duct Heaters

B. Electric Wall Heaters

1.02 RELATED REQUIREMENTS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Product Data: Showing performance data, ratings, electrical data, wiring diagrams, fusing quantity and types.

B. Operating and Maintenance Data

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Electric Duct Heaters:
   1. Indeeco
   2. Markel
   3. Chromalox
   4. Redd-i
   5. Thermoair

B. Electric Wall Heaters:
   1. Chromalox
   2. Markel
   3. Indeeco
   4. Cadet
   5. Q-Mark

2.02 ELECTRIC DUCT HEATERS

A. Description:
   1. Resistance wire shall be iron free, 80 percent nickel and 20 percent chromium, spaced no more than 4-inches apart with ceramic insulators and bushings, supported in aluminum steel frame.
   2. Test dielectrically for 1000V plus twice the rated voltage.
   3. Designed for horizontal or vertical air flow as required.
   4. Three Phase Heaters: Shall have balanced three phase steps.
   5. Control Voltage: 24V
      a. Overcurrent Protection:
      b. Built-in and prewired fuses with one overcurrent device for each 48A circuit except with only one overcurrent device required for entire heater for those heaters rated 48 amperes or less.
      c. Fuses sized for available fault current with 20,000 AIC rating minimum.
      d. Supplier to coordinate with Division 26, Electrical.
   6. Disc-type automatic reset thermal cutout for primary protection.

7. For secondary protection, furnish a sufficient number of heat elements in case the primary cutout fails.
8. Thermal cutout and heat limiters shall be serviceable through the terminal box without removing the heater.
9. Terminal box with hinged, solid cover, duct mounted or remote as indicated on drawings.
10. Built-in Accessories: Factory wired with terminal blocks as required for field connections.
    a. Contactors:
        1) Mercury-type to de-energize heater circuits; 3-pole line break for three phase and 1-pole break for single phase.
        2) Furnish a contactor for each heater circuit (step).
    b. Air Flow Switch:
        1) Pressure type to de-energize heater in the event of inadequate air flow.
        2) Switch located to function down to 25 percent of maximum air volume on discharge side of terminal unit.
    c. Transformer: With primary fuse protection to supply control voltage.
    d. Built-in disconnect switch.
11. Frame Style: Flanged medium pressure application. Slip-in or flanged for low pressure application, suitable for lined ductwork.
12. Capacity: See Schedule on Drawings for KW rating, number of steps and duct sizes.

2.03 ELECTRIC WALL HEATERS

A. Description:
    1. Heavy duty, wall mounted forced air unit heater, complete with steel enclosure for [surface] [recessed] mounting, fan and motor, steel sheathed heating elements with manual reset thermal overloads, capacity as indicated on drawings.
    2. UL listed and wired per NEC.
    3. Thermostat: Unit mounted, built-in, adjustable.

PART 3 EXECUTION

3.01 ELECTRIC WALL HEATERS

A. Install per manufacturer’s instructions. Comply with NEC and UL listings.

B. Install heaters in place with box trim flush with finished wall.

C. Install thermostat as shown on drawings. Provide control wiring from thermostat to unit.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Oxide inhibiting compound.

F. Wire pulling lubricant.

G. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

I. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.

J. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

K. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

O. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

P. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

Q. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

R. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

S. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

T. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet (1.8 m).
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
   2. In addition to other applicable restrictions, may not be used:
      a. Where exposed to damage.
      b. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
      c. For patient care areas of health care facilities requiring redundant grounding.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

H. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
         1) Services: Copper conductors size 1/0 AWG and larger.
         2) Feeders: Copper conductors size 1/0 AWG and larger.
      b. Where aluminum conductors are substituted for copper, comply with the following:
         1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
         2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.
   4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

I. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 100 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 250 feet: 10 AWG, for voltage drop.
         4) Residential applications only, 15A, 120V circuits: 14 AWG..
   2. Control Circuits: 14 AWG.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:
   1) Phase A: Black.
   2) Phase B: Red.
   3) Phase C: Blue.
   4) Neutral/Grounded: White.
c. 240/120 V, 1 Phase, 3 Wire System:
   1) Phase A: Black.
   2) Phase B: Red.
   3) Neutral/Grounded: White.
d. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. General Cable Technologies Corporation: www.generalcable.com/#sle.
      d. Southwire Company: www.southwire.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):
      a. Encore Wire Corporation: www.encorewire.com/#sle.
      b. Southwire Company: www.southwire.com/#sle.
      c. Stabiloy, a brand of General Cable Technologies Corporation: www.stabiloy.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid or stranded.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid or stranded.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

G. Armor: Steel, interlocked tape.

H. Provide PVC jacket applied over cable armor.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
   3. Connectors for Aluminum Conductors: Use compression connectors or mechanical connectors.

C. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   5. Aluminum Conductors: Use compression connectors or mechanical connectors for all connections.
   6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

F. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. nVent ILSCO: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

G. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. nVent ILSCO: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

H. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

2.06 ACCESSORIES

A. Electrical Tape:
   1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
   2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).

B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

C. Wire Pulling Lubricant:
   1. Listed and labeled as complying with UL 267.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Suitable for use at installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
   a. Use listed fittings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2025.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

E. Grounding Electrode System:
1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    a. Provide continuous grounding electrode conductors without splice or joint.
    b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal Underground Water Pipe(s):
    a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
    b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
    c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
    a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
    a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Rod Electrode(s):
    a. Provide two electrodes unless otherwise indicated or required.
    b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

F. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:

a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
b. Metal gas piping.
c. Metal process piping.

G. Communications Systems Grounding and Bonding:
1. Provide bonding jumper from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
b. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

1.06 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.

2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

D. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
2. Comply with MFMA-4.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide required vibration isolation and/or seismic controls; see Section 260548.

H. Equipment Support and Attachment:
1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.

2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches (80 mm) in height; see Section 033000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners in accordance with manufacturer's recommended torque settings.

K. Remove temporary supports.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Galvanized steel intermediate metal conduit (IMC).
C. Liquidtight flexible metal conduit (LFMC).
D. Galvanized steel electrical metallic tubing (EMT).
E. Rigid polyvinyl chloride (PVC) conduit.
F. Reinforced thermosetting resin conduit (RTRC).

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 078400 - Firestopping.
C. Section 260526 - Grounding and Bonding for Electrical Systems.
D. Section 260529 - Hangers and Supports for Electrical Systems.
E. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
G. Section 312316 - Excavation.
H. Section 312323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2025.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2025.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.
G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
J. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.
K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
M. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
P. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
Q. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
   2. Indicate proposed arrangement for conduits to be installed where exposed to view in finished locations.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
   4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends greater than 45 degrees.

D. Embedded Within Concrete:

1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit or rigid PVC conduit.
3. Within Concrete Walls Above Ground: Use rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

K. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

L. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Provide conduit, fittings, supports, and accessories required for complete raceway system.

C. Provide products listed, classified, and labeled as suitable for purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 3/4-inch (21 mm) trade size.
2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
3. Underground, Interior: 3/4-inch (21 mm) trade size.
4. Underground, Exterior: 1-1/4"-inch (_____ mm) trade size.
   a. 1" allowed for 20A/120v circuits.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular.com/#sle.
3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   2. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   2. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.06 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.
   4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.08 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

B. Supports: As recommended by manufacturer.

C. Fittings: Same type and manufacturer as conduit to be connected.

2.09 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

E. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

F. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

E. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

F. Conduit Routing:
   1. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   2. Unless otherwise approved, do not route exposed conduits:
      a. Across floors.
      b. Across roofs.
      c. Across building exterior surfaces.
   3. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   4. Arrange conduit to maintain adequate headroom, clearances, and access.
   5. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
   6. Group parallel conduits in same area on common rack.

G. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.

2. Provide required vibration isolation and/or seismic controls; see Section 260548.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

J. Underground Installation:
1. Provide trenching and backfilling; see Section 312316 and Section 312323.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 18 inches (460 mm).
3. Underground duct banks (two or more conduits installed in parallel):
   a. Support ducts on duct spacers suitable for the conduit size used.
   b. Provide spacer quantity per length per manufacturer's instructions. Stagger spacers at least 6 inches between tiers.
   c. Secure entire duct assembly together with non-metallic straps.
   d. Provide concrete encasement of entire duct bank where indicated, otherwise provide sand backfill.
4. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 260553.

K. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Secure conduits to prevent floating or movement during pouring of concrete.

L. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated; see Section 033000.

M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
4. Where conduits are subject to earth movement by settlement or frost.

N. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

O. Provide grounding and bonding; see Section 260526.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

END OF SECTION

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

E. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Nonmetallic boxes shall be permitted to be used within dry locations of multifamily dwellings of type III, IV, and V construction.
      a. Fire rated boxes or listed fire rated wraps (putty pads) must be used in fire rated assemblies. Refer to architectural drawings for locations.

b. Boxes must maintain Architect's specified Sound Transmission Class (STC) for all assemblies. Acoustic rated wraps (putty pads) must be used where the box does not meet the STC.

8. Do not use "through-wall" boxes designed for access from both sides of wall.
9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
11. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
12. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
13. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
14. Wall Plates: Comply with Section 262726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
a. Indoor Clean, Dry Locations: Type 1, painted steel.
b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

E. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
4. Manufacturer: Same as manufacturer of floor box service fittings.

F. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
4. Applications:
a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
a. Manufacturers:

1) Hubbell Incorporated; Quazite Products; _____: www.hubbellpowersystems.com/#sle.
2) MacLean Highline; _____: www.macleanhighline.com/#sle.
3) Oldcastle Precast, Inc; _____: www.oldcastleprecast.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.

b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
2. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
3. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
4. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
   a. Concealed above accessible suspended ceilings.
   b. Within joists in areas with no ceiling.
   c. Electrical rooms.
   d. Mechanical equipment rooms.

E. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required seismic controls in accordance with Section 260548.
3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

F. Install boxes plumb and level.

G. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

H. Install boxes as required to preserve insulation integrity.

I. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

J. Underground Boxes/Enclosures:
   1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
   2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

K. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

L. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

M. Close unused box openings.

N. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

O. Provide grounding and bonding in accordance with Section 260526.

3.02 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Underground warning tape.

E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 260536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify power source and circuit number. Include location when not within sight of equipment.
         2) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Transfer Switches:
         1) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
   2. Service Equipment:
      a. Use identification nameplate to identify each service disconnecting means.
   3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
      a. Service equipment.
      b. Industrial control panels.
      c. Motor control centers.
      d. Elevator control panels.
      e. Industrial machinery.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
   3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
   2. Legend:
      a. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. Equipment Designation: 1/2 inch (13 mm).
   5. Color:
      a. Normal Power System: White text on black background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch (3 mm).

F. Color: Black text on white background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:

2.05 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 260573
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Study reports, stamped or sealed and signed by study preparer.

C. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
2. Include documentation of listed series ratings.
3. Identify modifications made in accordance with studies that:
    a. Can be made at no additional cost to Owner.
    b. As submitted will involve a change to the contract sum.

D. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

E. Site-specific arc flash hazard warning labels.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
1. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
2. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:
1. Comply with NFPA 70.
2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
        1) Obtain up-to-date information from Utility Company.
    b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
    c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
    d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
    e. Protective Devices:
        1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
        2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
    f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
    g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
2. Existing Installations:
    a. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    a. Maximum utility fault currents.
    b. Maximum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
4. Comply with applicable portions of IEEE 242 and IEEE 399.

E. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
    a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
    b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
    a. Maximum and minimum utility fault currents.
    b. Maximum and minimum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

F. Study Reports:
1. General Requirements:
    a. Identify date of study and study preparer.
    b. Identify study methodology and software product(s) used.
    c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
    d. Identify base used for per unit values.
    e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
    f. Include conclusions and recommendations.
2. Short-Circuit Study:
    a. For each scenario, identify at each bus location:
        1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
        2) Fault point X/R ratio.
        3) Associated equipment short circuit current ratings.
    b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
    a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
    b. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
        1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
        2) Include ground fault pickup and delay.
        3) Include fuse ratings.

4) Protective Relays: Include current/potential transformer ratios, and instantaneous pickup.

c. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
   a. For the worst case for each scenario, identify at each bus location:
      1) Calculated incident energy and associated working distance.
      2) Calculated arc flash boundary.
      3) Bolted fault current.
      4) Arcing fault current.
      5) Clearing time.
      6) Arc gap distance.
   b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
   1. Materials: Comply with Section 260553.
   2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
      a. Include the following information:
         1) Arc flash boundary.
         2) Available incident energy and corresponding working distance.
         3) Nominal system voltage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

END OF SECTION

SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automatic lighting control systems.

B. Occupancy sensors.

C. Time switches.

D. In-wall time switches.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

E. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

F. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

G. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
   1. Automatic lighting control systems: provide plans indicating location, model number, and orientation of each lighting control component, including low voltage switches, sensors, power packs, relay panels, networking infrastructure, and all associated system components.
      a. Include information regarding system network cabling requirements.
      b. Include all necessary wiring interconnection diagrams.
   2. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

3. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Field Quality Control Reports.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

F. Project Record Documents: Record actual installed locations and settings for lighting control devices.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 AUTOMATIC LIGHTING CONTROL SYSTEMS

A. Manufacturers:
1. Acuity Brands Inc; www.acuitybrands.com/#sle.
2. Cooper Contro
3. WattStopper: www.wattstopper.com/#sle.
4. Lutron Electronics Company, Inc: www.lutron.com/#sle.
5. Osram Sylvania Inc.
6. Substitutions: See Section 016000 - Product Requirements.
7. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Capacity: system shall be capable of future expansion by at least 25 percent of installed capacity, including relays, control points, and programmability.

C. Programming: fully programmable system with serial bus and IP interface for programming and monitoring.

D. Functionality: system shall be capable of all functions indicated on drawings.

E. Emergency egress lighting: system shall be capable of emergency lighting control in compliance with UL 924, with capability to maintain proper separation from normal lighting in accordance with NFPA 70.

2.03 OCCUPANCY SENSORS

A. Manufacturers:
1. Acuity
2. Cooper
3. Hubbell Incorporated: www.hubbell.com/#sle.
4. Lutron Electronics Company, Inc: www.lutron.com/#sle.
5. Sensor Switch Inc: www.sensorswitch.com/#sle.
6. WattStopper: www.wattstopper.com/#sle.
7. Substitutions: See Section 016000 - Product Requirements.
8. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.

2. Sensor Technology:
    a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
    b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
    c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
    a. Vacancy sensors: turn load off when no occupant presence is detected during an adjustable delay time interval. Load must be manually switched on.
5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
6. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
7. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
8. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    c. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    d. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.

D. Wall Dimmer Occupancy Sensors:
1. General Requirements:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
    b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

E. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
    a. Description: Low profile occupancy sensors designed for ceiling installation.
    b. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
    c. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

F. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.

G. Power Packs for Low Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
   2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   3. Input Supply Voltage: Dual rated for 120/277 V ac.
   4. Load Rating: As required to control the load indicated on drawings.

2.04 TIME SWITCHES

A. Manufacturers:
   1. Intermatic, Inc: www.intermatic.com/#sle.
   2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Digital Electronic Time Switches:
   1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability:
      a. 24-Hour Time Switches: Single channel, with same schedule for each day of the week and skip-a-day feature to omit selected days.
      b. 7-Day Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.
      c. Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
   3. Schedule Capacity: Not less than 16 programmable on/off operations.
   4. Provide automatic daylight savings time and leap year compensation.
   5. Provide power outage backup to retain programming and maintain clock.
   6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
   7. Input Supply Voltage: As indicated on the drawings.
   8. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:
      a. Indoor clean, dry locations: Type 1.
      b. Outdoor locations: Type 3R.

2.05 IN-WALL TIME SWITCHES

A. Digital Electronic In-Wall Time Switches:
   1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability:
      a. 7-Day Time Switches: Capable of different schedule for each day of the week.
      b. Astronomic Time Switches: Capable of different schedule for each day of the week and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
   3. Schedule Capacity: Not less than 40 programmable on/off operations.
   4. Provide power outage backup to retain programming and maintain clock.
   5. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.

6. Switch Configuration: Suitable for use in either SPST or 3-way application.
7. Contact Ratings: As required to control the load indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.

G. Provide required supports in accordance with Section 260529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Occupancy Sensor Locations:
   1. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.03 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Load centers.

D. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2025.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

G. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

O. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include documentation of listed series ratings upon request.
   2. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of design: Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B. ABB/GE: www.geindustrial.com/#sle.

C. Eaton Corporation: www.eaton.com/#sle.

D. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

E. Siemens Industry, Inc: www.usa.siemens.com/#sle.

F. Substitutions: See Section 016000 - Product Requirements.

G. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

D. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
   2. Listed series ratings are acceptable only where specifically indicated.
   3. Label equipment utilizing series ratings as required by NFPA 70.

E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Aluminum or copper.
   2. Ground Bus Material: Aluminum or copper.

D. Circuit Breakers:
   1. Provide bolt-on type.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum or copper.
   3. Ground Bus Material: Aluminum or copper.

D. Circuit Breakers: Thermal magnetic bolt-on type.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 LOAD CENTERS

A. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.

B. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Bus Material: Aluminum or copper.

C. Circuit Breakers: Thermal magnetic plug-in type.

D. Enclosures:
   1. Provide flush-mounted enclosures unless otherwise indicated.
   2. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.

2.06 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
         1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Provide compression lugs where indicated.
      c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      a. Provide electronic trip cirucit breakers rated 400 amps and above.
      b. Provide the following field-adjustable trip response settings:
         1) Long time pickup, adjustable _____.
         2) Long time delay.
         3) Short time pickup and delay.
         4) Instantaneous pickup.
   6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   7. Provide the following circuit breaker types where indicated:
      a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
      b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.

8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
   c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 260529.

F. Provide required seismic controls in accordance with Section 260548.

G. Install panelboards plumb.

H. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

I. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

J. Mount floor-mounted power distribution panelboards on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.

K. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.

L. Provide grounding and bonding in accordance with Section 260526.

M. Install all field-installed branch devices, components, and accessories.

N. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.

O. Provide filler plates to cover unused spaces in panelboards.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

D. Test GFCI circuit breakers to verify proper operation.

E. Test AFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.03 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262713
ELECTRICITY METERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment for electrical utility metering.

B. Equipment for Owner electricity metering.
   1. Single circuit electricity meters.
   2. Multi-circuit electricity meters.

1.02 RELATED REQUIREMENTS

A. Section 260913.26 Cloud Based Electrical Power Managemnt System

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems: Cabinets and enclosures for metering system components.

E. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. IEC 62053-21 - Electricity Metering Equipment - Particular Requirements - Part 21: Static Meters for AC Active Energy (Classes 0,5, 1 and 2); 2020.

D. IEC 62053-23 - Electricity Metering Equipment - Particular Requirements - Part 23: Static Meters for Reactive Energy (Classes 2 and 3); 2020.

E. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
   2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
   3. Coordiante with owners IT department for network needs and meeting security/firewall requirements.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed locations of meters and final equipment settings.

1.06 QUALITY ASSURANCE

A. Utility metering equipment: conform to all requirements of the serving electrical utility.

B. Comply with requirements of NFPA 70.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Electricity Meters:
   1. Source Limitations: Provide electricity meters produced by single manufacturer and obtained from single supplier.

2.02 EQUIPMENT FOR ELECTRICAL UTILITY METERING

A. Meter bases: provide meter socket bases as indicated, configuration to comply with all requirements of the serving electrical utility.

B. Current transformer cabinets and enclosures: comply with all requirements of the serving electrical utility.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment components in accordance with Section 260529.

D. Provide grounding and bonding in accordance with Section 260526.

E. Provide fuses complying with Section 262813 as required.

3.02 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION

SECTION 262816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Manufacturer's equipment seismic qualification certification.

D. Project Record Documents: Record actual locations of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

F. Source Limitations: Furnish enclosed switches and associated components produced by a single manufacturer and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy or general duty as indicated; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

E. Horsepower Rating: Suitable for connected load.

F. Voltage Rating: Suitable for circuit voltage.

G. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

H. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

I. Provide with switch blade contact position that is visible when the cover is open.

J. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

K. Conductor Terminations: Suitable for use with the conductors to be installed.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
   1. Comply with NEMA BS 31047.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Provide compression lugs where indicated.
      c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

P. General Duty Switches:
   1. Conductor Terminations:
      a. Provide mechanical lugs.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Provide externally operable handle with means for locking in the OFF position, capable of accepting two padlocks.

Q. Provide the following features and accessories where indicated or where required to complete installation:
   1. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 260553.

3.02 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.03 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 263213
ENGINE GENERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:
   1. Engine and engine accessory equipment.
   2. Alternator (generator).
   3. Generator set control system.
   4. Generator set enclosure.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 233100 - HVAC Ducts and Casings.

C. Section 235100 - Breechings, Chimneys, and Stacks: Engine exhaust piping.
   1. Includes installation of exhaust silencer specified in this section.

D. Section 260526 - Grounding and Bonding for Electrical Systems.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 263600 - Transfer Switches.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.

C. NEMA MG 00001 - Motors and Generators; 2024.

D. NFPA 30 - Flammable and Combustible Liquids Code; 2024, with Errata (2025).

E. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2024, with Amendment.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

H. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.

I. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

J. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
      a. Transfer Switches: See Section 263600.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
   1. Include generator set sound level test data.
   2. Include characteristic trip curves for overcurrent protective devices upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

D. Specimen Warranty: Submit sample of manufacturer's warranty.

E. Manufacturer's factory emissions certification.

F. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
   1. Certified prototype tests.
   2. Torsional vibration compatibility certification.
   3. NFPA 110 compliance certification.
   4. Certified rated load test at rated power factor.

G. Manufacturer’s detailed field testing procedures.

H. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

I. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

J. Maintenance contracts.

K. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fuses: One of each type and size.
   3. Extra Filter Elements: One of each type, including fuel, oil and air.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
   3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
   4. NFPA 30 (Flammable and Combustible Liquids Code).

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Packaged Engine Generator Set:
   1. Caterpillar Inc: www.cat.com/#sle.
   2. Cummins Power Generation Inc: www.cumminspower.com/#sle.
   3. Generac Power Systems: www.generac.com/industrial/#sle.
   4. Rehlko: www.powersystems.rehlko.com/#sle.
   5. Rolls-Royce Power Systems; MTU: www.mtu-solutions.com/#sle.

B. Substitutions: See Section 016000 - Product Requirements.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:
   1. Application: Emergency/standby.
   2. Configuration: Single packaged engine generator set operated independently (not in parallel).

D. Packaged Engine Generator Set:
   1. Type: Diesel (compression ignition).
   2. Power Rating: As indicated on drawings, standby.
   3. Voltage: As indicated on drawings.

E. Generator Set General Requirements:
   1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
   2. Factory-assembled, with components mounted on suitable base.
   3. List and label engine generator assembly as complying with UL 2200.
   4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
   5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
   6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.

F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

G. Starting and Load Acceptance Requirements:
   1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
   2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
   3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
   4. Maximum Load Step: Supports 100 percent of rated load in one step.

5. Motor Starting Capability: Supports starting of motor load indicated with a maximum voltage dip of 15 percent.

H. Exhaust Emissions Requirements:
1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

I. Sound Level Requirements:
1. Comply with applicable noise level regulations.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Fuel System - Gaseous (Spark Ignition):
1. Fuel Source: Natural gas.
2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
3. Provide line gas pressure regulator that was tested with the generator to be installed by mechanical contractor. Protect openings from foreign debris.
4. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:
a. Carburetor.
b. Gas pressure regulators.
c. Fuel shutoff control valves.
d. Low gas pressure switches.

C. Engine Starting System:
1. System Type: Electric, with DC solenoid-activated starting motor(s).
2. Battery(s):
a. Battery Type: Lead-acid.
b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:
a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
c. Listed as complying with UL 1236.
d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
f. Provide alarm output contacts as necessary for alarm indications.

D. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.

2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
2. Oil Heater: Provide thermostatically controlled oil heater to improve starting under cold ambient conditions.

F. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
3. Ducted Radiators: Where ducted radiator air discharge is to be field-installed, provide suitable radiator duct flange/adapter.
4. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

G. Engine Air Intake and Exhaust System:
1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
3. Exhaust Silencer: Provide critical grade or better exhaust silencer; select according to manufacturer's recommendations to meet sound performance requirements, where specified.

2.04 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 00001; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:
1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 00001, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 00001, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

2.05 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:
1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
2. Generator Set Control Functions:
a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).

b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.

3. Generator Set Status Indications:
   a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
   b. Current (Amps): For each phase.
   c. Frequency (Hz).
   d. Real power (W/kW).
   e. Reactive power (VAR/kVAR).
   f. Apparent power (VA/kVA).
   g. Power factor.
   h. Duty Level: Actual load as percentage of rated power.
   i. Engine speed (RPM).
   j. Battery voltage (Volts DC).
   k. Engine oil pressure.
   l. Engine coolant temperature.
   m. Engine run time.
   n. Generator powering load (position signal from transfer switch).
4. Generator Set Protection and Warning/Shutdown Indications:
   a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
      1) Overcrank (shutdown).
      2) Low coolant temperature (warning).
      3) High coolant temperature (warning).
      4) High coolant temperature (shutdown).
      5) Low oil pressure (warning).
      6) Low oil pressure (shutdown).
      7) Overspeed (shutdown).
      8) Low fuel level (warning).
      9) Low coolant level (warning/shutdown).
      10) Generator control not in automatic mode (warning).
      11) High battery voltage (warning).
      12) Low cranking voltage (warning).
      13) Low battery voltage (warning).
      14) Battery charger failure (warning).
   b. In addition to NFPA 110 requirements, provide the following protections/indications:
      1) High AC voltage (shutdown).
      2) Low AC voltage (shutdown).
      3) High frequency (shutdown).
      4) Low frequency (shutdown).
      5) Overcurrent (shutdown).
   c. Provide contacts for local and remote common alarm.
   d. Provide lamp test function that illuminates all indicator lamps.
5. Other Control Panel Features:
   a. Event log.

C. Remote Annunciator:

1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
2. Remote Annunciator Cabling: Include manufacturer recommeded cabling between remote monitor panel, generator, and transfer switch.
3. Generator Set Status Indications:
    a. Generator powering load (via position signal from transfer switch).
    b. Communication functional.
4. Generator Set Warning/Shutdown Indications:
    a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:
        1) Overcrank (shutdown).
        2) Low coolant temperature (warning).
        3) High coolant temperature (warning).
        4) High coolant temperature (shutdown).
        5) Low oil pressure (warning).
        6) Low oil pressure (shutdown).
        7) Overspeed (shutdown).
        8) Low fuel level (warning).
        9) Low coolant level (warning/shutdown).
        10) Generator control not in automatic mode (warning).
        11) High battery voltage (warning).
        12) Low cranking voltage (warning).
        13) Low battery voltage (warning).
        14) Battery charger failure (warning).
    b. Provide audible alarm with silence function.
    c. Provide lamp test function that illuminates all indicator lamps.

D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.06 GENERATOR SET ENCLOSURE

A. Enclosure Type: Sound attenuating, weather protective.

B. Enclosure Material: Steel or aluminum.

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

F. Openings: Designed to prevent bird/rodent entry.

G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

I. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch (150 mm) high concrete pad constructed in accordance with Section 033000.

F. Provide required support and attachment in accordance with Section 260529.

G. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.

H. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

I. Provide duct for cooling air intake/exhaust in accordance with Section 233100.

J. Provide engine exhaust piping in accordance with Section 235100, where not factory installed.
   1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
   2. Do not exceed manufacturer's maximum back pressure requirements.

K. Do not insulate piping for engine components restricted by manufacturer.

L. Install exhaust silencer in accordance with Section 235100, where not factory installed.

M. Provide grounding and bonding in accordance with Section 260526.

N. Identify system wiring and components in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

F. Preliminary inspection and testing to include, at a minimum:
   1. Inspect each system component for damage and defects.
   2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
   3. Check for proper oil and coolant levels.

G. Prepare and start system in accordance with manufacturer's instructions.

H. Perform acceptance test in accordance with NFPA 110.

I. Inspection and testing to include, at a minimum:
   1. Verify compliance with starting and load acceptance requirements.
   2. Verify voltage and frequency; make required adjustments as necessary.
   3. Verify phase sequence.
   4. Verify control system operation, including safety shutdowns.
   5. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).
   6. Verify fuel piping compliance with manufacturer's recommendations.
   7. Perform load tests in accordance with NFPA 110 (1.5 hour building load test followed by 2 hour full load test).

J. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

D. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters and fill fuel storage tank.

3.04 MAINTENANCE

A. Provide to Owner at no extra cost, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

B. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

END OF SECTION

SECTION 263600
TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications.

1.02 RELATED REQUIREMENTS

A. Section 263213 - Engine Generators: For interface with transfer switches.
   1. Includes code requirements applicable to work of this section.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA IA 10042-1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2025.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.

G. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
      a. Engine Generators: See Section 263213.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

C. Manufacturer's equipment seismic qualification certification.

D. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

E. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

F. Maintenance contracts.

G. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for system Level specified in Section 263213.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Transfer Switches:
   1. ABB: www.electrification.us.abb.com/#sle.
   2. ASCO
   3. Eaton Corporation: www.eaton.com/#sle.
   4. Rehlko: www.powersystems.rehlko.com/#sle.
   5. Schneider Electric; ASCO Power Technologies: www.ascopower.com/#sle.
   6. Thomson Power Systems: www.thomsonps.com/#sle.

2.02 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:
   1. Utilize open delayed transition transfer unless otherwise indicated or required.
   2. Neutral Switching (Single Phase, Three Wire and Three Phase, Four Wire Systems):
      a. Unless otherwise indicated or required, provide solid (unswitched) neutral.

D. Construction Type: Only "contactor type" (open contact) transfer switches are acceptable. Do not use "breaker type" (enclosed contact) transfer switches.

E. Automatic Transfer Switch:
   1. Transfer Switch Type: Automatic transfer switch.
   2. Voltage: As indicated on the drawings.
   3. Ampere Rating: As indicated on the drawings.
   4. Neutral Configuration: Solid neutral (unswitched), except as indicated.

F. Comply with NEMA IA 10042-1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

H. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

I. Switching Methods:
   1. Open Transition:

2. Delayed Transition:
    a. Provide break-before-make transfer with programmable time delay in a neutral position not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
3. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

J. Seismic Qualification: Provide transfer switches and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

K. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

L. Enclosures:
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    a. Indoor Clean, Dry Locations: Type 1 or Type 12.
    b. Outdoor Locations: Type 3R or Type 4.
2. Provide lockable door(s) for outdoor locations.
3. Finish: Manufacturer's standard unless otherwise indicated.

M. Short Circuit Current Rating:
1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
2. Short Time Rating: Where the requirement for selectivity is indicated, provide transfer switches with short time ratings suitable for the maximum short time delay setting of the supply side overcurrent protective device.

N. Automatic Transfer Switches:
1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
2. Control Functions:
    a. Automatic mode.
    b. Test Mode: Simulates failure of primary/normal source.
    c. Voltage and Frequency Sensing:
        1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
        2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
        3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
    d. Outputs:
        1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
        2) Auxiliary contacts; one set(s) for each switch position.
    e. Adjustable Time Delays:
        1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
        2) Transfer to alternate/emergency source time delay.
        3) Retransfer to primary/normal source time delay.
        4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.

f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.
g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.

3. Status Indications:
a. Connected to alternate/emergency source.
b. Connected to primary/normal source.
c. Alternate/emergency source available.

4. Automatic Sequence of Operations:
a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.
b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

O. Interface with Other Work:
1. Interface with engine generators as specified in Section 263213.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 260529.

E. Install transfer switches plumb and level.

F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify transfer switches and associated system wiring in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Automatic Transfer Switches:
1. Inspect and test in accordance with NETA ATS, except Section 4.
2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.04 MAINTENANCE

A. Provide to Owner at no extra cost, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

B. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

END OF SECTION

SECTION 264300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 262413 - Switchboards.

C. Section 262416 - Panelboards.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.
   2. Single Split Phase Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):
   1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
   2. 240/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

3. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.
   2. Outdoor locations: Type 3R.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
   1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Switchboards: See Section 262413.
   2. Panelboards: See Section 262416.

2.02 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

D. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

END OF SECTION

SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

1.02 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.

B. Section 260533.16 - Boxes for Electrical Systems.

C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 260923 - Lighting Control Devices.

E. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

F. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

B. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

C. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

K. UL 1598 - Luminaires; Current Edition, Including All Revisions.

L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

E. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

H. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
   4. All luminaires to be minimum 80 Color Rendering Index (CRI) unless indicated otherwise.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.

2.04 BALLASTS AND DRIVERS

A. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to 10 percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Wall Dimmers: See Section 262726.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 260529.

E. Provide required seismic controls in accordance with Section 260548.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
   5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

I. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

3. Install canopies tight to mounting surface.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. Install lamps in each luminaire if required.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.03 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.04 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.06 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 265600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 265100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1598 - Luminaires; Current Edition, Including All Revisions.

G. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

C. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 016000 - Product Requirements.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 BALLASTS AND DRIVERS

A. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
   3. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   4. Material: Steel, unless otherwise indicated.
   5. Shape: Square straight, unless otherwise indicated.
   6. Finish: Match luminaire finish, unless otherwise indicated.
   7. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 260529.

F. Provide required seismic controls in accordance with Section 260548.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Pole-Mounted Luminaires:
   1. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 033000.
         1) Install anchor bolts plumb per template furnished by pole manufacturer.
         2) Position conduits to enter pole shaft.
      b. Install foundations plumb.
      c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
      d. Tighten anchor bolt nuts to manufacturer's recommended torque.
      e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
      f. Install anchor base covers or anchor bolt covers as indicated.
   2. Grounding:
      a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   3. Install separate service conductors, 12 AWG copper minimum , from each luminaire down to handhole for connection to branch circuit conductors.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.03 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

3.05 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 270533.13
CONDUIT FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel electrical metallic tubing (EMT).

B. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 270529 - Hangers and Supports for Communications Systems.

C. Section 271000 - Structured Cabling.

1.03 REFERENCE STANDARDS

A. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

B. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.

C. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

D. BICSI TDMM - Telecommunications Distribution Methods Manual, 15th Edition; 2024.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e.

M. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

P. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of cables to be installed.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of communications cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, TIA-569, BICSI ITSIMM, BICSI TDMM, manufacturers' instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.

D. Concealed Within Masonry Walls: Use galvanized steel electrical metallic tubing (EMT).

E. Concealed Within Hollow Stud Walls: Use galvanized steel electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use galvanized steel electrical metallic tubing (EMT) or UL listed communication J-hooks.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70 and TIA-569.

B. Provide conduit, fittings, supports, and accessories required for complete communications pathway.

C. Provide products listed, classified, and labeled as suitable for purpose intended.

D. Where conduit size is not indicated, size to comply with NFPA 70, TIA-569, and BICSI TDMM, but not less than applicable minimum size requirements specified. Where specified standards differ, comply with most stringent.

2.03 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression/gland type.
      a. Do not use indenter type connectors and couplings.
   4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.04 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
3. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
    a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.

C. Galvanized Steel Electrical Metallic Tubing (EMT): Install in accordance with NECA 101.

D. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

E. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Communications rooms.
    c. Mechanical equipment rooms.
    d. Within joists in areas with no ceiling.
5. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

F. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

G. Connections and Terminations:
1. Use suitable adapters where required to transition from one type of conduit to another.
2. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect cables.
3. Secure joints and connections to provide mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves and/or slots for penetrations as indicated or as required to facilitate installation.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed cables or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

J. Provide grounding and bonding.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Correct deficiencies and replace damaged or defective conduits.

3.03 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of cables.

END OF SECTION

SECTION 271000
STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Communications outlets.

E. Communications grounding and bonding.

F. Communications identification.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260536 - Cable Trays for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 262726 - Wiring Devices.

E. Section 270533.13 - Conduit for Communications Systems.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).

C. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

D. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

E. UL 444 - Communications Cables; Current Edition, Including All Revisions.

F. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

G. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Arrange for Communications Service Provider to provide service.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding.

D. Evidence of qualifications for installer.

E. Field Test Reports.

F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
   1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
   2. Supervisors and installers factory certified by manufacturers of products to be installed.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with Communications Service Provider requirements.
   2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
   3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.
   4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
   1. Locate main distribution frame as indicated on the drawings.
   2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.

C. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 PATHWAYS

A. Conduit: See section 270533.13.

B. Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40.

2.03 COPPER CABLE AND TERMINATIONS

A. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
   2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
   3. Cable Capacity: 4-pair.
   4. Cable Applications:
      a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
      b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
      c. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.
   5. Cable Jacket Color - Voice and Data Cable: Blue.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
   1. Performance: 500 mating cycles.
   2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

2.04 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 260533.16.
   1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

B. Wall Plates:
   1. Comply with system design standards and UL 514C.
   2. Accepts modular jacks/inserts.
   3. Capacity:
      a. Voice Only Outlets: 2 ports.
      b. Data or Combination Voice/Data Outlets: 4 ports.
   4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 262726.

2.05 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

2.06 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with Communication Service Provider requirements.

B. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

C. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:
   1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
   2. 12 inches (300 mm) from power conduits and cables and panelboards.
   3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.
   4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.

B. Conduit, in Addition to Requirements of Section 260533.13:
   1. Arrange conduit to provide no more than the equivalent of 3 90 degree bend(s) between pull points.
   2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
   3. Minimum Cover - Underground Service Entrance: Comply with NFPA 70 and Communications Service Provider requirements.

C. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of telecommunications outlets provided under this section.
      a. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

b. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 120 inches (3000 mm).
   2. At Outlets - Copper: 12 inches (305 mm).

C. Copper Cabling:
   1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.
   2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
   3. Use T568B wiring configuration.

D. Wall-Mounted Racks and Enclosures:
   1. Install to plywood backboards only, unless otherwise indicated.
   2. Mount so height of topmost panel does not exceed 78 inches (1980 mm) above floor.

E. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

F. Identification:
   1. Use wire and cable markers to identify cables at each end.
   2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.

D. Testing - Copper Cabling and Associated Equipment:
   1. Test backbone cables after termination but before cross-connection.
   2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
   3. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
   4. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION